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Sustainability Accounting and Reporting

Stefan Schaltegger, Martin Bennett
and Roger Burritt (Eds.)

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Sustainability Accounting and Reporting

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PREFACE

This book provides an up-to-date overview of the most current developments in environmental and sustainability accounting and its links to reporting. This fourth volume in the Environmental Management Accounting Network (EMAN) series is characterized by a broad geographical and a contextual range of topics. Contributions from nearly all continents discuss new developments in environmental accounting and investigate topics and links between corporate environmental and sustainability issues as well as between strategy, measurement and information management or between accounting and reporting.

For the last five years EMAN, the environmental and sustainability accounting network, has developed from a small, dedicated group of European academics to a full-fledged international network with strong links to corporate accounting and reporting practitioners, international organizations and regulators. The network provides a platform for the exchange of ideas and the sharing of experiences with environmental and sustainability accounting and reporting. "EMAN Global" (www.eman-global.net) serves as an umbrella organisation of the regional sections in the Asia Pacific (EMAN-AP), Europe (EMAN-EU), Americas (EMAN-AM) and Africa (EMAN-AF). Based on the success of the annual conferences of the European and Asia Pacific sections the American and African groups are planning their first workshops. The regional sections of EMAN have their own independent work agendas but are linked with each other through the steering committee of EMAN GLOBAL and by participating in other regional conferences, fora and workshops.

Dealing with sustainability accounting and reporting EMAN has concluded that environmental management accounting (EMA) constitutes an indispensable cornerstone and can be defined as a subset of sustainability accounting and reporting. Currently EMA is the most developed subset of sustainability accounting. This is why the steering committee of EMAN decided to keep its well-known acronym EMAN but to rename the network into Environmental and Sustainability Accounting Network.

With the extending global EMAN network the fourth EMAN book draws its selection of best papers from the EMAN-EU conference on sustainability accounting and reporting held in Lüneburg in 2004, with more than 200 participants, and the 2005 EMAN-AP conference in Bangkok with more than 100 participants.

The papers presented in this book have gone through an independent peer review and thorough editing process to ensure the highest possible research quality for academic submissions, or, for more practically orientated contributions, the greatest usefulness for potential corporate and political practitioners. The publications presented in this book have been selected following an intense blind review and editorial process drawing from over eightly initial abstracts and papers submitted. Most papers had to be revised on the basis of two to four reviewer reports linked with two to three revision cycles. Such activity does not just involve a substantial workload for the authors it also depends on the goodwill of and commitment of time from the reviewers and editors. For their valuable comments we would like to thank all reviewers for their diligent and important work: Pat Anderson, Patrick Albrecht, Jan Jaap Bouma, Frank Dubielzig, Reinout Heijungs, Gjalt Huppes, Christian Herzig, Ralf Isenmann, Ki-Cheol Kim, Markus Milne, Andreas Möller, Pall Rikhardsson, Chika Saka, Stefan Seuring, Heiner Tschochohei, Tobias Viere, Marcus Wagner and four reviewers who prefer to remain anonymous. For the initial involvement we would also like to thank Jan Jaap Bouma. All papers have also been reviewed by the editors. A very special thank you goes to Martin Bennett and Roger Burritt who, in addition to the "normal" editing work, given the international nature of contributions, also made a very thorough language check of each paper. In addition, we would like to thank Katja Höltkemeier for the very thorough way in which the manuscript has been brought into the required layout format, with the help of Victoria Voss. Special thanks to Cornelia Fermum for her always reliable secretarial support.

We would like to thank the various organisations whose generous financial support has helped to ensure the success of the EMAN conferences in Lüneburg and Bangkok and to develop this EMAN book: the Asian Society of Environmental Protection (ASEP), German Federal Ministry of Environment (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, BMU), InWent Capacity Building gGmbH, PricewaterhouseCoopers (PWC) Denmark, University of Lüneburg and Volkswagen AG.

In particular, the editors of this volume and the Steering Committee of EMAN Europe and EMAN Asia Pacific would like to thank all participants who, by joining in and making presentations at its conferences, have supported the continuing development of environmental and sustainability accounting.

We would also like to invite anyone interested in joining EMAN to visit the website: www.eman-global.net. Further information can be obtained from the EMAN Europe chairperson Stefan Schaltegger (schaltegger@uni-lueneburg.de) and from the EMAN-Europe website (www.eman-eu.net or www-eman-global.net).

The editors
Stefan Schaltegger, Martin Bennett and Roger Burritt

Chapter 1

SUSTAINABILITY ACCOUNTING AND REPORTING: DEVELOPMENT, LINKAGES AND REFLECTION

An Introduction

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Abstract: Companies are key contributors to economic, environmental and social well-being. Corporate activities pervade the present and are likely to be critical in the future, so that corporate sustainability is necessary for long-term sustainable development of the economy and society. In this context, sustainability accounting and reporting which serve the collection, analysis and communication of corporate sustainability information become crucial triggers for management towards corporate sustainability. If corporate sustainability is seen as being the result of management attempts to address sustainability challenges, then it makes sense to discuss and define sustainability accounting and reporting on the basis of the challenges embedded in the sustainability triangle and addressed by cornerstone publications. This chapter concludes with a discussion of the link between accounting and reporting and the question of whether reporting is, or should be, driven by accounting, or conversely whether accounting is or should be driven by reporting.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 1-33.

1. CORPORATE SUSTAINABILITY – THE BASIS OF SUSTAINABILITY ACCOUNTING AND REPORTING

1.1 What is Understood by Corporate Sustainability?

Companies are key contributors to economic, environmental and social well-being. Corporate activities pervade the present and are likely to be critical in the future, so that corporate sustainability is necessary for long-term sustainable development of the economy and society.

From a pragmatic point of view, *corporate sustainability* can be viewed as the result of management attempts to tackle challenges posed by the need for corporations to move towards the goal of sustainability (Dyllick and Hockerts 2002, Schaltegger and Burritt 2005). However, it remains unclear when a company can be considered to have reached the state of being sustainable. Sustainable development of a corporation requires the initiation and establishement of organisational development and organisational learning processes. If this view is taken to its extreme, corporate sustainability cannot reflect a given state to which management may strive, but will always have to be a moving target for organisational development. Nevertheless, for reasons of clarity it is helpful for a company which is striving towards corporate sustainability to distinguish between the target state of corporate sustainability and the process of sustainable development. The term corporate sustainable development is therefore used here to mean the processes which are implemented in order to reduce negative impacts and to increase the positive effects of corporations towards attaining a sustainable economy, environment and society, whilst corporate sustainability represents the desired outcome of such processes (Schaltegger and Burritt 2005, see also Dyllick and Hockerts 2002). In corporate practice, the focus is usually on the processes rather than on the end state, representing in essence an incremental process of continual development towards sustainability.

The distinction between corporate sustainability and corporate sustainable development is to some extent also reflected in environmental standard ISO 14031's distinction between operational performance indicators (OPIs, which map performance and outputs) and management performance indicators (MPIs, which map the route that management is taking to improve its future OPIs).

Given the broad and ambitious goal of sustainable development in general, corporate sustainability is a challenging concept which is in need of operationalisation. In this context, information about sustainability impacts and sustainability performance can help managers to incorporate deliberative, sustainable thinking into their decision-making, planning, implementation and control activities. This is the sharp end of the debate about corporate sustainability. As a consequence, sustainability accounting and reporting – which serve the collection, analysis and communication of corporate sustainability information – become crucial tools for management in moving towards corporate sustainability.

1.2 Historical Development of Sustainability Accounting and Reporting

The concept of *sustainability accounting* has emerged over a period of years from both philosophical accounting discussions (e.g. Bebbington 2001, Bebbington and Gray 2001, Gray and Bebbington 2000) and developments in accounting (e.g. Forum for the Future 2005, Schaltegger and Wagner 2006a, Schaltegger and Wagner 2006b, see also Schaltegger and Burritt 2006).

First, it needs to be recognised that accounting has long been presented in a conventional way for use by both management and external parties.

Financial reporting is based on accounting information which is gathered within organisations and then prepared for presentation to external parties through disclosure in external reports. The information which is disclosed revolves around a number of statements which are related to the organisation's financial activities. In particular the statement of financial position, or balance sheet, shows the financial position of the organisation at a particular date; and the statement of financial performance, or income statement, provides information about the financial inflows and outflows of the organisation in a specified period. Both are based on accruals-based accounting information which is designed to reflect the financial impact of transactions on the assets, liabilities and equity of a company as they occur. Separate information about cash movements in a period is reflected in a cash flow statement, which also reconciles the initial and closing cash balances. Over the years specific rules have been adopted by professional accountancy bodies and regulators on how specific transactions should be accounted for in order to maintain the credibility of financial statements and the organisation in the eyes of external readers.

A second type of accounting, *cost accounting*, was initially closely related to financial accounting in that it provided information about inventory values for inclusion in the annual financial reports (Wells 1978). Cost accounting was then adapted from its initial financial accounting purpose in order to assist with management control, to emphasise performance reporting based on financial representations of the expected and actual performance of both organisations, and of parts of organisations such as divisions or departments, and their comparison to provide the basis for management action based on the differences reported.

Since this early adaptation of financial accounting for management control, *management accounting* has developed separately to focus on generating information for management planning, control and decision-making (Horngren et al. 2005:10). In recent years the *strategic importance of management accounting information* has been emphasised (Morse et al. 2003, Ratnatunga et al. 1993). Adoption of a strategic approach means that strategic management accounting places stress on the ways in which organisations match their resources to the needs of the market place, particularly to competitive pressures, in order to achieve defined organisational objectives.

This has raised the question of *corporate (environmental and sustainability) performance measurement and management* which as an integrative approach tries to link strategic management, management accounting, and reporting, in order to organize the flow of information between its justification, creation and communication (e.g. Schaltegger and Wagner 2006a, 2006b). In this view, the term ‘reporting’ is not limited only to external reporting as it is in financial reporting but rather encompasses the whole information communication process, internally as well as with external stakeholders.

The term *sustainability reporting* is usually used to refer to the publication of external reports, as either printed brochures or electronic versions on the internet. However, one main effect of sustainability reporting is the involvement of management and employees in setting sustainability goals for the corporation, collecting data, and creating and communicating sustainability information. The design of external sustainability reporting should therefore consider its interplay with internal communication and reporting processes.

The significance of these historical developments is that sustainability accounting and reporting could be developed in different ways: first, based on an entirely new system of accounting; and, second, as a development of conventional financial, cost, or management accounting. The former is appealing because if sustainability accounting is developed *de novo* it allows a complete reappraisal of the relative significance of social, environmental and economic considerations and their interactions in corporate accounting systems, for management and external parties (see Houldin’s (2001:3) comment in relation to the development of new environmental accounting systems). The latter is closer to practice since piecemeal modifications to existing accounting require less dramatic change.

Changes to conventional accounting have taken the form of: *environmental accounting and reporting* as the foundation for external environmental reporting, with a major emphasis on environmental impacts and extended performance expressed in physical and qualitative terms (Schaltegger and

Burritt 2000); and *triple bottom line reporting* which introduces separate economic, social and environmental statements for organisations (Gray and Milne 2002). Environmental management accounting (EMA) and environmental reporting constitute in any case an important part of sustainability accounting and reporting.

However, each of these accounting and reporting systems suffers from association with conventional accounting and its well known defects. Firstly, the conventions behind financial reporting can be criticised as having a narrow corporate perspective on the boundary of activities (the entity concept): '…accounting typically adopts a set of implicit assumptions about the primacy and desirability of the conventional business agenda…' (Gray and Bebbington 2000). Maunders and Burritt (1991:12) also draw attention to the defects of accruals, consistency and prudence conventions in terms of their use to evaluate corporate activities which have ecological impacts.

Secondly, monetary measurement in financial accounting has been criticized since it is based on different types of measures – historical, current, replacement, net present value – which in financial accounting are then added together as though they are similar, but do not in practice produce useful, comparable information (Chambers 1966). An overemphasis on monetary measurement in relation to the ecological impacts of an organization can mislead, as physical and qualitative environmental information may be critical when assessing whether ecological damage is irreversible, or carrying capacity is being exceeded through corporate activities (Schaltegger and Burritt 2000:77). Hence, conventional accounting is heavily criticized for failing to facilitate an understanding of corporate environmental impacts. Such criticism has led to calls for the additional disclosure of environmental and social performance and their balancing with economic performance (Epstein 1996, Figge et al. 2002, Schaltegger and Dyllick 2002).

Environmental, triple bottom line accounting and reporting have emerged in this milieu (e.g. Elkington 1998, Forum for the Future 2005). Accountants are beginning to consider the potential of new reporting models for business (ICAEW 2003, Illingworth 2004, KPMG 2003). The business case for change is related to the cost advantages from: having an integrated reporting and communications strategy; the need to portray a balanced performance story that reports bad as well as good news; measuring and reporting social and environmental as well as financial information; and the improved confidence of boards and executives in the new reporting model and statements.

However new reporting models have also been the subject of criticism. Environmental reporting has met considerable opposition from government and business because environmental regulation is seen as imposing unnecessary costs on business (ENDS 2005). Frost and English (2002) found that arguments used in Australia against mandating environmental reporting disclosures included the comments that: corporation law does not extend to non-financial issues; mandated disclosure would reduce the flexibility of companies to tailor their reporting to individual stakeholder needs; and unnecessary additional costs of compliance would be incurred. Gray and Milne (2002) suggest that triple bottom line reporting remains and is likely to continue to remain dominated by financial considerations, with the social and environmental being a mere add-on. They call for the quality of social and environmental reporting to be dramatically improved.

The zenith of accounting and reporting at present is *sustainability accounting and reporting* with its conceptual emphasis on accounting for eco-systems and for communities, and consideration of eco-justice, as well as more conventional issues of effectiveness and efficiency (Gray and Milne 2002). Corporate sustainability reporting is claimed by Gray and Milne (2002) to present a challenge because of the need to address the entity concept and to focus on eco-systems and their carrying capacities, thresholds and cumulative effects. They suggest that, as it is not possible to define what a sustainable organization would look like, the accounting that would be necessary to provide the basis for sustainability reporting must also be unknown. Hence, the challenge for corporate sustainability accounting and reporting to succeed has been laid down and its recent development and prospects are outlined below and in the contributions appearing in this text. A key part of this challenge is to reconsider the importance of accounting which has hitherto been understated (ICAEW 2003:72): non-financial information (i.e. environmental and social information, as well as eco-efficiency and socio-efficiency information, reflecting the links between environmental and economic issues, and between social and economic issues); forward-looking information (future orientation); and the needs of other users as well as those of investors (participatory issues with other stakeholders including societal stakeholders). However beyond these is the need to adopt the conceptual underpinnings with which a new form of accounting, sustainability accounting, must engage if it is to be successful operationally.

The next section starts by exploring the concept of corporate sustainability as the basis of any related approach to accounting and reporting. The following section defines sustainability accounting and reporting and considers the connections between them. Finally, this Introduction concludes with a broad overview of the structure of and contributions to this book.

2. STRUCTURING CORPORATE SUSTAINABILITY ACCOUNTING AND REPORTING USING THE SUSTAINABILITY TRIANGLE

If corporate sustainability is viewed as the result of management's attempts to address sustainability challenges, it makes sense to discuss sustainability accounting and reporting on the basis of the challenges embedded in the sustainability triangle (see Figure 1-1). The vision of corporate sustainability today is a broad approach relating to the contextual integration of economic, environmental and social characteristics (Schaltegger and Burritt 2005). It comes as a surprise to realise that the best known aspect of accounting for corporate sustainability is the heuristic, multi-criteria *triple bottom line perspective* which aims to integrate the economic, social and environmental aspects of business management (Elkington 1998). This differs from the preceding political and macro perspective in which the orientation towards future and present needs, as formulated in the Brundtland report, has dominated for much longer (UNWCED 1987). Figure 1-1 illustrates the sustainability triangle approach and the related core contextual challenges of corporate sustainability. This Section addresses both the triple bottom line approach and the Brundtland requirements for understanding the main corporate sustainability challenges and issues which need to be covered by sustainability accounting and reporting.

2.1 Challenges Deriving from the Sustainability Triangle

The sustainability triangle visualises the three perspectives of sustainability not just by plotting ecological, social and economic goals in a triangle but by also addressing the interrelationships between these three dimensions. The challenges to corporate sustainability relate to the economic, ecological and social considerations in the triangle and their interrelationships.

The difference between focussing on a corner or on a line between two corners of the sustainability triangle is defined by the distinction between effectiveness and efficiency. *Effectiveness* is the goal whenever management attempts to improve a single dimension of the sustainability triangle. Effectiveness – whether economic, environmental or social effectiveness – can be measured in *absolute indicators,* or figures. *Efficiency*, by contrast, describes the relation between different dimensions such as the environmental and economic dimension for eco-efficiency, or the social and economic dimension for socio-efficiency (even economic efficiency reflects the relation between different economic issues such as assets, profit, time, etc.). Efficiency is therefore measured in *relative indicators* or ratios. Efficiency indicators are cross-indicators which incorporate two separate units of measure, unless both dimensions of an efficiency analysis are measured in monetary terms.

Economic effectiveness, i.e. achieving the best possible economic result, is the classic entrepreneurial and management task, which is also relevant in the context of sustainable development. The aim is to balance economic risk and return in corporate activities. As this is the subject of conventional business management, it is usually not specifically addressed as a task of corporate sustainability. However, this could be a mistake since economic survival is the *sine qua non* of ongoing commercial corporate activity.

Apart from the need to focus on the conventional economic management of the business, the remaining, contextual corporate sustainability challenges with which corporate sustainability management has to deal are the ecological, the social, the eco-efficiency and socio-efficiency, as well as the integration challenges (Schaltegger et al. 2003b, Schaltegger and Burritt 2005, Schaltegger et al. 2003a). To support management, sustainability accounting and reporting must provide information on the company's performance and development in relation to all corporate sustainability challenges, including the contextual, as well as further challenges.

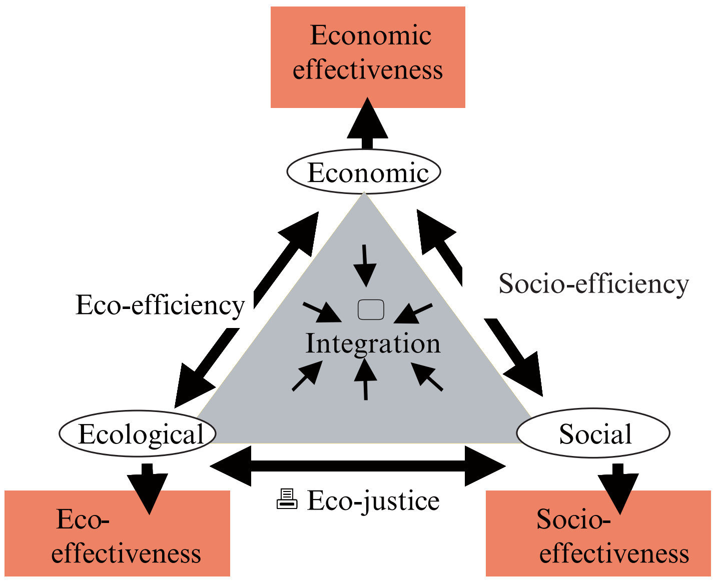

Figure 1-1. Structuring information needs for corporate sustainability challenges with the sustainability triangle (source: Schaltegger et al. 2003b, Schaltegger and Burritt 2005, Schaltegger et al. 2003a).

The *ecological challenge* is to increase the ecological effectiveness, or eco-effectiveness (① in Figure 1-1), of business activities. *Eco-effectiveness* describes how well environmental impacts have been reduced. All human activities influence the ecosystem, with some influences having irreversible effects and being considered of major relevance to the survival and existence of an intact natural environment. The central environmental problems include the greenhouse effect, the destruction of the ozone layer, acidification and over-nitrification of soil and water, declining biodiversity, photochemical smog, toxicological burdens harmful to humans and the environment, desertification, etc. (see e.g. Heijungs et al. 1992). The excessive overall environmental burdens in many areas such as CO_2 emissions therefore confront businesses with the challenge of making substantial reductions in the absolute scale of the environmental impacts of their production processes, products, investments, etc. (e.g. Braungart and McDonough 2002). To provide information to tackle the corporate ecological challenge is why physical environmental management accounting approaches (also called PEMA, see Burritt et al. 2002a, 2002b) such as product life cycle assessment (LCA), with what are effectively aggregate indicators of eco-effectiveness, have been developed. Because of difficulties in arriving at a commonly accepted integrative measure of environmental impact added, eco-effectiveness is usually expressed in terms of specific indicators such as CO_2 emissions or CO_2 equivalents (e.g. Heijungs et al. 1992), business ecological footprints (Wackernagel and Rees 1996), or simply the total quantity of materials mass involved in a product life cycle (e.g. Schmidt-Bleek 1994). The criterion for assessing how successfully a company is meeting the ecological challenge is ecological effectiveness (also known as eco-effectiveness or environmental effectiveness). *Ecological effectiveness* measures the absolute environmental performance (e.g. tonnes of CO_2 emissions reduced in the last period) and is a general description of the extent to which the targeted objective of minimizing environmental impacts has actually been achieved.

The *social challenge* of corporate sustainability is to increase the company's social effectiveness, or *socio-effectiveness* (② in Figure 1-1). The social challenge related to corporate sustainability is to ensure the existence and success of the enterprise whilst at the same time taking account of the diversity of social, cultural and individual social demands. This is related to safeguarding the social acceptance of the enterprise and the legitimation of its business activities. When dealing with a great variety of social factors such as inter-regional and inter-temporal equality of rights, fairness, equity of needs and performance, it has to be borne in mind that these can never be completely satisfied, as human desires may be unlimited. Management is therefore challenged to set priorities in a dialogue or multi-logue with principal stakeholders. From an information management perspective, social indicators and the reporting of various aspects of social performance, usually only loosely linked if at all, dominate the current approach. It has to be acknowledged that it is conceptually difficult to define what social performance really means because there are no such clear generally accepted absolutes as there are for the environmental and economic dimensions, such as the reduction of environmental impacts or the creation of wealth - even the most basic social goal, the right to life, is challenged in those countries which continue to use the death penalty. Compliance with cultural norms is not clearly defined and may be disputed when norms conflict between different countries, such as the role and rights of women. We have to keep in mind that social expectations vary substantially between different cultural contexts, which in turn complicates any approach of accounting and reporting for socio-effectiveness. Nevertheless, accounting and reporting research is thus challenged to develop more comprehensive approaches which allow accounting for socio-effectiveness as the criterion that indicates how successful a company has been in reducing the absolute level of its negative social impacts relative to expectations, and the extent to which it gives rise to valuable positive social impacts and benefits.

The *economic challenge to environmental and social management* aims to improve *eco-efficiency* (③ in Figure 1-1) and *socio-efficiency* (④ in Figure 1-1). Whereas the traditional economic challenge consists of creating corporate and shareholder value and increasing the company's profitability, the economic sustainability challenge is concerned with undertaking effective environmental management and social management as economically as possible. Because profit-orientated businesses operating in a competitive setting are established and run primarily for economic purposes, environmental protection and social commitment are always confronted with the challenge of either increasing value, making a contribution to profitability, or at least minimizing costs. However, not-for-profit organisations also face limited budgets and are therefore challenged by economic considerations. The so-called 'business case of sustainability' is therefore not limited only to companies with shareholders but is of fundamental importance generally (e.g. Schaltegger and Wagner 2006b, Steger 2005, similarly Dyllick and Hockerts 2003).

The traditional criterion for achieving economic success is efficiency, which is a relative measure of performance. The economic interpretation of efficiency is based on monetary performance data and is normally expressed as profitability indicators such as return on investment, return on equity, value added, etc. In the context of corporate sustainable development, the monetary efficiency interpretation is supplemented by ecological and social aspects. In addition to economic efficiency, two types of efficiency are of special importance: eco-efficiency as economic-ecological efficiency, and socio-efficiency as economic-social efficiency.

Eco-efficiency is defined as the ratio of an economic (monetary) measure to a physical (ecological) measure (Schaltegger and Sturm 1990:279ff., Schmidheiny and BCSD 1992). It can be defined as the ratio of value added to environmental impact added per unit, where environmental impact added is equivalent to the sum of all environmental impacts which are generated directly or indirectly by a product or activity. Examples of eco-efficiency measures are value added (in $ or Euro) per tonne of emitted CO_2, the contribution margin of a product (in $ or Euro) relative to its contribution to greenhouse effect (in CO_2 equivalents), etc. Various publications provide examples of possible target ratio improvements between economic and environmental performance (e.g. “factor four” by von Weizsäcker et al. 1997 and “factor ten” by Schmidt-Bleek 1994) and case collections of companies applying and promoting eco-efficiency (e.g. Hawken et al. 1999, Schmidt-Bleek 1994, von Weizsäcker et al. 1997). Accounting for eco-efficiency (e.g. Schaltegger 1998) is at the heart of EMA which provides physical as well as monetary data using various accounting methods, and which deals with integrative eco-efficiency indicators. However, apart from the Environmental Shareholder Value concept (Schaltegger and Figge 1997), most current approaches to environmental accounting do not provide the necessary information to answer crucial questions such as: how does the consideration or non-consideration of specific environmental and social issues influence the economic performance of the business?

Similarly to eco-efficiency, *socio-efficiency* (also known as ‘societal efficiency’) can be defined as the ratio of value added to social impact added, where social impact added represents the sum of all negative social impacts originating from a company, product, process or activity. Examples of socio-efficiency yardsticks are value added (in $ or Euro) relative to the number of staff accidents, or value added (in $ or Euro) relative to the number of days lost through absence due to employee illness. In the same way that socio-effectiveness may also be defined by the positive social effects or the social value created by a company (and not only by the reduction of its negative social impacts), socio-efficiency can also be expressed in terms of social and economic value created. Given the difficulties of defining and measuring socio-effectiveness, and because of the existing weak methodological basis of accounting for social effectiveness, it is not surprising that accounting for socio-efficiency is still in its infancy.

The *integration challenges* (⑤ in Figure 1-1) are the *contextual integration challenge* which is about bringing together the first three challenges, and the *methodological integration challenge*, which focuses on integrating environmental and social management into conventional economically-orientated business management. The three challenges of sustainability management as described above can be met by systematic efforts to act in an eco- and socio-effective as well as in an eco- and socio-efficient manner. However, the biggest challenge of corporate sustainability management – and thus also sustainability accounting and reporting – is the integration challenge. This challenge is to combine and simultaneously satisfy the objectives described above. Contextual integration of the three characteristics (economic, ecological and social) in the sustainability triangle requires the simultaneous accounting for and improvement of the four challenges of ecological effectiveness, social effectiveness, eco-efficiency and socio-efficiency. Both the contextual and the methodological challenge also require acceptance of a philosophy that engages with conventional business management whilst lifting the veil on these challenges.

2.2 Brundtland and Further Challenges for Corporate Sustainability

As well as the four contextual issues outlined in the previous section, corporate sustainability embraces further considerations of which the most prominent are dealing with time, participation, methodological integration into core business methods and processes, and adoption of a mind set that engages with sustainability orientated information. Creating and providing relevant information concerning these challenges is also part of sustainability accounting and reporting.

2.2.1 Orientation towards the Future and Stakeholder Participation

Orientation towards the future has always been a core business management issue, which in management accounting is reflected in tools such as investment appraisal and budgeting and the assessment by financial analysts and investors of the company's economic value. With environmental management, consideration of the future impacts of emissions and other environmental impacts has been added to the set of management responsibilities. However, recognition of a broader set of *stakeholders* than only those with a financial interest in the company, and explicit consideration of *future generations* and *non-economic stakeholders,* has been addressed in the business literature only more recently (see e.g. Dyllick and Hockerts 2003, Schaltegger et al. 2003a) and still remains an open field for social accounting.

To adapt Brundtland's widely accepted definition of sustainable development, corporate sustainable development can be seen as *meeting the needs of a corporation's direct and indirect stakeholders without compromising its ability to meet the needs of future stakeholders as well* (e.g. Dyllick and

Hockerts 2002). Corporate sustainability thus includes the vision of *participation* in processes for analysing sustainability problems, for finding solutions to these problems, and in decision and implementation processes. In the light of participation, sustainability accounting and reporting may include *accounting for Corporate Social Responsibility (CSR)* which not only covers the company's CSR performance and contributions but should also support participation processes, and address the information needs and communication of the costs and benefits associated with *stakeholder relationships* (e.g. Figge and Schaltegger 2000).

As a consequence of the broad approach and its various contextual aspects, corporate sustainability is not limited only to the corporate organisation itself but directs attention towards the social embeddedness of the corporation and the influence that it has on its social environment. In the more recent marketing and *entrepreneur* literature, corporate sustainability is therefore seen as an approach that is not limited only to niche markets and market-related business activities (e.g. Schaper 2003). Instead, corporate sustainability requires the adoption of sustainability as a *high priority business goal* as well as recognition of its considerable potential *impact on mass markets and society* (Schaltegger 2002). Sustainability managers can thus be seen as actors who of necessity have to involve themselves in the development of market frameworks for internalising the external effects of business and who, through lobbying and other means, increase public awareness of the need for sustainability (e.g. Dyllick et al. 1997). The societal role of managers is thus an important aspect of sustainability management, although evidence about the extent to which significant 'morphogenic' change in corporate performance and reporting can be encouraged by stakeholder engagement remains an open question (see Deegan and Blomquist, 2005:28). In summary, corporate sustainability management, through the adoption of a more encompassing view, is seen as a *business approach* which is designed to shape the environmental, social and economic effects of a company in a way that, firstly, results in the sustainable development of the company and, secondly, provides an important contribution towards the sustainable development of the economy and society (e.g. Schaltegger et al. 2003a).

2.2.2 Methodological Integration and Conditioning Effects

The methodological integration of environmental and social accounting and reporting activities into core business processes (including conventional accounting and reporting), with other management tools, has been addressed as one aspect of the challenges of integration for corporate sustainability (e.g. Schaltegger et al. 2003b). In practice environmental and social management, as well as environmental and sustainability accounting and reporting, are usually established in parallel with conventional management systems. This can lead to inefficient information management and business solutions where, for example, attempts to find innovative products and other sustainability orientated process-based innovations are not recognized early enough. Thus one of the core challenges for sustainability accounting and reporting is the integration of environmental and social accounting and reporting approaches into the core business management processes and systems.

A related challenge is the problem of removing the conditioning which is associated with conventional business management and accounting (Maunders and Burritt 1991:13). For example, in the face of opportunities being presented that reduce corporate environmental impacts and improve financial performance, logic dictates that action should be taken. However, as Herbohn (2005:523ff.) found, even in those circumstances where management recognises the need to incorporate positive and negative environmental impacts into conventional net profit figures, implementation and change can be constrained through: over-optimism by certain staff; staff turnover; the 'business as usual' (Bebbington and Gray 2001) constraint whereby change is marginalised through resource withdrawal and political lobbying; and the re-emergence of old attitudes, such as the view that resource management decisions cannot be reduced to financial components for decision-making and that non-market values are at best only supplementary information. Corporate sustainability management, and especially sustainability accounting and reporting, are therefore challenged to recondition the conventional business climate in an organisation by means of methodological and information change.

3. DEFINING AND LINKING SUSTAINABILITY ACCOUNTING AND REPORTING

With increasing attempts to promote corporate sustainability, management is being challenged to rethink contemporary information management systems. These currently are inadequate: at best existing systems are inefficient, at worst they lead to poor decision-making and lax accountability. Because of the growing environmental and societal impacts of corporations as well as the increasing number of reporting regulations, government pressures, international verification and accounting standards, and changing stakeholder strategies and demands, managers recognize that systematic approaches to the integration of environmental and social issues into financial and management accounting have become a necessity.

3.1 What is Sustainability Accounting and Reporting?

With the growing communication efforts being made by companies which place importance on sustainability, it is not surprising that sustainability accounting and reporting have achieved respectable – and for many, astonishingly fast – management relevance. Furthermore, this development is characterized by a broad variety of different perspectives to address relevant company sustainability issues. It will be disturbing for deep green and very ambitious actors that new approaches towards measuring, analyzing and communicating sustainability issues are mainly being developed on the basis of the history and growing body of literature on EMA and reporting. However, this development can also be interpreted as an evolutionary process founded in the environmental origins of sustainability accounting and reporting.

Under this view, the term *sustainability accounting* is used to describe new information management and accounting methods that aim to create and provide high quality information to support a corporation in its movement towards sustainability. *Sustainability reporting,* by contrast, describes new formalized means of communication which provide information about corporate sustainability.

The *linkage of both sustainability accounting and reporting* is crucial for two reasons. Firstly, accounting information which is not communicated cannot exert any influence and is thus unable to contribute towards the company's sustainable development. Secondly, reporting is needed in order to substantiate information about the actual status of, and progress towards, corporate sustainability; otherwise the information tends to be considered to be rather superficial.

3.2 Accounting-Driven Reporting or Reporting-Driven Accounting?

If corporate sustainability communication and reporting is to be substantiated, it has to progress beyond qualitative value statements and statements of future prospects such as those provided in glossy reports, which are necessary but insufficient. The credibility of sustainability accounting information for internal and external recipients, and the associated trust and veracity which this implies, requires the visibility of specific activities as well as material improvements. Substantive corporate sustainability communication therefore requires a credible explanation of management efforts and the disclosure of corporate sustainability performance. Sustainability performance is communicated through both qualitative descriptions of activities and, as a necessary element, quantitative measures of environmental and social impacts and achievements along with their economic relevance to business success.

As argued above, accounting and reporting are thus strongly interlinked. Furthermore, effective contributions to corporate sustainability require that sustainability accounting and reporting are embedded in a structured sustainability approach to performance management. With this in mind, sustainability performance management could be structured in two fundamentally different ways (Schaltegger and Wagner 2006a):

- Strategy and accounting-driven sustainability reporting (the "inside-out perspective")
- Reporting-driven sustainability accounting (the "outside-in perspective")

From a performance management perspective, sustainability accounting and reporting will mostly be derived from corporate and business strategy. Such an *inside-out perspective* is characterized by reporting that has been planned and achieved on the basis of corporate strategy, accounting and management performance. Based on the strategic analysis of which environmental, social and societal issues are of core relevance to the economic success of the company, information needs and key performance indicators will be deduced. A recognized approach to support the process of developing key performance indicators from the company's strategy is the Sustainability Balanced Scorecard (Figge et al. 2002, Schaltegger and Dyllick 2002). Based on these indicators, the next step is to define the requirements for the accounting methods and systems which are necessary to provide the management information which is required. From such a performance management perspective, reporting serves as the end point in the process of the communication of corporate developments based on the strategically relevant indicators which are being accounted for.

In short, with strategy and accounting-driven sustainability reporting, strategy defines the performance measurements and indicators which in turn define the accounting methods and the contents of sustainability reporting.

The *outside-in perspective* takes a different approach. From this view, sustainability accounting and performance management are driven by reporting and communication needs. The starting point is external expectations of stakeholders, guidelines and requirements about what should be reported and how. Guidelines such as the Global Reporting Initiative (GRI), as well as environmental and sustainability rankings, and rating and assessment schemes, are consulted in order to identify a set of information requirements and indicators relating to the company. Following this rationale the company's external corporate reporting information is deduced from (published) external expectations about the contents of reports. This, in turn, drives the company's development of its sustainability reporting and internal corporate information and communication systems. Once information requirements have been defined, the accounting and information management system can be designed to create the required information. Sustainability accounting and sustainability performance management can be streamlined to serve the reporting requirements.

In short, for reporting-driven sustainability accounting, external guidelines, rating and assessment schemes define information requirements and indicators which in turn define the accounting methods and information management systems.

As with most dichotomies, both the inside-out and the outside-in approaches are related to each other. On the one hand, a good corporate strategy has to consider external stakeholder expectations and requirements and thus is not isolated from reporting requirements. On the other hand, good corporate reporting requires substantive performance results which can be demonstrated only on the basis of relevant, reliable, comparable and understandable information about corporate sustainability.

Simple adoption of guidelines and requirements which do not relate to strategically relevant key aspects of the company's performance will not be enough to create the necessary benefits for the company. Isolated improvements in performance, however, could also be hampered because any corporate sustainability strategy has to relate to its societal environment. Sustainability accounting and performance management cannot be effective without considering the societal and business environment, nor can sustainability reporting have a meaning without reliable information and performance. This means that stakeholder perceptions and requirements must be considered by corporate management if the efforts and performance improvements are to be recognized and corporate sustainability is to be improved. Thus, both the "inside-out" and "outside-in" perspectives have their strengths and weaknesses, and combining them may be most fruitful.

In any case, the management of an ambitious company which is striving for sustainability will need to consider and integrate both approaches and crosscheck on the sustainability accounting and reporting system which is best for improving corporate sustainability. Depending on the company's situation, and on whether societal expectations are relatively strong or weak, different emphases may be needed. This raises the question of how relevant sustainability accounting and reporting are in different societal environments.

3.3 Business Environment, Expectations and Sustainability Accounting and Reporting

Table 1-1 adopts and slightly modifies the well-known distinction in societal business climates between "trust me", "tell me", "show me" and "prove to me" worlds (similar to Shell 1998) and gives an overview of the potential relevance of sustainability accounting and reporting.

Table 1-1. Changing role of sustainability accounting and reporting in different societal business environments.

Business environment	Societal expectation	Relevance of sustainability accounting	Relevance of sustainability reporting
Trust me	None	Internal efficiency improvements	Internal communication to achieve efficiency improvements
Tell me	Communicate	Information creation for highly visible and formally required issues	Sustainability as an important internal and external communication element
Show me	Communicate and illustrate	Information creation for an over-arching picture of sustainability performance	Essential communication element as part of a set of "voluntary" communication activities
Prove to me	Measure, account for, communicate and illustrate	Basis of sustainability performance management Basis to create transparency Basis for verification	Additional element in a systematic set of trust building activities (such as stakeholder dialogues and involvement)

In a world in which society trusts business managers without having any specific sustainability expectations, management will focus on environmental and social information which has been identified as being of internal organisational and direct economic relevance. Not only does the role of sustainability reporting depend on societal expectations, but stakeholder reactions also exert a substantial influence on what management considers is sufficiently important to be accounted for. The importance of social and environmental measurement, sustainability accounting, the quantity of information required, and the quality requirements of information created, all increase with changes in societal expectations:

- In a *"trust me"* world, accounting for relevant sustainability issues may happen only for a limited range of purely internal reasons, e.g. to improve the efficiency of materials use and production processes. Sustainability reporting will either not be an issue at all or will merely serve to facilitate management processes for efficiency improvements for internal communication reasons. The inside-out perspective described above will dominate sustainability performance management.
- A *"tell me"* world is characterized by the expectation that companies should communicate with society, i.e. that they inform society about their social and environmental activities. Sometimes societal representatives such as environmental or tax agencies have been entrusted by society to receive and evaluate certain corporate information. Here, the outside-in

perspective will dominate. Accounting and reporting consider those sustainability issues which are highly visible and addressed by society, or for which reporting and information requirements have been defined by society.

- A *"show me"* world requires further sustainability accounting and reporting activities. Communication is expected to be complemented by illustrative activities to support the veracity of the contents which are reported. The accounting and reporting of corporate sustainability thus becomes an essential communication element as part of a set of more-or-less voluntary communications activities. The outside-in perspective is of primary relevance, whereas the inside-out perspective adds support for performance management.
- The *"prove to me"* societal environment is the most challenging to business management. It requires substantial efforts towards and improvements in corporate sustainability, combined with the effective communication of these efforts. Sustainability performance management, accounting and reporting have to work hand in hand. Inside-out and outside-in approaches create an ongoing management circle of sustainability performance measurement and management. Furthermore, the involvement of stakeholders is necessary to create transparency and trust in the procedures as well as in those taking actions on behalf of the corporation. In order to create transparency, sustainability accounting is the essential basis for sustainability performance management and for verification of corporate performance and of reporting. Although the importance of accounting and reporting for sustainability performance management increases substantially in a "prove to me" world, its role nevertheless is supplementary to other management tools. Sustainability accounting and reporting become necessary additional elements of a systematic set of trust-building activities such as stakeholder dialogues, stakeholder involvement processes, employee volunteering, sustainability marketing and sustainable strategic management.

It should be mentioned that corporations do not have merely a passive role in identifying their societal environment and adapting to it through their accounting, reporting and management systems. Company managers can also influence their business and societal environment and contribute to a change in the way their management is approached. It is possible for trust in the business world to result from creating transparency, involving and communicating with stakeholders in a trustworthy manner, and accounting for and revealing sustainability performance improvements on the basis of best practice measures. By voluntarily taking the actions associated with a "prove to me" world, without having been forced into this, management can contribute towards achieving the needed attitudinal and behavioural business climate. Management can build up relationships such that it can operate its business in an environment of stakeholder trust. Central to this will be an understanding of the dynamics of institutionalising high-trust relations, in particular the understanding of embedding accounting and reporting in the intrinsic satisfactions that stakeholders gain from their social involvement with organisations (Fox 1975:72).

Covering a large variety of different issues, the topic of sustainability accounting and reporting reaches far beyond academic discussions about corporate practice. Progress with the development of trust in business as well as with internal company accounting and reporting systems is of course not linear, but will face setbacks depending on political developments, media attention, public awareness, changes in management, social, economic and environmental crises, etc. Hence, it is not surprising that accounting and reporting approaches often do not match the business environment with societal expectations.

While it should be recognized that sustainability accounting and reporting will not be a panacea for solving all problems associated with attempts to encourage sustainable actions, they play an important part because accounting information provides a common language in most communication and reporting activities, both inside the company and to external stakeholders.

4. STRUCTURE OF THE BOOK

4.1 Structure and Contributions

With its annual conferences and books, the Environmental Management Accounting Network (EMAN) contributes to the development and discussion of new approaches towards sustainability accounting and reporting. This is the fourth EMAN book of a refereed selection of the best papers which have originated from the annual EMAN conferences, with most of the papers included in this volume having been presented at the 2004 conference in Lueneburg. Whereas the focus of the previous books has been on theories and applications of EMA, the overall theme of this book is the development of sustainability accounting and sustainability reporting in its different facets and contexts, as well as in a variety of different countries. Papers dealing with EMA still constitute a large part of the book since EMA is currently the most developed subset of sustainability accounting.

The first Part of the book *(Part I)* opens with an *overview of new conceptual developments of sustainability* and *environmental accounting tools*.

In the second chapter *Stefan Schaltegger* and *Roger Burritt* provide an overview of approaches and perspectives to sustainability accounting. Their contribution reviews the literature and reflects the state of the art. Although the term ‘sustainability accounting’ has been used for over a decade already, its methodological development is still at an early stage. Based on the notion of corporate sustainability, the authors show how accounting could support corporate sustainable development.

David Bent describes and explains an innovative new method of social accounting which has been developed from an earlier environmental accounting method. In co-operation with a producer of alcoholic drinks, the author used a shadow costing approach to calculate the environmental and social costs of the company’s activities, and thus move towards developing a monetised Triple Bottom Line and support the company in taking appropriate avoidance and restoration actions.

Juan Piňeiro Chousa and *Noelia Romero Castro* provide a “linear, cause-effect model” to assess the relationship between the environmental and social aspects of corporate sustainability and their financial ramifications. Based on an extended use of the Du Pont system of ratio analysis, the authors explain how their model provides for the financial analysis of corporate sustainability through sets of ratios that integrate *ex post* accrual accounting and *ex ante* market numbers, and monetary and physical measures, and focus on assessing sustainability impacts on corporate shareholder value.

A rapid increase in the volume of environmental impact data can easily lead to information overload for users, or a lack of understanding of the growing set of indicators available for assessing corporate environmental performance. *Timo Busch, Christa Liedtke* and *Severin Beuker* explain how to reduce this by using the concept of life cycle material intensities (Schmidt-Bleek 1993, Weizsäcker et al. 1997) through “Resource Efficiency Accounting”, which combines physical and financial (or cost) data with a focus on eco-efficiency. They support their argument with a case study on the management of packaging materials by Toshiba Europe GmbH (Germany).

As well as their human consequences, occupational accidents can entail significant costs for companies, although since many of the effects of accidents can be remote from the original incident, these may be difficult to measure. However *Pall Rikhardsson* argues that if the full costs of accidents can be made more transparent, companies should be more able to develop convincing cases for taking steps to prevent their occurrence. He describes four alternative approaches that have been developed to measure these costs and identifies the principal features of each, and then develops from this a comparative analysis to guide companies in selecting the most appropriate approach for their own circumstances. *Thomas Heupel* extends into the area of sustainability management the well-established literature which criticizes conventional management accounting for its alleged failure to adapt quickly to changes in the external business context such as changing technologies, and the importance of process-based rather than predominantly hierarchy-based management. He provides a worked example to explain how conventional standard costing can be extended into 'sustainability-oriented standard costing' which includes both human capital costs and ecological costs, both internal and external to the organization, and also argues for prognostic cost accounting. He argues that this will help to guide and motivate managers within organizations and thus support sustainability management in decentralized organizations.

Given that the business case of corporate sustainability is a core issue and a driver for sustainability accounting and reporting, *Part II* discusses approaches to *link environmental and sustainability accounting with the economic success of a company.*

Marcus Wagner investigates the influence of different corporate environmental strategy positions. He formulates a theoretical model which he tests with two empirical analyses: firstly for the European paper manufacturing industry, and secondly for a set of British and German manufacturing firms. He finds that the potential for different industries to realize a win-win relationship between environmental and economic performance differs substantially. However, a management approach which is in line with the concept of Environmental Shareholder Value, such as a pollution prevention-oriented approach, will support companies in realizing environmental-economic sustainability.

Predicting, quantifying and planning for the potential impacts of environmental pressures on business is one of the main aims of strategic EMA. *Niki Rosinski* reports his analysis of the potential financial effects on the automotive industry of likely government policies in the US, Europe and Japan to curtail carbon emissions, by examining the extent to which 10 leading global car-makers were vulnerable, based on factors such as the carbon emissions performance of their current product ranges and their abilities to introduce needed new technologies. They found that over the medium to long-term the effects of these policies were likely both to be substantial and to differ materially between different firms, which could imply a substantial impact on the competitive balance across the sector.

Benjamin Karatzoglou investigates the possibilities for making an integrated assessment of corporate economic, environmental and social performances. He observes that in Greece, corporate managers, shareholders, and financial intermediaries emphasize and base their credit and investment decisions on various accounting ratios of return, and analyzes how these traditional accounting ratios, which are extensively used by Greek companies, discourage the implementation of investment plans that aim to improve companies' environmental performance and can therefore be inadequate and misleading for sustainable development applications. He argues that there is a need to adjust the ratios so that managers can record the positive economic impact of sustainable actions, and recommends how such an adjustment can be achieved even within traditional accounting principles. *Samuel Mongrut Montalván* and *Jesus Tong Chang* examine whether there is a link between the environmental performance of Peruvian companies, as indicated by their achievement of ISO 14001 certification, and their economic performance as indicated by stock prices. By analyzing stock price data from the Lima Stock Exchange in a series of event studies they found positive abnormal returns around the dates when ISO 14001 certifications were achieved. This could provide a powerful motivator for companies to improve their environmental management, particularly as the importance of environmental issues becomes increasingly perceived by Peruvian investors. They note that further research is also needed to ascertain the reactions of stock markets to the specific ways in which companies may seek to manage their environmental performance.

The Value Added Statement is now well recognised as a possible addition to the conventional basic financial reports which supplements them by focusing on the wider implications of an organisation's activities beyond its profits or losses for investors. *Laurie Mook* extends this into an Expanded Value Added Statement which also includes estimates of the potential benefits of a company's activities for its customers, and for the environment and society, respectively. She presents a worked example of this applied to the evaluation of a new building which measures the relative benefits of a sustainable building design in terms of its overall performance over its life, in comparison with a conventional design, to help to focus attention on its full impacts.

One way in which sustainability accounting can create value for management is by providing benchmarking information and reporting this to important stakeholders. *Part III* therefore deals with the *links between accounting and sustainability reporting* and the use of accounting information for benchmarking and communication purposes.

Christian Herzig and *Stefan Schaltegger* provide an *overview* of the main goals and benefits of corporate sustainability reporting and its development in recent decades. Reporting and external corporate communication play an important role for corporate sustainability: Firstly, because corporate management is challenged to secure social acceptance by communicating externally the benefits that the company creates for society and the sustainability of its activities. Secondly, the vision of sustainable development emphasizes the participation of stakeholders, which in turn requires the reporting and communication of sustainability-relevant issues and activities to these constituencies. Finally the chapter provides an outlook on current challenges and developments.

The Global Reporting Initiative (GRI) Guidelines have rapidly become widely recognized and accepted as the global standard on environmental, social and sustainability reporting. *Ralph Thurm* describes the Structured Feedback Process of stakeholder consultation which *GRI* followed in its review of its 2002 Guidelines to obtain feedback in order to inform their continuing development. This included requests for supplementary guidance on specific techniques and for specific sectors; clarification of certain issues with which some reporting companies had experienced problems; advice on the design and use of performance indicators; guidance on how organizations who are new to sustainability reporting can adopt an incremental approach in order to work over time towards full integrated reporting; and practical issues such as the storage and dissemination of data by GRI.

It is not surprising that innovations in environmental accounting have been forthcoming in Japan since a set of environmental accounting and reporting practices are promoted by government agencies. *Nobuyuki Miyazaki* describes one such innovation which focuses on improving *corporate ecological efficiency,* the *Japan Environmental Policy Priorities Index (JEPIX)*, which is a form of environmental accounting based on the concept of ecological bookkeeping introduced by Müller-Wenk (1978) and extended into the concept of ecoscarcity. JEPIX is a set of comparable indicators of corporate environmental impacts which can be integrated into a single master index called an Environmental Impact Point. This information has been used as a practical benchmark by the JEPIX Forum of 12 Japanese companies. This paper describes how JEPIX is used by Komatsu, a manufacturer of construction machinery, which calculates and compares two eco-efficiency rates for each plant – their environmental impact improvement rate and their environmental impact utilization efficiency rate. The paper concludes by identifying a set of problems with JEPIX which, when addressed, would lead to future improvement.

The *Green-Budget Matrix Model* is another such suggestion, made by *Yoshihiro Ito, Hiroyuki Yagi* and *Akira Omori*. The matrix provides a means to develop plans (both short-run operational and long-run capital budgets) and actions to reduce corporate environmental emissions and improve environmental performance, especially eco-efficiency. The Matrix Model combines and extends the future orientation of “Materials and Energy Activity-Based Budgeting” (Schaltegger and Burritt 2000) with “Quality Costing for the Environment” (Hughes and Willis 1995). Its novelty lies in the addition of external environmental (failure) losses expressed in physical terms, which are not included in calculations recommended by government agencies. Practical steps towards implementing the matrix are outlined and an application by Nitto Denko, an industrial products manufacturing company, is examined.

Environmental accounting information which is made available to the public has long been criticized for its poor quality and lack of usability for benchmarking and comparisons. *Roger Burritt* and *Chika Saka* examine the quality of mandated *Pollutant Release and Transfer Register (PRTR)* data for six international countries. After revealing the generic problems with the available PRTR data in each country, the authors test its adequacy by attempting to obtain information about the emissions of xylene by Toyota, with only limited success. The paper reveals a range of problems for usability, considers the implications for EMA and environmental reporting, and makes suggestions for further research.

Universities have significant direct environmental impacts, arising in particular from their buildings and estates. *Martin Bennett, Peter Hopkinson* and *Peter James* report on a project which used an existing central database of estates management statistics of universities in England and Wales, of which they found that practitioners were as yet making only limited use, to *benchmark performance between universities* and encourage the sharing of good practices. However they found that meaningful comparisons were difficult due to differences in both data definitions and different universities' organizational structures. The outcome was a decision to change the project design fundamentally, from attempting to make comparisons at institutional levels to smaller-scale comparisons within groups of buildings of similar type and purpose. As well as its environmental implications, this study has implications and lessons for benchmarking exercises generally.

The next three *Parts* of the book illustrate the increasing acknowledgement and dissemination of sustainability accounting and reporting as well as the computer implementation efforts made. *Part IV* provides insights into *national and regional experiences with environmental and sustainability accounting*.

Jaroslava Hyršlová and *Miroslav Hájek* provide an overview of the current situation with the introduction of environmental management systems (EMSs) in the *Czech Republic.* The paper discusses the reasons for implementation and the expected and actual benefits of EMSs in relation to the current state of implementation of environmental cost accounting by companies. The first attempts to implement EMA in the Czech Republic were driven by the single goal of protecting the environment, but this changed during the late 1990s when the tracking and evaluation of environmental costs started to dominate. The authors conclude that the introduction of environmental cost accounting is strongly related to the implementation of EMSs, and look ahead to anticipated future developments in the use of EMA by Czech companies.

China, because of its sheer size and its compelling economic growth and volume of industrial activity, will have an important part to play in the resolution of future environmental and sustainability problems. *Hua Xiao* examines the development of and prospects for environmental accounting and reporting in China, through a review of literature in Chinese journals over the period 1992-2003. This reveals a shortage of empirical work, with most of the available empirical publications being descriptive, and the dominance of normative studies. The aspect which is found to receive most attention in the literature is environmental accounting. The paucity of environmental accounting courses at educational institutions in China is noted, although the Accounting Society of China is showing a formal interest in environmental accounting research. The Chapter concludes with a set of considerations for researchers, government, educational institutions, and the accountancy profession.

Byung-Wook Lee, Seung-Tae Jung and *Jeong-Heui Kim* discuss experiences with EMA in *Korea*. Since the mid-1990s, when a wide range of stakeholders started to show their interest in corporate environmental performance and its disclosure, some leading Korean companies have started to introduce environmental accounting, and since the late 1990s the Korean government has also made efforts to encourage environmental accounting by industry in order to encourage sustainable development. The paper outlines the "Environmental Accounting Guideline" published by the Korean Ministry of Environment, and describes Korean environmental accounting software developments and corporate case studies which have been funded by the Korean Ministry of Commerce. It concludes with key issues for the successful adoption of environmental accounting by companies in both Korea and developing countries.

Christian Herzig, Tobias Viere, Roger Burritt and *Stefan Schaltegger* relate the concept of EMA to the decision-making context of successful EMA applications in small and medium-sized enterprises (SMEs) in developing and newly industrialised countries in the *South-East Asian region*. The EMA framework established by Burritt et al. (2002) is used to identify and distinguish managerial decision contexts and to choose the adequate EMA tool for the relevant management task. The proposed approach is of generic use for EMA applications and appears to be of particular importance for SMEs whose management activities are often constrained by limited monetary, time and personnel resources. The paper concludes with a discussion of the initial results from the analysis and the case studies.

Part V discusses *options, limits, strengths and weaknesses of different reporting approaches* and covers *national experiences with environmental and sustainability reporting*.

Frank Ebinger, Martha Fani Cahyandito, Roderich von Detten, and *Achim Schlüter* examine how companies can use their sustainability reports to communicate with stakeholders most effectively, through comparative case studies in two major *German* companies with several years' experience of reporting. Interviews with both managers and stakeholders of both companies showed significant differences not only in approach and target audience but also in stakeholders' opinions of the ultimate effectiveness of the reports, although in some circumstances good reports can increase the bonding felt by stakeholders with the company. Although there might be several possible explanations, one conclusion is that it may be unrealistic to expect to meet adequately the various information demands of different stakeholders with a single all-purpose report. The authors suggest that a more imaginative approach to the structure of reporting is needed, and draw several lessons to guide good reporting practice.

Ralf Isenmann and *Ki-Cheol Kim* examine options to increase *interactivity* in sustainability reporting, including mechanisms to involve key target groups and provide feedback, facilities for user control, and opportunities to select report contents and design. Currently, one-way sustainability reports in the form of 'one size fits all' hard copies, or simple electronic duplicates of these which do not add any value, hardly fulfil stakeholder expectations and reporting requirements. In spite of codes of conducts, standards, guidelines, and other recommendations, current reporting practice has significant room for improvement. The authors propose a framework and give practical examples of how a more interactive sustainability reporting approach could be realized.

Claus-Heinrich Daub and *Ylva Karlsson* present their results of a quantitative and qualitative analysis of corporate sustainability reporting in *Switzerland*. This is the second and, at the time, the most comprehensive study worldwide on reporting practices in a single country. The authors present the results of the Swiss study, including experiences drawn from interviews with managers of twenty-five companies. The paper finishes with a brief reflection on the methodology of the Swiss study independent of other empirical approaches used to date.

Markus Langer compares the contents of a number of sustainability reports published by *Austrian* companies against a sample of those published by multi-national companies (MNCs), and finds substantial differences not only between individual companies, but also systemically between Austrian companies and MNCs. Some differences may be explained simply by sector-specific issues or company-specific preferences, but it appears that legal and cultural differences also cause differences between reports, particularly in reporting on social sustainability performance. These differences reduce the inter-company comparability of reports and support the case for further standardization, although it also appears there is in any case an opportunity for Austrian reporters to learn more from the examples of good practice offered by MNCs.

Part VI deals with new approaches on how *computer support* can facilitate *the implementation of environmental and sustainability accounting and reporting.*

In the introductory chapter to Part VI, *Andreas Möller, Martina Prox* and *Tobias Viere* deal with *methods to support EMA with computer applications.* For EMA, data collection, data processing, and data support are central features of appropriate computer applications. In this context, enterprise resource planning (ERP) systems are a prominent data source of EMA but these cannot cover all areas of EMA, which is where computer-based modelling and simulation tools come into play. These are eligible applications in future-oriented EMA but they also have their weaknesses. The paper concludes by describing a current trend in software engineering and software development: 'componentisation', which allows the strengths of the different approaches to support EMA to be combined.

Edeltraud Günther and *Susann Kaulich* offer the *EPM-Kompas* as a software approach to systematically measure, assess and improve the environmental and economic performance of SMEs in manufacturing industry. This tool supports the collection of environmental data, the choice of the most relevant master parameters, the definition of objectives for improvement, and the assessment of the effectiveness of measures implemented. The authors place particular emphasis on the special environmental assessment method which has been developed for the specific needs of SMEs.

Adeline Maijala and *Tuula Pohjola* describe *'EcoTra',* a web-based EMA tool that has been developed to assist companies in the transportation sector to measure their environmental performance and costs. EcoTra provides companies with a standardized system to help with data collection and information management and thus reduce the costs and barriers of implementing environmental management, particularly for SMEs for whom this can be relatively more difficult and costly than for larger companies. The software is being developed as part of a continuing project together with a related training system which identifies the sector's significant environmental effects and relevant legislation. EcoTra itself is specific to the transport sector, but the example of a standardized sector-specific approach offers a model that might also be adapted for other sectors to support and encourage SMEs.

The book ends with discussion by *Stefan Schaltegger* and *Marcus Wagner* of an approach which combines the inside-out and the outside-in perspectives to sustainability accounting and reporting to develop an *integrative sustainability performance measurement and management.* Sustainability performance management addresses the social, environmental and economic performance of corporate management and highlights the links between these performance perspectives. The management of sustainability performance in all of its facets requires a management framework which firstly links environmental and social management with the corporate strategy, and secondly integrates environmental and social information with economic business information and sustainability reporting. The article proposes linking the Sustainability Balanced Scorecard as a strategic information and management approach with sustainability accounting as a supporting measurement approach, and with sustainability reporting for communication and reporting.

4.2 Creating Value Added for Further Development and Diffusion

Issues which were addressed in the introductory chapters of previous EMAN books included discussions of the value added which is created with EMA and of whether EMA can be classified as an innovation or as a managerial fad. These two questions are of course closely related: in order to be classified as an innovative management approach, EMA has to create value for corporate management. Furthermore, to create value any kind of information system must be open and able to deal with newly emerging relevant issues. With the increasing importance placed on sustainability, EMA must be further developed to incorporate all relevant aspects of corporate sustainability. In practice, the end result of creating a set of sustainability accounts is a set of new statements on the impacts of the business (Forum for the Future 2005). A set of information is provided in these statements as follows: location of impact - internal or external; type of impact - environmental, social or economic; and timing of impact. A three-stage pragmatic approach to assessing these impacts can be taken (Forum for the Future 2005):

- Stage 1, identification and confirmation of the organisation's most significant environmental impacts
- Stage 2, estimation of what a sustainable level of impacts may be, in order to determine relevant sustainability targets or the 'sustainability gap'
- Stage 3, valuation of those impacts on the basis of either what it would cost to avoid them in the first place or, if avoidance were not possible, what it would cost to restore any resulting damage (using market-based prices where possible)

To follow this procedure, a framework such as the EMA framework (Burritt et al. 2002) is necessary in order to distinguish between different decision situations. This provides a basis for choosing, from the multitude of tools available, those sustainability accounting and reporting tools which best support managers in creating and communicating relevant information and in taking the most sustainable decisions.

Sustainability accounting and reporting are the logical and necessary further developments of EMA, but they do not replace the role of supporting environmentally and economically relevant management decisions. This is why EMAN will continue to support improvement, research and application of EMA as well as the development of sustainability accounting and reporting. As a consequence, this book provides an overview of recent methodological developments in environmental and sustainability accounting and reporting and of their increasing diffusion through corporate practices being adopted in various countries throughout the world. A special focus is given to sustainability accounting and reporting developments in European and Asian countries.

Casella Stanger et al. (2002:v) capture the contemporary situation from the business perspective, as follows: 'Sustainability accounting provides a useful tool to identify, evaluate and manage social and environmental risks, by identifying resource efficiency and cost savings, and linking improvements in social and environmental issues with financial opportunities. It also allows comparison and benchmarking of performance, and identification of best practice.' As with EMA, the further development of sustainability accounting and reporting must be accompanied by the questions: what is the value created by extending accounting for corporate environmental issues to corporate sustainability issues, and what is the value for corporate sustainability from linking accounting with reporting and from linking both with other management approaches?

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PART I

CONCEPTUAL DEVELOPMENTS OF SUSTAINABILITY ACCOUNTING TOOLS

Chapter 2

CORPORATE SUSTAINABILITY ACCOUNTING

A Catchphrase for Compliant Corporations or a Business Decision Support for Sustainability Leaders?

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Abstract: In the recent past "sustainability accounting" and related terms (such as "sustainability management accounting" and "sustainability financial accounting") are being used with greater frequently at academic conferences and in corporate practice. This raises the question of the relationship between accounting and sustainability and the role of accounting for sustainability, as well as what could be understood by sustainability accounting.

This contribution reviews the literature on the corporation and sustainability accounting and distinguishes between different views when dealing with this topic. In addition, different approaches towards the further development of sustainability accounting are discussed.

1. INTRODUCTION

"Sustainability accounting" has become a term used with greater frequency at academic conferences and in corporate practice. However, review of the literature reveals a blurred picture of what is covered by this and related terms, such as "sustainability management accounting" and "sustainability financial accounting". Virtually no definitions of sustainability accounting exist, not even in papers with the term in their titles. Also, in the context of discussions about the related notion of sustainability reporting, sustainability accounting has, in the main, not been conceptualized. At best a vague description can be found of what is expected from sustainability accounting. In

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most cases sustainability accounting is just used as another term for environmental accounting or environmental reporting.

This picture raises a number of questions such as:

- What is implicitly understood by the notion of sustainability accounting in the literature and in corporate practice? Is the term and the attention it gains used for a philosophical debate about capitalism and world philosophies in general? Is it part of the processes and attempts to realize a more sustainable economy and society and thus seen as a logical consequence of corporate challenges which management should deal with?
- What could be understood by sustainability accounting in the light of movements towards corporate sustainability and what is the goal of establishing sustainability accounting systems?
- What paths for and approaches to the development of a corporate sustainability accounting system make sense from the perspective of management?

This paper focuses on the role of sustainability accounting as an approach to help support management improve corporate sustainability and responsibility. After the examination of two fundamental views (Section 2), related to the philosophical debate and the management approach, the chapter discusses the role of sustainability accounting in corporate responsibility and reasons for its introduction (Section 3). The fourth Section deals with interpretations and paths of sustainability accounting from a management perspective. Section 4 discusses the need for a pragmatic goal driven path to sustainability accounting and highlights two different ways of following this path.

2. HISTORICAL DEVELOPMENT: TWO LINES OF DEBATE

2.1 The Philosophical Debate. Are Corporate Sustainability and Sustainability Accounting an Illusion?

The first publications linking accounting with sustainability focused on the deficiencies of conventional accounting in addressing sustainability issues, as well as the limits of the underlying philosophy of accounting which focuses on monetary, quantitative measures of corporate economic activities. Sustainability accounting, as a notion, has emerged from developments in accounting over a period of years. First, it needs to be recognised that accounting has long been presented in a conventional way for use by management and external parties.

Financial accounting provides the foundation for information gathered within organisations and prepared for presentation to external parties through disclosure in external reports. The information gathered relates to the financial activities of the organisation. In particular, the statement of financial position, or balance sheet, shows the financial situation of the organisation at a particular date; the statement of financial performance, or income statement, provides information about the financial inflows and outflows of the organisation in a specified period. Both are based on accrual accounting information which is designed to reflect the financial impact of transactions, transformations or external events on the assets, liabilities and equity of a company, as they occur. Separate information about cash movements in a period are reflected in a cash flow statement, which also reconciles the initial and closing cash balance, or stock of cash. Over the years specific rules have been adopted by professional accountancy bodies and regulators, about the ways in which specific transactions should be accounted for in order that information about the organisation remains credible in the eyes of external readers.

A second type of accounting, *cost accounting*, was initially closely related to financial accounting in that it provided information about inventory asset values, for inclusion in the annual financial reports (Wells 1978). Cost accounting was adapted from financial accounting to assist with management control, to emphasise performance reporting based on financial representations of both expected and actual performance of organisations, or parts of the organisations such as divisions or departments, and their comparison as the basis for management action.

Since this early adaptation of financial accounting for management control, *management accounting* has developed separately to focus on information for management planning, control and decision making (Horngren et al. 2005:10). In recent years the strategic importance of management accounting information has been emphasised (Ratnatunga et al. 1993, Morse 2003). Adoption of a strategic approach means that strategic management accounting places stress on the ways in which organisations match their resources to the needs of the market place, in particular to competitive pressures, in order to achieve established organisational objectives. This accounting provides a pragmatic and purpose-orientated way of providing meaning to managers in relation to the messages being communicated (Chambers 1966:177).

The significance of these developments in accounting is that *sustainability accounting could be developed in different ways*: first, based on an entirely new system of accounting; and, second, as an extension of, or modification to, conventional financial, cost, or management accounting. The former is appealing because if sustainability accounting is developed *de novo* it allows a complete reappraisal of the relative significance of social, environmental and economic benefits and risks and their interactions in corporate accounting systems, both for management and external parties (see Houldin 2001:3). The latter is closer to practice, as piecemeal modifications to existing accounting require less dramatic change.

Recent changes to conventional accounting have taken the form of: *environmental accounting* as the foundation for external environmental reporting, with a major emphasis on environmental impacts and extended performance being expressed in physical and qualitative terms, or non-financial, terms (Schaltegger and Burritt 2000); and *triple bottom line accounting* which introduces separate economic, social and environmental foci for organisations (Gray and Milne 2002).

Within a decade, environmental accounting and triple bottom line accounting have filtered down as an approach, from a few academic think tanks and progressive companies to the corporate sectors in just about every region of the world. Each of these accounting systems suffers from their association with conventional accounting and its well known defects (Schaltegger and Burritt 2000:76ff.). First, the conventions of financial accounting have been the subject of criticism because they have a *narrow legal perspective on the boundary of corporate activities* (the legal entity concept). Second, '...accounting typically *adopts a set of implicit assumptions* about the primacy and desirability of the conventional business agenda…' (Gray and Bebbington 2000), including the primacy of profits and profitability rather than environmental and social concerns. Third, Maunders and Burritt (1991:12) draw attention to the *defects of accruals, consistency and prudence conventions* in terms of their use for evaluation of corporate activities which have ecological impacts. Fourth, monetary measurement in financial accounting has been criticized because it is *based on different types of measures* – historical, current, replacement, net present value – which are then added together in financial accounting as though they are similar, but which in practice do not produce useful, comparable information (Chambers 1966). An overemphasis on monetary measurement in relation to ecological impacts of an organization can lead to an incomplete picture of opportunities and risks, as physical and qualitative environmental information may also be critical when assessing whether ecological damage is irreversible, or when carrying capacity is exceeded through corporate activities (Schaltegger and Burritt 2000:77). Hence, conventional financial accounting is heavily criticized for not facilitating an understanding of corporate environmental impacts. Such criticism has led to calls for the additional disclosure of environmental and social performance and their balancing with economic performance (Figge et al. 2002, Schaltegger and Dyllick 2002).

Environmental and triple bottom line accounting and reporting have emerged in this milieu. Hence, accountants have begun to consider the potential of *new reporting models* for business which include non-financial information (ICAEW 2003, Illingworth 2004, KPMG 2003). The business case for such change is related to the cost advantages from: having an integrated reporting and communications strategy; the need to portray a balanced performance story that reports bad as well as good news; extension to include social and environmental as well as financial information; and improved confidence of boards and executives in the new reporting model and statements. Yet these new reporting models have also been the subject of criticism. Environmental reporting receives considerable opposition from government and business because its requirement under environmental regulation is seen as imposing unnecessary costs on business (ENDS 2005). Frost and English (2002) found that arguments used in Australia against mandating environmental disclosures included the comment that: corporations' law does not extend to non-financial issues; that mandated disclosure will reduce the flexibility of companies to tailor reporting to individual stakeholder needs; and that unnecessary additional costs of compliance would be incurred. Gray and Milne (2002) suggest that triple bottom line reporting remains and is likely to continue to remain dominated by financial considerations, with the social and environmental being a mere add-on. They call for the quality of social and environmental reporting to be dramatically improved.

Sustainability accounting at the moment represents the zenith of accounting and reporting with its conceptual emphasis on accounting for ecosystems and accounting for communities, consideration of eco-justice, as well as a focus on issues of effectiveness and efficiency (Gray and Milne 2002). Corporate sustainability accounting and reporting is claimed by Gray and Milne (2002) to present a challenge because of the need to address the entity concept and focus on eco-systems and their carrying capacities, thresholds and cumulative effects. They suggest that, it is not possible to define what a sustainable organization would look like, hence, the necessary accounting as the basis for sustainability reporting must also be unknown. Thus, the challenge for corporate sustainability accounting and reporting to succeed has been laid down and its recent development and prospects are outlined below. *The key to this challenge is the need to reconsider the importance of accounting hitherto underplayed*: non-financial information; forward-looking information; and the needs of other users (stakeholders) in addition to the needs of investors (ICAEW 2003:72). But, beyond these is the need to adopt the conceptual underpinnings with which a new form of accounting, sustainability accounting, must engage if it is to be successful in an operational sense.

There is no doubt that conventional accounting does not provide sufficient relevant information about corporate sustainability and specific corporate contributions to sustainable development (Maunders and Burritt 1991). Although the limits of conventional accounting in providing corporate sustainability information are widely acknowledged, different conclusions are drawn from this in discussions about the relationship between accounting and sustainability and the role of accounting for sustainability.

From a philosophical viewpoint the question can be raised as to whether accounting can be developed or further modified so that it can help management to foster the sustainable development of a company, or whether the accounting approach would, in principle, be overtaxed if it was to address sustainability issues.

In a world where companies are expected to demonstrate their performance in terms of contributions towards sustainability, accountability and transparency have become major prerequisites to enabling a cooperative and constructive participation of employees, customers, the financial community and civil stakeholders. But is really meant when talking about sustainability accounting?

A completely different development is observable in the field of applied management research and corporate practice, where a variety of approaches to information management are discussed under the title of sustainability accounting.

2.2 The Management Approach. Struggling with Terms and Tools

Living and doing business within the capacity of supporting social and natural systems information management is a vital concept which is sometimes overlooked in discussions about growth and competitiveness. However, for good or bad, business cannot escape the economic and competitive consequences of a large number of emerging sustainability issues.

Anybody pursuing sustainable development as a corporate goal in practice will sooner or later face questions such as how progress towards sustainability could be operationalised, measured and communicated. In particular, the demand for information about the economic effects of environmental and social activities helps push the development of sustainability accounting tools for use in corporate practice. At present there is an enormous potential to improve development towards corporate sustainability, which highlights the importance of management linking value creation with environmental and social considerations. To realize this potential, it is necessary for sustainability issues to be given adequate consideration in information management accounting. Hence there is a need to revise conventional corporate accounting systems to incorporate environmental and social issues and their financial impacts.

Investigation of corporate practice reveals that sustainability accounting is sometimes just used as a new term for environmental accounting. Sometimes it consists of a collection of two or three independent accounts or reports. On occasion interdependency is recognised through eco-efficiency reports, which combine environmental and economic information about the company, and related information systems that focus on one of the links between the three dimensions of sustainable development (see Herzig and Schaltegger 2006, Schaltegger et al. 2006). However, to date, no clear approach to sustainability accounting has emerged from corporate practice.

Hence, when adopting the management perspective the term sustainability accounting has to be conceptualized from a theoretical, but practice orientated perspective. In this sense, sustainability accounting is the term used to describe new information management and accounting methods which attempt to create and provide high quality, relevant information to support corporations in relation to their sustainable development.

Sustainability accounting thus describes a subset of accounting that deals with activities, methods and systems to record, analyse and report:

- First, environmentally and socially induced financial impacts
- Second, ecological and social impacts of a defined economic system (e.g. the company, production site, nation, etc.)
- Third, and perhaps most important, sustainability accounting deals with the interactions and linkages between social, environmental and economic issues constituting the three dimension of sustainability

This definition of sustainability accounting addresses the question of its role in the management of corporate responsibility.

3. CORPORATE RESPONSIBILITY AND THE ROLE OF SUSTAINABILITY ACCOUNTING

Corporate responsibility is a contested notion as it is frequently attributed to individuals rather than institutions, although the notion of responsibility accounting recognises the practical importance of both (Solomons 1965:54). For an individual to be held responsible the process begins with perception of phenomena, then proceeds towards identification of certain morally significant features such as impact on others, harm, or pain. These perceptions are taken into account in reflection over the consequences of actions taken by individuals, the consideration and weighing of alternatives and the moral concern to justify or explain actions taken, or to be accountable to others. From the perspective of corporate responsibility, the corporate information gathering system provides it with a way of perceiving, the first step in acting responsibly (Stone 1976:118), prior to the identification of the morally significant features of corporate activities. Other considerations such as the authority structure, reward and promotion criteria, and information channels must also be in place for corporate responsibility to function effectively, but the information system remains fundamental. If the information system is incomplete, lacks relevance, or does not assist with comparability of different alternatives the likely outcome is irresponsible corporate activity and impacts. The centrality of accounting information in the process of promoting and maintaining responsible corporations is linked with the view that accounting is concerned with the individual behaviour or the behaviour of individuals in groups, such as in departments, divisions or corporations (Chambers 1966:14, Solomons 1965:56). The focus of accounting information will direct and guide corporate decision makers. Narrow or ill conceived accounting information will bias corporate actions and lead to impacts that are ill considered (Chambers 1966). Where corporate sustainability is the focus of attention (see Schaltegger and Burritt 2005), then corporate sustainability accounting will provide the foundation for the way that management perceive sustainability issues (see also Schaltegger et al. 2006). For managers who aim to improve corporate sustainability, sustainability accounting thus plays a crucial role.

In the context of daily business, however, further reasons related to conventional management activities may also play a role in creating the demand for sustainability accounting.

3.1 Further Reasons for Sustainability Accounting

Apart from the ethical motivation of some managers and the importance of accounting for sustainable development of a company there are at least three reasons which encourage managers to establish a corporate accounting system that provides information for assessing corporate actions on sustainability issues:

- *Legislative pressure:* The introduction of mandatory information and reporting requirements through legislation is the first possibility and easiest for most people to think of (e.g. as discussed in relation to the new EU chemical regulation, REACH). In case of enforced information requirements on sustainability, institutional compliance is necessary for the continuation of corporate activities.
- *Self regulation:* Self-regulation is a voluntary activity where a company or an industry association restrains its actions or commits itself to certain non-market actions (e.g. the disclosure of social and environmental

information). The corporation or industry seeks to improve its performance and reputation in a voluntary way, set within a framework whereby commercial or profit making considerations maybe important (see CMAC 2005:12), but not necessarily the main driver. Self-regulation on an industry level is often introduced in order to impede further mandatory government regulations, to maintain social acceptance and reputation, or to prevent competing companies from free-riding (e.g. by not bearing the costs of information management).
- *Managing the business case for sustainability:* One reason to introduce sustainability accounting is to identify and realize the economic (e.g. cost reduction or sales revenue increasing) potential of voluntary social and environmental activities. Corporate management will be motivated by this reason if it has some inkling that the company may have a business case for pursuing sustainability, but which would only be made transparent with better information.

All three reasons are concerned with corporate benefit, or the avoidance of detriment. The first tends to focus on accounting for compliance; whereas the second leans towards the role of accounting for developing industry reputation and freedom of action. The third reason is clearly associated with improved corporate performance and focuses on corporate competitiveness. Apart from the general desire to shape sustainable development of the economy and society, all three reasons are necessary for corporations to demonstrate corporate sustainability.

A narrow view of the compliance approach recognises that corporations need to demonstrate that they comply with the letter of the law. For example, this has been the driving force behind recent rules introduced after the Enron collapse in the USA and is linked with the Sarbanes-Oxley legalistic approach to resolving corporate issues associated with: the effectiveness of audit committees/corporate governance; disclosure and internal controls; external financial reporting; and executive reporting and conduct.

From the compliance perspective sustainability accounting can focus on information about what has to be complied with (e.g. the amount of certain air emissions, effluents, labour standards, etc.), whether it has been complied with, and exception reports showing where non-compliance has occurred and how the situation will be improved.

A broader view would argue the need for corporate compliance with the spirit of the law (CMAC 2005). Acceptance of moral liability for breaches of this spirit may be a better corporate strategy in order to maintain support against reputational risks and liabilities that could severely affect corporate value (SustainAbility et al. 2004). From this broader perspective accounting needs to provide awareness of the potential and actual social legitimation issues.

In the drive to ensure or encourage acceptable corporate behaviour it has not been enough to confront the corporation with the threat of negative profit outcomes for unacceptable behaviour (e.g. fines, removal of licences), or to take legal action against the corporation or key corporate individuals for non-compliance with the myriad of legal rules laid down (CMAC 2005:12, Stone 1976:29). Recognition of the limited scope of penalising corporations for non-compliance or non-conformance has led to a second approach gaining in popularity as a way of encouraging acceptable corporate actions. The *voluntary self-regulation* of improved corporate performance (CMAC 2005:18) challenges the view that the corporation must pursue maximum profits regardless of the consequences for society, and involves the management of risk and return. Companies and industries may choose to restrict their actions for intrinsic moral reasons, to improve their reputation, to reduce incentives for politicians to pass new regulations and to design themselves optimal cost-minimizing approaches achieving certain sustainability goals, or for the reason that they seek increased profit. In this view it may even make sense, from a corporate perspective, for companies to decide on self regulation of the industry and to accept higher costs. The higher costs will not reduce competitiveness if all companies have to bear them as part of an industry agreement. In this sense, self-regulation makes sure other companies cannot act as free-riders, or that the government does not impose more stringent or more costly regulations. Self regulation can either be driven by moral objectives, the desire to reduce potential costs or competitive disadvantages, or by the intention to increase the company's profit. The rationale is that it is beneficial to signal that the company or industry is going beyond mandated regulations in the consideration of social and environmental concerns

Under the self regulatory approach sustainability accounting can provide information about the economic, social and environmental costs and benefits of new self regulations for a single company or the industry, post assessments of existing self regulations, compliance of competitors with industry self regulations, cost differentials between the self regulation and a possible government regulation, cost differentials between competitors, etc.

A third important reason that company management may be interested in developing or introducing sustainability accounting is to increase its profits/ wealth under the given regulatory and market conditions. Such a *business case perspective* implies that it is in the company's own short and long term interests to take into account the environmental, social, as well as economic contexts in which it operates. Economic success based reasons for this view can be driven by risk or opportunity. Risk management is an often underestimated element of the business case approach to corporate responsibility. Control of financial, social and environmental risks all have a bearing on corporate success, shareholder value and maintenance of the corporation's licence to operate (Schaltegger and Figge 1997, SustainAbility et al. 2004). Trade offs between different risks in the short and long term are important to long run corporate success. An accounting system that advises and informs decision makers about relevant risks, as a basis for risk management, is to be preferred to one which turns a blind eye to certain risks, such as the risks associated with environmental and social impacts of corporations. Apart from risks, the increasing globalization of markets and standardization of products also provides opportunities for companies to differentiate themselves in terms of sustainability. This has become a driving force especially for many medium size companies but also larger corporations that have identified possibilities for developing their products, production systems and marketing in a more sustainable direction. As with risks, which by definition have not yet occurred, an opportunity based business case needs to be created and managed. Among the main reasons to create a business case for corporate sustainability are: to reduce costs or risk, to enter new markets, to improve employee morale, or to increase contribution margins, prices, sales, innovation, corporate reputation, or intangible values such as brand value (see e.g. Schaltegger and Hasenmüller 2006, Steger 2004; see also Schaltegger et al. 2006).

Under the business case approach sustainability accounting can be regarded as that subset of accounting which provides information about the business opportunities and risks an organisation faces in the light of sustainable development considerations including potential cost savings, reputational issues, or other profit increasing possibilities.

Thus, the question is in which direction sustainability accounting will develop, from the management perspective.

3.2 Interpretation of and Paths for Sustainability Accounting

Apart from the philosophical debate, four possible interpretations or paths for the development of sustainability accounting can be distinguished. Sustainability accounting can be interpreted as:

- An empty buzzword blurring the debate
- A broad umbrella term bringing together existing accounting approaches dealing with environmental and social issues
- An overarching measurement and information management concept for the calculation of corporate sustainability

- A pragmatic, goal driven, stakeholder engagement process which attempts to develop a company specific and differentiated set of tools for measuring and managing environmental, social and economic aspects as well as the links between them

The following sections give a short overview of these interpretations and paths.

3.2.1 Sustainability Accounting as Buzzword

From both a philosophical view and also from a manager's perspective sustainability accounting can be seen as an empty buzzword which blurs the view of corporate sustainability and sustainable development. From a "hardline" management view the tool can be used for greenwashing, or window dressing, to cover up the lack of activity, or to make sure that no engagement with corporate sustainability process is expected. The fact that sustainability is sometimes used as a buzzword for window dressing activities has lead some critics to condemn the management approach to sustainability accounting and to question the usefulness of sustainability accounting and management for sustainable development in general (Gray 2002:698, Gray and Bebbington 2000, Welford 1997).

However, a general rejection of a management approach towards corporate sustainability is an exaggerated response as it would devalue and cast aside all and any positive engagement processes, results and attempts towards improving the links between corporations and sustainability. Development of sustainability accounting from a management perspective is necessary for a number of reasons even though some specific company cases may justify a strong critique:

- *No alternative to management*: to date there is a alternative stakeholder than management, who could effectively initiate and establish sustainable development of and with companies. Any potentially effective (and efficient) approach which supports the decision takers of a company must therefore be managerial in kind. Everything else is an illusion.
- *Different kinds of management motivations*: managers, as individuals and as part of a management team, can have very different views about sustainability. This is reflected in the way they consider sustainability issues in their business, whether as a core topic for their core business, as an opportunity driven issue, a subject of risk, an administrative task to be complied with, or as an issue to be fought against.
- *Different kinds of management approaches*: depending on the sustainability preferences and their possibilities managers will define other goals and shape the corporate sustainability process in different ways. As

a result the tools will differ and the concrete operationalization and implementations will be different. In other words: the shape, process and effects of sustainability accounting can be very different from company to company. However, the variety of approaches does not mean that sustainability issues are not taken seriously.

The last point especially suggests that another view of sustainability accounting is as a broad umbrella term for a multitude of different tools.

3.2.2 Sustainability Accounting as a Broad Umbrella Term

Sustainability accounting could just be used as a broad umbrella term bringing together existing accounting and reporting approaches dealing with environmental, social, eco-efficiency, etc. issues. Among the main reasons for this interpretation are:

- Discussions about general sustainability and the corporate sustainability debate in particular, have been characterized by the *frequent use of new and similar terms.* To most observers, sometimes even for experts, the links and differences between these terms are unclear or obscure. One possible reaction of managers is to use them interchangeably or to use one term as an umbrella term covering a large variety of approaches in the broader area.
- Sometimes the use of the term "sustainability" is not driven by the concept of sustainability at all but it is instead an *expression of the struggle with the complex bundle of issues* and goals covered by the concept of sustainable development.

However understandable the reasons for such interpretation are, this basis for development of sustainable accounting *ignores a decisive characteristic of sustainability: the consideration of interlinkages* between the different dimensions of sustainable development. Thus, to consider sustainability accounting as an umbrella term not only reflects a certain *ignorance* of the basic idea of the sustainable development concept, but also is accompanied by the danger of coincidental or other misuse. This may be illustrated and expressed most clearly in cases where the word "sustainable" or "sustainability" is used indifferently and interchangeably with the word "environmental" (accounting).

As a consequence, the consideration of sustainability accounting as a broad and fairly nebulous umbrella term for a large variety of methods would in effect mean sustainability accounting is being handled as a buzzword, without a specific approach or meaning. Furthermore, if used as an umbrella term it basically is *difficult to distinguish whether management is* *not well informed* or trained about sustainability issues, whether it is ignorant, or whether it is an exponent of the art of window dressing. Hence, it makes sense from a management as well as from an academic position to provide the term sustainability accounting with further meaning by linking it to the need to treat corporate sustainability as an outcome, track progress towards this outcome and feed back information that can be used to ensure the corporation is on course, and if not, to use feed forward (planning) devices to help the organization take actions that will bring it back on track.

3.2.3 Sustainability Accounting as an Overarching Measurement Tool

Some may expect sustainability accounting to become a single overarching "comprehensive" measurement and information management tool quantifying and covering all aspects of sustainability with one measure. The desire to express the level of sustainability through one, preferably monetary, measure has accompanied discussion and research about sustainability since its beginnings. A large body of literature addresses this topic for national accounting (e.g. Banzhaf 2005, van Dieren 1995, Hecht 2005), product assessment (e.g. the early approaches to life cycle assessment, e.g. Aoe 2003, Bartelmus and Seifert 2003, Mueller-Wenk 1978), and even to the measurement of corporate sustainability performance (Chambers and Lewis 2001) and sustainability ratings of firms.

Without doubt, an overarching key figure for sustainablility performance has its appeal and can serve as a spur to sustainable development through comparisons of products, brief communication of extraordinary performance, or discrimination against laggards.

Use of this single measure approach to measuring sustainability faces the problem that the sustainability concept becomes even broader and more pluralistic than the measurement of environmental impacts or performance. Sustainability does not just cover three times as many issues as the evironmental dimension it also addresses issues such as participation, future orientation, diversity, cultural issues and the linkages between them all. Furthermore, corporate sustainability requires the specific consideration of spatial, regional and time aspects which can differ substantially. Given the multi-perspective character of sustainability and the variety of goals and stakeholders involved, no matter how technically sophisticated it might be, an approach aiming for a single overarching measure must remain a technocratic illusion. If a single approach to measurement and one key number representing corporate sustainability at a particular time prevailed in public and political debate, a large variety of crucial aspects and issues related to sustainable development and critical to the sustainability vision and its realization in corporate practice, could be hidden.

This does not mean that a specific key figure for sustainability performance will never be of use for answering specific questions, contributing to the understanding of situations, or providing information about company performance. Instead, it means that such an approach to measurement and indicators will never be able to fulfil the information needs of managers and stakeholders who are really concerned about improving corporate sustainability and who engage with the corporate sustainability challenges. Corporate sustainability management covers a wide range of issues which are very different in kind. Managers who really want to engage with these challenges and who wish to contribute to their solution with tangible activities must accept these differences in their measurement, information and management methods. This discussion shows as a consequence that *sustainability accounting must be placed and developed somewhere between the extremes of an umbrella term and a single measurement tool,* each of which is insufficient on its own.

3.2.4 Sustainability Accounting as a Pragmatic Goal Driven Development Approach

Sustainability accounting can be seen as a pragmatic goal driven approach which attempts to develop measurement tools for different integration levels and methods of environmental, social and economic accounting and reporting expressed in physical and monetary terms. This includes the measurement and management of information about all linkages and aspects of corporate sustainability (see Schaltegger and Burritt 2005, Schaltegger et al. 2006) eco-efficiency, socio-efficiency, stakeholder value, shareholder value contributions of corporate citizenship, etc. As a result various subsystems of sustainability accounting and information management are currently emerging such as eco-efficiency accounting, accounting for social impacts and benefits, and accounting for socio-efficiency (e.g. measuring stakeholder value).

The acceptance of a range of different information management methods for the design of a company's sustainability accounting should not be confused with chaotic development of any kind of indicator and measurement systems. The management challenge of corporate sustainability accounting is to design an information management approach which is, first, linked to the relevant sustainability issues the company is confronted with and, second, clearly shows the relevance of the information to corporate success.

A core question for this approach is identification of the specific sustainability challenges for the company, the sustainability issues it is exposed to, which of these are relevant, how they can be reduced to relevant sustainability goals, and how they can be measured, analysed, communicated and improved. Hence, from this perspective, sustainability accounting research has to provide proposals for *procedures about how relevant sustainability challenges can be identified and how measures and indicators for a given corporate and management situation can be deduced.*

With this pragmatic goal driven perspective of sustainability accounting, from a manager's perspective the task is to *develop a company specific framework* and system related to clearly defined businesses, company tasks and decision situations. One reference leading in this direction provides the framework for environmental management accounting (Burritt et al. 2002b) which destinguishes different decision situations and encourages management to identify their information needs and to chose the appropriate EMA tools (see also Herzig et al. 2006).

Developing sustainability accounting from a goal or target driven pragmatic perspective requires that *addressees and key stakeholders are identified and that the core topics and expected contributions of sustainability are identified.* These requirements make it clear that sustainability accounting cannot be completely separated from sustainability reporting and the strategic and operational management of sustainability issues. Furthermore, the role of accounting and accountants is seen to:

- Support the process of engaging management in the development and improvement of corporate sustainability
- Review results, processes and inputs as well as to relate these areas to each other
- Facilitate communication and review of reports
- Support and challenge management in their choice of corporate sustainability measures

One of the main differences between the pragmatic process development approach and the umbrella term for interpretation of sustainability accounting is that the umbrella interpretation does not consider relevance. Instead it places all kinds of information tools beside each other, without the specific focus on what relevance they have for a given corporate or sustainability context. From a pragmatic goal driven perspective, sustainability is accepted as a real, not just an abstract or theoretical, corporate challenge where the description and measurement of sustainability performance has to be made concrete in the specific context in which each company finds itself. This requires an approach which can identify and differentiate between the issues of relevance to corporate sustainability for a given setting. Thus, pragmatism is distinctly different from, on the one hand, ignorance and, on the other, from assigning all tools the same level of importance. The next section discusses two views of how sustainability accounting could be developed further from a pragmatic perspective.

4. PRAGMATIC GOAL DRIVEN APPROACHES TO SUSTAINABILITY ACCOUNTING

This section discusses two basic approaches which can be distinguished to develop a pragmatic sustainability accounting system in general and in a specific company context:
- The top-down approach
- The stakeholder driven approach.

The *top-down approach to sustainability accounting development* starts with the broadest definition of sustainable development and corporate sustainability and from this the measurement approach is derived. The logic is that the overall term sustainable development is broken down into partial indicators and measurements in the most systematic way possible. The basic idea of this approach is to develop a generally usable key indicator system similar to that offered by the Return on Investment (ROI) indicator scheme made popular by DuPont. The characteristics and perspectives of sustainable development such as the three pillars, future orientation, participation, long term view, etc. are used in order to develop a system of accounting and information management tools derived from the top and extended downwards to provide relative measures of sustainability topics in a systematic and integrated, or related, manner. Measures and measurement approaches have then to be established to create the defined goal orientated information and to calculate the relevant indicators.

This approach can result in a compelling sustainability performance measurement and management concept if specific conditions hold: first, corporate responsibility and accountability relationships must be clearly defined; second, an appropriate strategic analysis of the company and its interface with sustainability and sustainable development issues must be mapped. However, as an academic endeavour this approach remains mostly as an abstract academic experience for an intellectual elite, because of its orientation towards the blanket coverage of all detailed possibilities – or at least a large number of these defining indicators. This contrasts with actual corporate practice, where only a limited number of indicators are seen as being relevant and it is necessity to recognise that sustainability performance depends on the specific location and application on hand.

The *stakeholder driven approach to sustainability accounting* organizes the development of sustainability accounting in a quite a different way. A stakeholder driven development of sustainability accounting means that the question of what sustainability performance means for a specific company and industry, what indicators are considered to mirror this performance best and how it should be measured and communicated is *determined through stakeholder engagement processes.* The basic logic is that if management wishes to make sustainability a real world phenomenon the engagement of stakeholders is a prerequisite to the development of an effective sustainability accounting system.

Behind the stakeholder driven development of sustainability accounting is the notion that identification of the core corporate sustainability issues is neither an abstract theoretical exercise nor a unitary view (e.g. the management perspective). *Participation and involvement of key stakeholders* are thus considered to be key components of business strategy designed to establish an effective information management system for corporate sustainability. Furthermore, participation is a crucial aspect of sustainable development itself so that the development of a measurement and information management system should also be undertaken through a participatory, or at least consulting, based process.

The stakeholder driven approach to sustainability accounting starts with one, or usually several, *multi stakeholder dialogues.* The first management step is to identify and include in dialogue addressees and key stakeholders and the core topics and sustainability contributions which the stakeholders expect from the company. These dialogues should produce goals which are jointly derived and ideally result in agreement on measures and indicators. They reflect initial corporate commitment to the process of stakeholder engagement. In the second step, management is challenged to develop its sustainability accounting and information management framework and measurement approaches on the basis of these goals and indicators. The result of this process should be a targeted stakeholder orientated sustainability accounting system in which purpose orientated information is collected, classified and analysed, compared with performance targets and actions taken to develop improvement plans that, when implemented, move the company towards sustainability.

In the third step, stakeholders are advised about the direction and strength of such movements through two complementary processes, verification and reporting. Verification adds credibility to information disclosed, while the reporting of credibly information provides the basis for further stakeholder dialogue and incremental improvement.

A comparison of the top down approach with the stakeholder driven approach to develop sustainability accounting shows that both have a certain logic which may be appropriate in a given corporate situation. Whereas the stakeholder driven approach may be linked best with reporting, social acceptance and reputation requirements, the top down approach may make it easier to bring into line with the strategic goals and the competitive strategy of the company. As a consequence the development of the corporate sustainability accounting system firstly, cannot be isolated from the development of the sustainability reporting system. Secondly, management may want to choose a *twin track approach* to check whether all relevant issues addressed by the stakeholders, addressed with the business strategy, and raised as major general sustainability issues, are covered.

5. CONCLUSIONS AND OUTLOOK

The term sustainability accounting and the relationship between sustainability and accounting began to be addressed about ten years ago. Considerable academic discussion seemed to have become caught up in an ongoing philosophical debate. This has resulted in different views and intended uses of sustainability acocunting (Table 2-1). The development of a pragmatic set of tools for corporate practice is yet to progress beyond an early stage of development and is hampered by insufficiently refined and immature proposals. Thus future research needs to address the real challenge to corporate management - to develop pragmatic tools for sustainability accounting for a well described set of business situations.

Table 2-1. An overview of different approaches to corporate sustainability accounting.

View of sustainability accounting	Use of sustainability accounting
It is an illusion and buzzword	Window dressing
Broad umbrella term	Window dressing or expression of ignorance
Precise overarching measurement approach	One measure covering all aspects of sustainability
Process developing a set of pragmatic information management tools and information	Identification of relevant sustainability issues of the company, overall performance tracking and measurement with specific respect to the specific characteristics of the relevant sustainability issues

Such business situations need to address the decision and control needs of corporate managers, whether they are responsible for environmental, social or economic issues associated with corporate activities, and with some combination of these. The trade-offs (conflicts) and complementary situations need to be identified, analysed and accounting that provides a basis for movement towards corporate and general sustainability developed. In this context, two critical questions arise:

- What appear to be the outstanding tasks for research into the development of sustainability accounting?
- What are the requirements for the development and use of a sustainability accounting system in corporate practice?

First, given the significance of the task there is a need for *diversity of research methods* to be encouraged in direction of sustainability accounting, whatever the philosophical stance being taken – empirical, qualitative and research based on mixed methods (Creswell 1997).

Second, conducting theoretical *research that is useful to corporate managers in practice* (Lawler et al. 1985) is necessary if sustainability accounting is to demonstrate its fitness for purpose, and will require: the creation of meaningful indicators and information using a range of tools; support for meaningful interpretation and relevant use of these indicators and information; a sustainability accounting system that is reliable and transparent and, thereby, provides a credible basis for decision making and accountability; and for many sustainability issues which are relevant for corporate success a new definition and understanding of accounting boundaries is necessary, one that pulls relevant information into the corporate net through *value chain information management.*

Third, the linkage between sustainability accounting and sustainability reporting needs to be extended as a pragmatic imperative *by moving beyond the procedural tasks* designed to emphasise report preparation, information verification and disclosure (SIGMA 2003:5) and *towards behavioural change* within corporations, such that performance is improved (Schaltegger and Wagner 2006). In this context, sustainability reporting remains at an early stage of development, and at present is still more of a buzzword than a well defined approach.

Fourth, a further pragmatic challenge for research is the need to provide a framework for and evidence about measurement and reporting which balances the need for *integration* of the variety in information about sustainability with the *differentiated* unitary information effects between the dimensions of sustainable development (Lawrence and Lorsch 1967), at various corporate management levels (e.g. top management and site management) and for various management functions (e.g. strategy development and operations).

Fifth, researchers need to recognise that to fall short of a *convincing conceptualization* will leave sustainability accounting as a broad umbrella term, with little practical usefulness.

Finally, the tasks for applied research, development and training are: to recognise and accept the limited function of accounting information and the need for its serviceable information in business; to capitalise on the specific guidance for mangers offered by sustainability accounting; and to conceptualise an acceptable proportionality in sustainability challenges to business and to independently research links between this proportionality and the mindsets, actions, attitudes and behaviours of managers, given the predetermined policy goal of sustainable society. Of course, the debate remains open to those with a philosophical bent, to challenge this goal and the whole edifice constructed on the premise of sustainability, its operationalisation and its accountings.

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Chapter 3

TOWARDS A MONETISED TRIPLE BOTTOM LINE FOR AN ALCOHOL PRODUCER

Using Stakeholder Dialogue to Negotiate a 'Licence to Operate' by Constructing an Account of Social Performance

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Abstract: Forum for the Future has been working in partnership with an alcohol producer, "AlcCo", in its aim of making sustainable development possible by being a model of a sustainable business. With AlcCo, the social and environmental accounts are each composed of a monetary valuation of externalities and the 'shadow costs' of avoiding or restoring that externality. For the environmental accounts the 'shadow' cost was derived by identifying the gap between current and sustainable environmental performance and the present market price of closing that gap; the externalities were derived using public information. The social dimension was created through wide stakeholder engagement to construct a social externality that they believed the company was responsible for and the how much it would cost the company to discharge its responsibility for this damage. Work is continuing on a sector-wide approach so that the alcohol industry and the government can step out of the cycle of promoting the place of alcohol in society only to service the consequential misuse. Stakeholder engagement is a source of feedback for AlcCo and provides validity for the approach. It is allowing AlcCo to negotiate a new role in contributing to a sustainable society.

1. INTRODUCTION

Forum for the Future ("Forum") is the UK's leading sustainable development charity, which works in partnership with industry, government and education institutions researching and establishing new practices with the aim of making the transition to a sustainable way of life. Forum and AlcCo,

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 61-82.

a drinks producer, have been working for over 4 years on sustainability issues relating to the alcohol industry.

The paper is structured as follows:

- The remainder of Section 1 introduces AlcCo, Forum's sustainability accounting method and the role of alcohol in the UK
- Section 2 explains how the environmental accounts were constructed
- Section 3 explains how the social accounts were constructed
- Section 4 provides conclusions

1.1 Introducing AlcCo

AlcCo is a leading UK producer of 'long' drinks (such as beer and cider), with a turnover of around £600m and a UK market share of 3.5% by alcohol volume. AlcCo aims to become a model sustainable business through:

1. Demonstrating a workable economic model, with subsidy structure, to support sustainable agriculture
2. Practising environmentally-benign manufacturing
3. Expressing a positive social role for the alcohol industry

Since 1999, AlcCo and Forum have been developing an accounting methodology to describe the company's environmental and social damage cost, and the cost of restoring and avoiding the damage in ways that can add value for shareholders. The work is moving towards a 'monetised' Triple Bottom Line, or a set of financial sustainability accounts.

Accounting for the economic, social and environmental impacts of AlcCo serves two purposes. AlcCo can use the sustainability accounts to take the right strategic and operational decisions to move it towards sustainability. For instance, the sustainability accounts have informed a decision to move towards responsible marketing as a strategic and operational course to fulfil its responsibilities and mitigate its regulatory risks. The company can also use them to engage different audiences, which can both hold AlcCo to account and be shown how AlcCo is taking its share of responsibility.

The ultimate aim is a business model which adds value for shareholders and stakeholders across the different dimensions of sustainability, economic, social and environment. Therefore, the aim of the sustainability accounts is to play a significant role in linking the financial viability of the alcohol industry with the environmental impacts of its manufacturing practices and with occupying a positive role in society.

1.2 Forum for the Future's Financial Sustainability Accounting

Forum's work on sustainability accounting has grown out of its environmental accounting methodology, as described in a joint publication with the UK Chartered Institute of Management Accountants in October 2002 (Howes 2002). Forum uses the following definition of 'financial sustainability accounting':

"The generation, analysis and use of monetised environmental, social and economically-related information in order to improve corporate environmental, social and economic performance."

This framework for financial sustainability accounting is based on three dimensions:

1. *Timing of impact*: Is the data a snapshot in time of the state of the *stock* or does it show the *flow* of goods and services arising from the stock over a period?
2. *Location of impact*: Is it a valuation within the company's financial reporting boundaries (*internal*); a cost or benefit imposed outside the boundaries (*external*), or the cost or benefit to the company of avoiding or restoring the external impact (*shadow*)?
3. *Type of impact*: Is the impact environmental, social or economic?

Under this framework, traditional financial accounting is narrow: it only considers *internal*, *economic* Balance Sheet *stocks* and Profit and Loss account *flows*. Financial sustainability accounting expands to not only include *environmental* and *social* impacts but also consider the *externalities* created plus how much it would cost the company to avoid or restore those impacts (or *shadow* cost). The difference is illustrated in Figure 3-1.

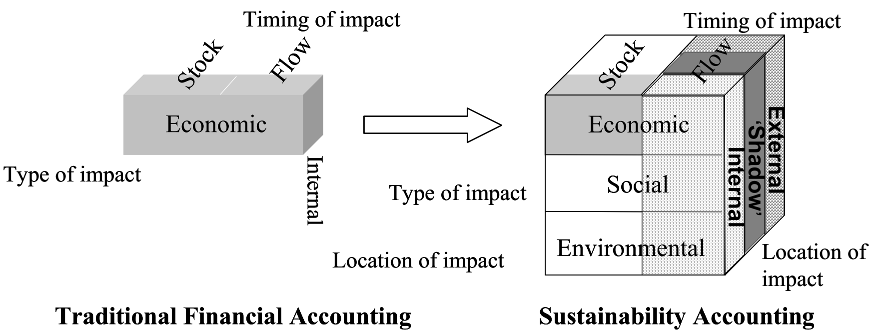

Figure 3-1. Comparing traditional and sustainability accounting.

According to Bebbington et al. (2001), an externality arises where private decisions do not reflect either the public costs (borne by the whole of society) or the private costs (borne by people other than the decision-maker) of the decision. They argue that externalities indicate how current prices fail to incorporate environmental and social issues and that for the current system of economic organisation to operate in an environmentally sensitive and socially just manner then externalities must be internalised in some way.

Forum uses 'shadow costs' to mean either the avoidance or restoration cost which the organisation would have had to spend in the last period so that the externality would not have been created. In effect, the shadow cost is synonymous with the cost of internalising the externality. If the company takes steps towards being more sustainable – for instance, by moving to renewable energy sources and so not contributing to climate change – then the costs of not creating the externality have been incurred (it is now an *internal, economic* flow); no externality has been created, and so there is no shadow cost. Put another way, the shadow cost is a measure of the cost to the company of meeting new stakeholder expectations of 'normal' business or of new regulatory standards. It can be thought of as a measure of exposure to regulatory or political risk.

For preference, the shadow cost is calculated from specific plans to avoid environmental impacts, such as a quote from a renewable energy provider. However, where these are not available, general restoration costs are used, for instance the cost per tonne of carbon sequestration.

In terms of the comprehensive framework proposed in Burritt et al. (2002), Forum's Financial Sustainability Accounting is a monetised-approach based on past oriented, routinely generated information which considers performance over the last year. Organisations which use this method produce annual accounts for stakeholder reporting purposes (which Burritt et al. refer to as 'external accounts') and potentially more frequently for internal decision-making (referred to by Burritt et al. as 'internal accounts').

A monetised triple bottom line of any organisation is greater than the financial results of its operations or the net financial impacts of environmental or social initiatives. A complete monetised triple bottom line also considers externalities imposed on the rest of society, now and in the future, plus the cost to the company of not creating the externalities.

The Forum approach assumes that it is possible to:

- Define a level of performance which is sustainable for the company and society
- Calculate the avoidance or restoration cost of moving to sustainable performance
- For the company to pay for the transition

Other writers in the field contest each of these assumptions. For instance, Gray and Milne (2002) ask "is the future safe in the hands of business?" and state that "our reading of the evidence is that our current systems of economic, financial and social organisation are moving us in the wrong direction – i.e. our current systems are making us more unsustainable". Nevertheless, Forum believes it is possible to make progress to a sustainable society with these assumptions in place.

Understanding the triple bottom line in this extended way acknowledges that any organisation is part of the wider social context. The results of a complete monetised triple bottom line can be used to demonstrate where there is a case for a company's operations being consistent with sustainable development. They can also be used to show where the market incentives of a company are not aligned to the economic good of society as a whole, through the social or environmental cost imposed. Where this is the case, the full set of sustainability accounts can be used to argue for government and other participants to intervene and re-write the rules of the market. Forum's work with AlcCo has been to produce a wide, though not complete, set of sustainability accounts, as illustrated in Figure 3-2.

The missing elements of the cube indicate that the sustainability accounts are still a work in progress. In particular the economic and social external benefits of alcohol have not yet been included, though they will be for the next iteration. The first estimates of social shadow costs are to be revised in the light of experience over time. For this set of sustainability accounts the limited resources were focussed on the most important areas, where there are the greatest stakeholder concerns. These matters are discussed in more depth in Section 3.

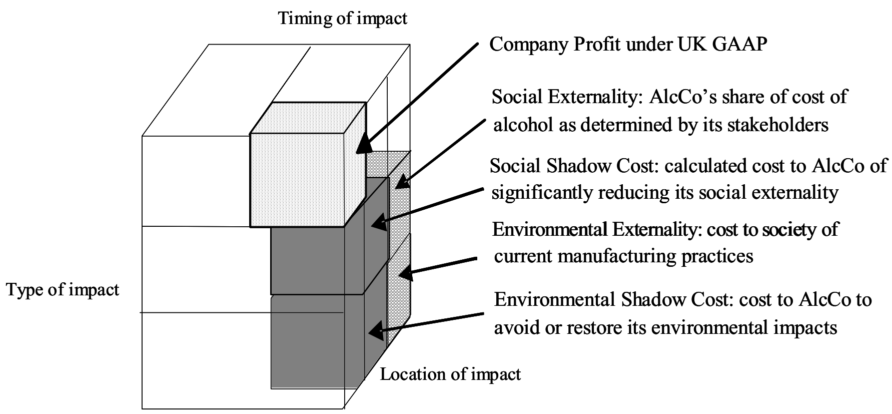

Figure 3-2. AlcCo's sustainability accounts.

1.3 Alcohol in the UK

Alcohol is a normal part of social life in the UK. As the Cabinet Office, the civil service department which administers on behalf of the UK Prime Minister, recently reported, "the vast majority of people enjoy alcohol without causing harm to themselves or to others – indeed they can gain some health and social benefits from moderate use" (Cabinet Office 2004:7). In addition, the alcohol industry employs up to a million people and contributes some £30b to the UK economy.

But alcohol consumption also leads to addiction, health problems, domestic violence and anti-social behaviour with impacts on the community such as late-night disorder in towns. The Cabinet Office report continues that, in England, alcohol misuse causes significant harms, which can be valued as £1.7b of health expenditure; £7.3b as the result of crime and anti-social behaviour; £6.4b in lost productivity and profitability, and £4.7b of human and emotional suffering – a total of £20.1b a year. The Cabinet Office valuation is based on costs to public services (such as treatment of disease or of dealing with alcohol-related crime); lost productivity and profitability (from alcohol-related absence and premature death) and from human and emotional suffering. As with any economic analysis, there are a number of assumptions with the Cabinet Office calculations. However, the figures are broadly accepted and form part of the policy landscape for the industry and civil society.

Furthermore, while consumption has fallen over recent years in most of the wine-producing countries, British alcohol consumption continues to rise. If present trends continue, the UK will rise to near the top of the consumption league within the next ten years (Cabinet Office 2004).

Historically, the UK government has placed a tax at the point of sale (an excise duty, also known as the alcohol duty; which is charged at the point of sale to the consumer; the current UK rate is about £0.35 per pint of beer). The purpose of this tax has been to reduce consumption and raise money for paying for the government services that treat alcohol misuse and its consequences.

The alcohol industry is under pressure from shareholders to increase its returns. Therefore, industry and government find themselves in a dilemma: As industry increases its volumes sold, government must raise duty to cover the extra social burden. Industry and government are apparently trapped in promoting the place of alcohol and then servicing the consequential misuse.

2. ENVIRONMENTAL ACCOUNTS

The starting point for Forum's work with AlcCo in 1999 was the environmental impacts of the manufacture and delivery of its product. Therefore, Forum and AlcCo created a set of environmental accounts which estimate the external cost imposed on society of AlcCo's manufacturing and distribution, and a market-price shadow cost of avoiding or restoring that externality. For reasons of space it has not been possible to give more detail on how the calculations have been performed. However, the operational workings of on the methodology can be found in Howes (2002, 2003).

2.1 Outline Steps

The following steps were taken in calculating these accounts:
1. Identification of the most significant environmental impacts
2. Determining the environmental sustainability gap
3. Valuation of those impacts

2.1.1 Identification of the Most Significant Environmental Impacts

The environmental accounts were prepared for AlcCo's UK operations. The starting boundary for the manufacturing process was growing of the raw material; the final boundary was the journey from AlcCo's factory to the distributor's depot. The main environmental impacts of AlcCo's UK operations have been identified as:

- Impacts to Air
  - *Climate change gases emissions*

    These gases are emitted supplying non-renewable energy for production purposes, and from transport such as the distribution of AlcCo products.
  - *Gaseous emissions such as sulphates (SOx) and nitrates (NOx)*

    These pollutants are emitted by the same energy sources as above. Their impacts include poor urban air quality, asthma, respiratory disease, cancer and loss of habitat.
- Impacts to Land
  - *Agricultural production*

    Growing the raw materials has an environmental impact through the farming methods used, such as the run-off of fertilizer, herbicides and pesticides. For the sake of simplicity, tractor fleet emissions to air are included in this cost.

- Impacts to Water
  - *Water extraction and discharge*

    The manufacture of cider requires that production water is drawn from local sources and discharged into a local river. Both abstraction and discharge have environmental impacts.

2.1.2 Determining the Environmental Sustainability Gap

The environmental sustainability gap is the difference between impact on the environment over the last year and the level of impact that would be environmentally benign. When looking at the year ending 31 March 2003, AlcCo's finance department, with assistance from the authors, calculated the levels of emissions using the in-house Environmental Management System and records of activity.

In considering the level of benign environmental impact the method is guided by the latest available scientific evidence or international guidelines. For climate change gases the Intergovernmental Panel on Climate Change (IPCC) suggests that emissions of greenhouse gases need to be reduced by about 60% (compared to their 1990 levels) in order to prevent dangerous anthropogenic interference on climatic systems. On road transport emissions, the World Health Authority (WHO) air quality standards require a reduction in ancillary pollutants, like NOx, of 50-60%.

2.1.3 Valuation of those Impacts

In these accounts there are two valuations: the avoidance or restoration shadow cost and the externality cost.

Shadow costs

As far as possible, shadow costs are based on real market prices of avoidance or restoration initiatives. The particular price depends on the source of the impact and what options AlcCo has available.

In the case of climate change gases, the emissions generating energy for the production process are based on a renewable energy surcharge, an avoidance cost. However, where emissions are not avoidable, such as burning natural gas for heat, the cost of sequestering carbon, a restoration strategy, has been used.

For the agricultural impact to land the valuation is based on widely quoted research on the external cost of agriculture (Pretty et al. 2000). The valuation of the impact to water was made in two steps. The first is to assess the cost of building a new water filtration system. The second is to depreciate that capital investment over the lifetime of the system, giving an annual charge.

Externalities
Pricing externalities involves greater judgement than pricing shadow costs, mainly because when a company chooses an avoidance or restoration strategy it is possible to try to find a market price for that option. By definition, externalities are costs borne outside the normal market system as they are not reflected in the market price. So any externality measure is more subjective than the market-based shadow price.

However, there is research into the externalities of environmental impacts, such as climate change (DEFRA 2003). To acknowledge the relatively subjective quality of these prices, a sceptical stance has been adopted and costs selected at the low end of the ranges. However, this does mean that the calculation of externalities is almost certainly an underestimate. For instance, the low range estimate of the external cost of climate change does not include the costs of more extreme weather events or of catastrophic changes, such as the ending of the Gulf Stream.

In the case of climate change, a Department for the Environment, Food and Rural Affairs (DEFRA) seminar in July 2003 (DEFRA 2003) gave at least three alternative ranges for the cost to future society for every tonne of carbon emitted today. The figure used is £6 per tonne of carbon, at the low end of the range from that seminar.

The external costs of the gaseous emissions are based on the ExternE (1997) research by the EU, which gives a low valuation of NOx and SOx of almost £5,000 per tonne each.

2.2 How AlcCo Plans to Avoid its Environmental Impacts

There are some capital investments AlcCo can make which would internalise almost half of its shadow environmental cost:

- *Biomass energy plant:* A biomass plant could supply AlcCo's electricity needs and release no 'new' carbon dioxide gases into the atmosphere, as an amount of CO_2 comparable to that released is fixed when growing the the next cycle of raw material for the generator.) This switch to locally-generated green energy would reduce the environmental shadow cost by £365k and the externality by around £1,125k.
- *Re-instating a railhead:* Re-instating a disused rail siding in the factory will allow AlcCo to have raw materials delivered and part of its distribution performed by rail. This initiative would potentially reduce AlcCo's transport emissions by 20-30%, reducing the environmental shadow cost by a further £210k, and the externality by around £110k.
- *Investing in a new water treatment works:* A new water treatment works could take non-product water through many more cycles, reducing

abstraction and discharge considerably. The impact to water shadow cost and the estimate of externality would both reduce by £200k.

Although the biomass energy project meets conventional pay-back criteria, the other projects do not. Therefore, overall it is hard to reconcile the compelling environmental case for AlcCo's avoidance and restoration programme with an equally compelling commercial case.

The environmental accounts for the year ending 31 March 2003 are given in Table 3-1.

Table 3-1. AlcCo's shadow and external environmental cost accounts.

	Shadow Cost	External Cost Low Estimate
	£'000	£'000
IMPACTS TO AIR		
Energy	410	1,196
Transport	832	2,772
Production and Manufacture	59	138
	1,301	4,106
IMPACTS TO LAND	215	214
IMPACTS TO WATER	200	200
TOTAL	**1,715**	**4,520**

3. SOCIAL ACCOUNTS

For the last two years Forum and AlcCo have been working to create a set of social accounts. The environmental accounts provide a starting point on how to build the social accounts. The environmental accounts assume that the level of environmentally sustainable performance is a scientific question, and, therefore, set an environmental sustainability gap based on latest sound science.

However, the question of what is the level of impact of sustainable social performance is different. Alcohol plays a complicated role in society, and touches the lives of many people. Each person has their own opinion on what the role of alcohol should be in the future in order to have a 'benign' or positive impact on society. Therefore, a stakeholder engagement method was chosen as the most valid approach to constructing the social accounts.

3.1 Outline Method

Constructing AlcCo social accounts has involved the following steps:
1. Apportion the costs of alcohol to AlcCo's products
2. Build a stakeholder consensus on external cost
3. Identify and cost practical measures to reduce social harm

The approach taken focuses on the social costs but there are also economic and social benefits of alcohol. However, these benefits were not included in the stakeholder engagement for several reasons. As noted above, the sustainability accounts remain a work in progress. Economic and social external benefits need to be included in the next iteration to give a more complete picture. Nevertheless, there are a number of reasons why the accounts remain useful.

First, in economic theory how much someone is prepared to pay is a measure of the utility they derive from the product. Therefore, most of the social benefits of drinking are included the price paid by the consumer and so are in the internal profits of AlcCo. There are some people who might be willing to pay more and in the next iteration of the accounts this 'consumer surplus' could be included to give a fuller valuation of the social benefit. In addition, the employment and contribution to economic growth of AlcCo and its products are an economic benefit, and could be included in the next stage.

However, the social and economic benefits do not accrue to the same people as the social costs. Therefore, under the Forum sustainability accounting method, these costs should not be subtracted from benefits to derive a 'net' figure as this would not accurately reflect alcohol's impacts on people (Similarly, there is some evidence to show that the annual deaths avoided from the medical benefits of moderate drinking exceed the premature deaths from alcohol consumption. However, in the eyes of most stakeholders a 'net' positive mortality count does not remove the need to understand the responsibilities of individuals, government and industry for the deaths that are attributed to alcohol.)

3.1.1 Apportioning the Costs of Alcohol to AlcCo's Products

The Cabinet Office built up a calculation of the social cost of alcohol in the UK by considering all of the different sorts of costs that were being carried, and arrived at a figure of around £20b (Cabinet Office 2004). Under the assumption that alcohol volume is the best available indicator of damage, it is possible to apportion costs to AlcCo's products by using its share of the drinks market by alcohol volume of 3.5% for the year ending 31 March 2003, in round numbers.

$$\begin{aligned}\text{Apportioned cost} &= \text{National Estimate x Share of alcohol market}\\ &= £20\text{b x } 3.5\%\\ &= £700\text{m}\end{aligned}$$

The figure of £700m represents an allocation of the monetised social costs of alcohol in the UK to AlcCo products. Taking this percentage proportion approach assumes that all units of alcohol give rise to the same harms overall from misuse. This assumption was made to give a place to start in constructing the social accounts. Like any assumption, it can be improved, but it is hard to think of an alcohol category that is exempt from abuse of one form or another. In misuse terms, AlcCo's products are as associated with misuse as any other, but especially with underage drinking, binge drinking, street drinking and domestic violence, but perhaps less with long-term alcohol addiction than other categories.

3.1.2 The Stages to Build Stakeholder Consensus on External Cost

Having established a monetary value for the social cost of AlcCo's products, stakeholder consensus was sought on how much of that cost AlcCo should take responsibility for.

Allocation of responsibility is complex. Following structuration theory (Giddens 1984), while players are not responsible for the actions of others, each does reaffirm the social structures in which other players make their choices. For instance, just as producers respond to the changing tastes of their consumers, individuals change in response to the advertising messages they receive, public health initiatives and peer pressure. This in turn generates a new context for the producer. There is a feedback loop: producers and consumers dynamically lead and follow each other as if in a series of dance steps. If the harm from alcohol is stitched into society, an approach is needed which allows players to affirm new social structures.

While structuration theory implies that responsibility cannot be divided up and fixed in place for ever, the process of allocating responsibility can be part of affirming new social structures where new choices are now possible. These new structures must take into account changing perceptions of the role of the state, companies and people. Therefore a stakeholder consultation was established that moves to allocate responsibility through the explicit negotiation of AlcCo's licence to operate.

At AlcCo's request, a team from Forum undertook the stakeholder consultation process over the period July 2002 – January 2003. The key tasks started with identifying key stakeholders. A series of semi-structured interviews were then conducted and finished with a stakeholder workshop.

When identifying the key stakeholders, those involved in and affected by the distribution, sale and consumption of AlcCo's products were focussed on. Stakeholders were selected from the following main categories:

- *Commercial*: These are stakeholders that have a commercial interest in the sale of AlcCo's products in particular, as well as those that have an interest in the commercial aspects of the alcohol industry. They included representatives of AlcCo (the producer) as well as advertisers & media companies; distributors; retailers (on- and off-trade: in the UK on-trade refers to places where alcohol is both bought and consumed – such as a bar or restaurant – and the off-trade refers to places where is only bought, such as a supermarket) and government departments (such as DEFRA; Customs and Excise).
- *Consumers*: This included representation of the end consumer of alcohol products in general, and AlcCo's products in particular. Stakeholder views were drawn from related studies by MORI, The Portman Group and AlcCo itself.
- *Caring*: These are stakeholders that have an interest in the economic, social and health impacts of alcohol misuse. They included NGO organisations such as Alcohol Concern; and government departments (such as the National Health Service and the Home Office).

Semi-structured interviews (face-to-face and telephone) of selected stakeholders were undertaken over the period August-November 2002. Interviews revolved around the following key questions:

- What are the social costs of alcohol misuse?
- What types of initiatives could be taken to reduce these impacts?
- How can responsibility for these social impacts be allocated across different stakeholders?

The final part of the consultation process was the alcohol stakeholder workshop held in London on 17th January 2003. The event was attended by stakeholders from a range of sectors and was facilitated by Forum. The workshop was organised around the same questions posed in the individual interviews. The main objectives were to:

- Reach consensus on how the social costs of alcohol misuse should be allocated across different stakeholders
- Identify measures that an alcohol producer can take to reduce these impacts

3.1.3 The Outcomes of the Stakeholder Consultation on External Cost

The results of the stakeholder consultation (including individual interviews and workshops) are summarised in this section. The consultation process addressed two key questions:

- The Allocation Problem: How might the responsibility for the social costs of alcohol misuse be shared amongst different stakeholders?
- What practical measures can an alcohol producer take to discharge their responsibility for the social costs of alcohol misuse allocated?

In establishing AlcCo's share of the social costs of its products, three stages were set out: understanding the role of government; allocating responsibility between consumers and commercial players; and allocating responsibility between commercial players.

Understanding the Impact of Government

Government has multiple interests with respect to the alcohol industry. These include regulation of and revenue raising from the industry through taxation; and provision of public services for remedial or preventative action (such as health treatment; crime prevention; public education campaigns). AlcCo contributes to public funds in several different ways: corporation tax, VAT payroll taxes as well as excise duty. Of these, the excise duty is the only alcohol specific tax which has a purpose of internalising the social costs of alcohol. The duty only applies to the alcohol trade. (Excise duty raises about £7b per annum, or about a third of the social costs identified by the Cabinet Office.)

Therefore, AlcCo's excise duty of £100m was offset from the apportioned cost of £700m a year, to derive an outstanding balance of £600m per annum as the share attributed to AlcCo's products.

Allocating Responsibility between Consumers and Commercial Players

The stakeholders start from very different positions on this key issue.

At one extreme, it could be argued that consumers are 100% responsible for the products they choose to consume. But various factors lessen this argument: manipulative social conditioning through the medium of consumer advertising; the addictive nature of the product; the degree to which consumers are informed and fully aware of the associated risks; and the extent to which they are already internalising the cost burden (e.g. through private payments for rehabilitation).

At the other extreme, it could be argued that suppliers are 100% responsible – they design the products (such as high concentration beer) ; create the advertising messages; make the product available; sell at an affordable price; and create the conditions for over-consumption (e.g. certain types of drinking establishments). In addition, marketing messages can avoid communicating the real risks of alcohol.

The interaction of these two extremes, and the mitigating arguments against each, illustrate the dance between the alcohol industry and the consumer. As a working hypothesis, the starting point of sharing responsibility equally (i.e. according to the ratio of 50:50) between consumers and suppliers was taken. There was broad agreement amongst the participants at the stakeholder working group that this was a reasonable starting point.

For AlcCo's products this means that the consumers share is 50% of the total social cost of £600m, or £300m a year. The remaining annual sum of £300m is shared amongst different commercial stakeholders in the supply chain (including AlcCo as an alcohol producer) in the next stage of allocating responsibility.

Allocating Responsibility between Commercial Players

The second stage is to understand how responsibility should be shared along the supply chain. From production to consumption, the commercial supply chain includes production; marketing; distribution and retail (on- and off-trade – for meaning see Section 3.1.2).

Table 3-2. AlcCo's external social cost accounts.

	£m
1. Apportion social cost of alcohol to AlcCo's products	
Social Cost of Alcohol (Cabinet Office)	20,000
AlcCo market share (by volume of alcohol consumed)	3.5%
Social Cost allocated to AlcCo's products	**700**
2. Build consensus on AlcCo's share of responsibility for the social cost of its products	
i. Understanding the impact of government	
less Alcohol Duty, that already contributes to alleviation of social cost	(100)
Social cost to be shared throughout AlcCo's products supply chain and consumer	**600**
ii. Allocating responsibility between consumers and commercial players	
Apportioned 50:50 between	
Consumer	300
Commercial players	300
iii. Allocating responsibility between commercial players	
AlcCo's revenue share (as available proxy for profit share)	19%
AlcCo's annual share of External Social cost	**57**

The simplest criterion, and the one that had greatest resonance for the stakeholders, was that responsibility should be shared according to relative profit. However, the stakeholders agreed that revenue share was used as a proxy for profit share since profit data (per unit of alcohol) is not readily available. Revenue share was calculated as the proportion of the price paid by the consumer that is retained by the company. For an average retailer the price per pint was £1.98, of which the retailer kept £1.51, the distributor £0.06, the advertiser £0.03 and AlcCo received £0.38. This method biases the allocation against those players with lower profit margins, probably the retailers.

AlcCo's revenue share is 19%. Therefore, its yearly share is £57m of the total £300m allocated annually to the commercial sector.

These steps are summarised in Table 3-2.

3.1.4 Identify Practical Measures to Reduce the Social Harm

The last section described the stakeholder process which allocated about 8% of the damage cost of AlcCo's products to AlcCo itself. This section describes the avoidance and restoration actions AlcCo can take for its 'shadow' cost.

None of the stakeholders proposed that AlcCo should pay for its share of social costs in cash terms, for instance increasing the excise duty by £57m. The stakeholders believed that this would be a counter-productive step. Instead, they were concerned with changing the dynamic of the situation so that there was less social cost in the first place.

The stakeholders agreed on several ways in which AlcCo can fulfil their responsibilities:

Responsible Marketing and Communications

AlcCo's stakeholders required that AlcCo's marketing messages should generate and reward responsible behaviour. This covers sponsorship, promotions, information and education on the impacts of alcohol. Responsible marketing means that all messages to all stakeholders – consumers, civil society and government – demonstrate a consistent approach.

The stakeholders were concerned about targeting of young people, binge drinking and the way in which advertising and sponsorship generated brand qualities through association with desirable images and social icons.

The MORI study on alcohol (Portman Group 2000) shows that the public expect industry to be a key source of information on health impacts – but at present the industry fails to meet public expectations. The stakeholders agreed that advertising messages were misleading and unrelated to the real effects of alcohol.

AlcCo are working on a study into responsible marketing and communications plan. The key elements are to develop sustainable marketing messages to: link product, brand and corporate identity; change target audience attitudes and behaviours, and sell the sustainability message and generate demand for more sustainable products and services.

In order to estimate the shadow cost of adopting a responsible marketing and communications the following question needs to be asked: how much extra would it cost AlcCo to go down this route? Internally it would need to re-train its marketing people and to put in new systems to check that messages carried the sustainability branding. An estimate, based on information from the marketing department, is that the cost of retaining might be as much as £100k. There should be no extra cost from examining all communications for consistency as this should happen already.

There is also the shadow cost of whatever profit had been lost if sales reduced from taking a responsible marketing approach. Clearly, it is not possible to know the effect on consumers of changing AlcCo's brand message. However, responsible values, and advertising based on product quality, represent an opportunity to the cider industry. The authors suspect that there would actually be no direct impact on profits. Therefore, a first estimate shadow cost of changing to responsible marketing messages is £100k per year.

As AlcCo puts the responsible marketing plan into action it proposes to track the internal costs (such as training and internal time) plus the changes in revenue and profitability. There will also be a study to examine whether and how the new responsible market plan is changing consumer behaviour. The degree to which social costs are being avoided or restored will be incorporated into future sustainability accounts.

Social Interventions

Stakeholders believed that, if AlcCo moved to responsible marketing, it should also continue to support public health investments in remedial activities or in measures that interrupt the spiral of alcohol misuse. Many such schemes are underfunded by government. A foundation related to AlcCo is already taking significant strides in this direction.

However, stakeholders were wary of alcohol services becoming financially dependent on the alcohol industry. Supporting public health investments, could include paying for social workers to make brief interventions at A&Es or in criminal courts. In order to retain stakeholder confidence any initiative should include highly transparent governance procedures, including long-term commitment, associated research into effectiveness and autonomy for the public services funded.

As noted by the Wanless Report, "there is generally little evidence about the cost-effectiveness of public health and prevention policies or their practical implementation."(Wanless 2004:5). Therefore any estimate of a shadow cost to discharge AlcCo's share of the social cost of alcohol can only be tentative. Furthermore, different initiatives will have an impact on different parts of the social cost; brief interventions have limited benefit for alcoholics, for instance. Therefore, as a way to start AlcCo's long-term commitment to transparently funding social interventions, AlcCo are committing £600k per annum to the local Community Alcohol Service. This step will allow AlcCo to learn about appropriate funding and governance and add to the wider evidence base on cost-effectiveness of alcohol services (as recommended by the Cabinet Office Strategy).

Again, this first estimate is being tested in practice. The impacts of the public health programmes AlcCo supports are being tracked. The degree to which social costs are being avoided or restored will be incorporated into future sustainability accounts.

A Sustainable Business Model

Stakeholders were clear that AlcCo should continue to develop a sustainable business model by becoming a transparent and accountable company that creates opportunities through reducing risk, deepens stakeholder engagement, attracts socially responsible investment and exerts leadership and influence on its peers.

As there is already a budget committed to sustainability issues, there is no shadow cost associated with this recommendation.

These different recommendations are summarised in Table 3-3.

Table 3-3. AlcCo's shadow social cost account.

	£'000
Responsible marketing and communications	100
Social interventions	600
Sustainable business model	–
Annual Total	**700**

Clearly, the calculation of a shadow cost is at an early stage. However, even if the shadow costs are under-estimated by a factor of ten, then the cost of meeting stakeholders' expectations of responsible behaviour are still less than 1.5% of the social cost stakeholders believe AlcCo is responsible for.

3.2 Summary of the Social Accounts

The model assumes responsibility is shared equally across consumers and suppliers and across the supply chain according to revenue share. It takes into account the payment of excise taxes on alcohol (assumed to be shared equally between consumers and producers).

Based on the stakeholder allocation model, AlcCo's share of responsibility for the social costs of alcohol misuse is estimated to be £57m. The social costs of alcohol misuse are the single most important external cost to AlcCo and represent a very significant business risk.

Turning this share of responsibility into a social provision involves AlcCo taking measures which reduce its impact by as much as possible**.** AlcCo can take practical measures to discharge its responsibilities in the eyes of its stakeholders. These measures will also reduce the social costs of alcohol misuse relating to its products. A first estimate of the shadow cost is £700k. At the stakeholder workshop, the following measures were identified as high priority areas:

- Responsible marketing and communications
- Social interventions
- Sustainable business model

Over time the social accounts will need to develop based on AlcCo's actions in meeting stakeholders' expectations and the behaviour of other industry players. This first iteration has established a baseline of externality that AlcCo's stakeholders' believe it is responsible for, and a first estimate of the shadow cost of discharging that responsibility. Over time the social accounts will need to evolve with evidence on changes to the total social costs, the success (or otherwise) of the shadow measures, and trends in stakeholder expectations. In the future stakeholders may believe that AlcCo is discharging its responsibility, in which case the allocated externality and shadow cost would reduce.

Conversely, AlcCo may not follow through on the actions above, the proposed measures may not be successful or the expectations stakeholders have of the industry may increase, in which case the allocated externality and shadow cost may increase. Either way it is clear that the role of alcohol in society is a sector-wide issue, and so a sector wide approach is needed.

4. CONCLUSIONS

4.1 AlcCo's Monetised Triple Bottom Line

From the work describe above it is possible to write a monetised Triple Bottom Line for AlcCo, either as Figure 3-3 or as Table 3-4.

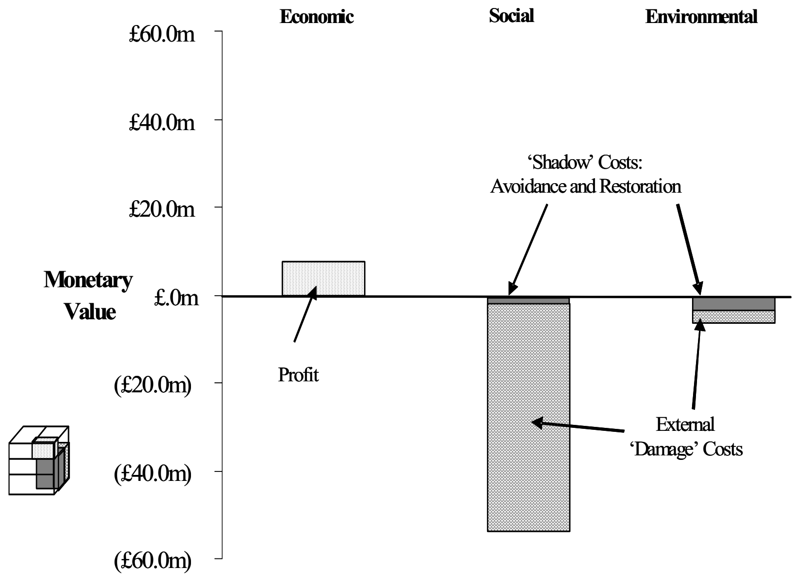

Figure 3-3. AlcCo's sustainability accounts as a diagram.

Table 3-4. AlcCo's sustainability accounts for year ending 31 March 2003

	Economic £m	Social £m	Environmental £m
Internal			
– financial impacts already included in the accounts	**7.4**	*	*
Shadow			
– cost of avoiding or restoring external impacts	*	**(0.7)**	**(1.7)**
External			
– damage cost to wider society, now and in the future	*	**(57.0)**	**(4.5)**

* not calculated for this set of accounts (see Section 1.2 for explanation)
The £7.4m is AlcCo's profit for the year, taken from its published accounts.

4.2 Sustainability Accounting to Negotiate a Licence to Operate

Using financial valuation for social accounting is an evolving process. However, the work to date demonstrates that an alcohol company can begin to negotiate its licence to operate with its stakeholders. Quantitative date can be used to ground the negotiation between companies and stakeholders on roles and responsibilities. The feedback from stakeholders inside and outside the company is that the accounting approach made discussions more meaningful. This initiative pilots an approach which allows players to begin renegotiating the role of alcohol in society.

If a company discharges the responsibility that stakeholders have allocated to it, by undertaking all the shadow cost measures, it will not necessarily mean that all of the social externality will be reduced to zero, though it is possible that they will be reduced. Instead, a new relationship will have been set up between the stakeholders and the company, and the company will have been acting within its licence to operate.

However, the expectations of stakeholders and wider society will evolve over time. Any organisation will need to continuously engage with its stakeholders (including shareholders) if it is to maintain its licence to operate. From the point of view of senior management and shareholders, this process will reduce strategic business risks, such as regulatory and political risks.

The stakeholder allocation accounting method (or perhaps 'participative accounting') above is not the only way of engaging with stakeholders with this purpose in mind: there are other forms of stakeholder engagement and dealing with social trends. It is possible that different methods would elicit different results. Usually for a business to address these long-term questions it must be able to point to short-term stability and financial viability. The stakeholder allocation accounting method can create an opportunity to affirm (and then re-affirm) new social structures, where the social harm is reduced and the financial sustainability of the business is more secure in the long-term.

At present the authors believe that the stakeholder allocation accounting method could be applied where:

- The industry as a whole is facing a significant question over its role in society
- The questions of individual, corporate, civil society and government responsibility are tightly bundled and not well addressed in public
- There is some independent economic analysis of positive and negative externalities
- There are articulate and identifiable stakeholders
- The debate is not yet so polarised that the different parties cannot conceive of undertaking the process

The costs of this approach compare favourably with producing a standard financial Annual Report. The potential upside is large: the company has the opportunity of the financial benefits of mitigating political and regulatory risks as well as keeping in touch with wider stakeholder trends.

With these tentative conditions in mind, areas where this work might be extended include the:

- Pharmaceutical industry and generic medicines
- Energy utilities and climate change
- Convenience food industry and obesity.

ACKNOWLEDGEMENTS

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Chapter 4

INTEGRATING SUSTAINABILITY INTO TRADITIONAL FINANCIAL ANALYSIS

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Abstract: The management of environmental, social as well as economic issues has become a key element to guarantee the survival of a company in the medium to long term, and to contribute towards its ability to generate shareholder value. As a consequence, the economic theory of the firm has started to integrate sustainability issues into the accounting and finance areas and to develop new tools and instruments, as well as to adapt those that already exist, to permit the strategic management of sustainability by companies and the capital markets.

The translation of the environmental and social impacts of business activities into accounting and financial terms allows not only to manage these impacts, but also to reveal their effects over businesses risks, profitability and value creation ability to all the economic agents that interact with the firm. Management and information systems based on performance indicators, such as the Balanced Scorecard and other models trying to identify cause and effect relationships between indicators, seem particularly well suited to this process. In this paper we review some of the lacks of these performance measurement systems and propose the development of an integrated framework for the financial analysis of the creation of sustainability-oriented value in companies.

1. INTRODUCTION

In recent years, an increasing number of studies have tackled the analysis of the link between the financial performance of a company and its environmental and social performance, attempting to find a correlation or a conceptual link between them (see, e.g., Griffin and Mahon 1997, Pava and Krausz

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 83-108.

1996, Salama 2003, Schaltegger and Figge 1997, 2000, Schaltegger and Synnestvedt 2002, Wagner 2001, 2003). But, as Zadek (2000) argues, some studies linking sustainable development with improved financial performance are not sufficiently conclusive. Furthermore, one question remains unanswered: which comes first - corporate social performance or financial performance?

Despite the appeal and interest in seeking a connection between social and environmental responsiveness and financial performance, we may question whether this is the most correct or suitable direction for research. As Reed (1998:6) suggests, regarding the environmental perspective of sustainability, “The appropriate question for mainstream investors is not: (1) do investors care about critical environmental events? Clearly they do. Nor is it (2) do investors have to sacrifice returns in order to limit the universe of possible companies in which to invest to those with decent environmental records? They do not. Nor is it (3) is there a statistical relationship between environmental and financial performance? There appears to be a positive one, but the vast majority of equity money is managed using investment styles that are not built primarily around statistical relationships. The meaningful question today is (4) does an understanding of a company’s environmental and social strategies and positioning add a useful insight to what investors already know about selecting stocks?”

Furthermore, there are many factors that, combined, determine the environmental performance of the company (Wagner and Schaltegger 2003), and it would be difficult to prove that a single factor as environmental performance can be the only driver of its financial outcomes or the only driver of the financial markets valuation of those outcomes (Case 1999). Therefore, it is maybe premature to claim on a scientific prove about the relationship between a good environmental performance and a better profitability, although few business people would deny today that environmental issues have a significant impact over a firm’s success.

Schaltegger and Synnestvedt (2002:341) recognize that it “is reasonable to assume that the relation between environmental and economic performance depends on the kind of management activities, strategies and concepts and whether they are applied correctly in the right situations (…) rather than on any mechanistic causal link”. Reinhardt (1998, 1999) argues that, instead of questioning if environmental management is a profitable activity, more attention needs to be paid to when environmental management is profitable for the firm, this is, under what circumstances environmental strategies contribute to competitiveness. Wagner and Schaltegger (2004) analyse the influence of corporate strategy choice on the relationship between environmental and financial performance. This view is related to some recent work that applies resource-based strategy perspectives to the analysis of environmental strategies (Aragon-Correa 1998, Christmann 2000, Hart 1995, Russo and Fouts 1997, Sharma and Vredenburg 1998), arguing that some companies may possess unique resources or capabilities that are difficult to imitate and make environmental strategies profitable.

So perhaps the most appropriate questions today should be: What does environmental performance tell us that we still do not know about financial performance? And what kind of sustainability strategies contributes to the shareholder value creation? And perhaps the most appropriate direction for research should be to adapt existing tools and models of financial analysis in order to incorporate the impact of sustainability issues on the company's economic and financial performance.

One particularly significant aspect in this regard is the absence of fundamental approaches to the incorporation of sustainable development approaches into the traditional financial analysis of companies. This is not only an instrument to assess a company's financial performance in the past, but also its strengths and weaknesses for the future. The information that such analysis provides is critical for all of the company's stakeholders in order to identify the kind of sustainability management implemented by the firm, evaluate its contribution to financial performance and develop their decision-making processes.

Financial analysis, traditionally considered as a suitable tool to assess a company's financial and economic situation and guide the decision-making processes of companies and financial markets, should embrace sustainability issues within its logic, under some kind of scheme or framework that permits the evaluation of a company's sustainable management system and the impact of sustainability issues on financial performance. An integrated model is needed that takes into account the social, environmental and economic performances of a company, and their expression using data that is both quantitative and qualitative, accounting and non-accounting, physical and monetary.

The aim of this paper is to provide companies with a methodology that allows them to focus on the environmental and social activities that create significant financial and/or non-financial benefits, and to integrate financial considerations into every major decision regarding sustainable development, as well as to provide the financial community with the appropriate decision-making tools and rules in order to be able to assess a company's sustainable management system and support its sustainability objectives, as well as its financial objectives. We will propose a conceptual and a performance measurement framework for the integration of sustainability into the analysis of the shareholder value creation and a three-dimensional framework for the financial analysis of sustainability, encompassing accounting, market and cash flow indicators. The empirical validation of the model is currently limited due to the lack of information and the existence of asymmetric information about the environmental and social performances of a company, so we only present the theoretical foundations of the model.

The paper is organised as follows: the second section insists on the importance of integrating sustainability into traditional financial analysis. Section 3 describes the general methodologies of financial analysis, performance measurement and ratio analysis. Section 4 presents the conceptual framework for the integration of sustainability into the analysis of the shareholder value creation and proposes a performance measurement framework based on the fundamental principles of cause-and-effect and the decomposition of ratios. Section 5 explains the development of a three-dimensional model for the financial analysis of sustainability and section 6 focus on the construction of its accounting perspective. Finally, section 7 summarizes the most relevant questions and draws some conclusions.

2. IMPORTANCE AND BARRIERS TO THE INTEGRATION OF SUSTAINABILITY INTO TRADITIONAL FINANCIAL ANALYSIS

As we have already mentioned, lack of information and the existence of asymmetric information are some of the pitfalls that we identify in the process of integrating the management of sustainability into the decisions made by companies and financial markets, and so it is in this field where most efforts have been made to promote this process and contribute towards linking environmental, social and financial objectives; the Eco-Management and Audit Scheme (EMAS) and ISO 14001 are just two examples. Significant efforts have also been made to integrate sustainability issues into the reporting schemes of firms to all their stakeholders; the Global Reporting Initiative is probably the most widely extended proposal.

One of the main hurdles in this process has been the absence of an adequate approach that links both financial and sustainability objectives in terms of profitability and risk, which are the terms best understood by firms and financial markets, as it is their own ‘language’. It is essential to support the application of the language, knowledge and tools of financial theory towards orienting the decision-making processes of the different economic agents when incorporating these sustainability objectives. Once the market has incorporated sustainability into its strategies a “sustainability circle” will have been closed, within which the market requires environmentally and socially responsible behaviour from companies that limits their risk and ensures a sustainable creation of value, while on the other hand, companies will need the support of the market to face up to the financial requirements derived from their commitment to sustainable development, support that should take the form of a lower cost of capital for those firms willing to assume the sustainability challenge. The recent development of Socially Responsible Investment is an example: greater investor activity fuels greater corporate activity, which itself adds to growing interest from investors (ABI 2001).

Some important advances have been already made towards integrating sustainability aspects into the strategic and financial management of companies (for a revision of concepts and instruments, see German Federal Ministry for the Environment and Federation of German Industries 2002), mainly focused on the environmental perspective, as this was the first sustainable development dimension to attract the attention of governments and business. Advances in the field of environmental and ecological accounting (Bartolomeo et al. 2000, Bennett and James 1998, 1999, Burritt 1997, Burritt et al. 2002, EPA 1995, Gray et al. 1993, Schaltegger 1996, Schaltegger and Burritt 2000, Schaltegger et al. 2000) and the design of various instruments and tools of environmental and/or sustainability management have only partially considered the financial implications of incorporating sustainability objectives into the decision-making processes of the different economic agents.

EPA (2000) has identified some barriers that explain why the financial implications of environmental strategies are not better reflected in financial analysis. Three of them are worth of mention for the purpose of this paper:

- An imprecise terminology for describing environmental performance
- Lack of information exchange and a common language for describing environmental strategies
- Lack of technical skills to understand how environmental strategies affect financial outcomes

Repetto and Austin (2000:73) point out that "Yet, firms and analysts find it difficult to translate the potential impacts and risks of environmental issues into the financial terms required for business planning and valuation". Without doubt, in order for environmental and social considerations to play a role in financial analysis, companies must increase the rigor with which they measure their results in ways that are meaningful to the financial analysts. Although many companies are producing sustainability reports and have made a significant effort to discuss publicly and start to quantify their sustainability performance, many reports are rather anecdotal or include little information on financial impacts (The Aspen Institute 1998).

Furthermore, one of the main problems for sustainable development has also been that the information provided to financial markets about sustainability issues can rarely be relied upon to improve decisions. This is partly because this data is usually appropriated from other areas, such as regulatory compliance, and has not been designed for use by financial markets, and partly because it is not comparable or verified and may be costly and time-consuming to make useable. Concise and strictly applicable data is needed, of a sort that can be put to use by analysts and provided to investors as a part of the corporate evaluation process. In the case of company analysis, figures need to relate either directly or indirectly to a company's management, earnings, balance sheet or potential growth. It is also necessary to recognise that without the involvement of financial and accounting sectors in the creation of improved reporting standards, whatever is created runs the risk of continuing to be financially irrelevant (Commission for Environmental Co-operation 2003).

Systems for budgeting, investment appraisal, performance measurement, financial analysis, etc., should integrate environmental impacts, costs and benefits (Epstein 1996), but have not yet been adapted to the environmental agenda and until they do develop in this way, companies will face conflicts between the environmental and social perspectives and the traditional financial perspective (Skillius and Wennberg 1998). It is therefore necessary to develop tools that allow evaluating the business performance and value related to the 'tripple-bottom-line' concept and "recognize that there is not necessarily a trade-off between environmental responsibility and corporate profitability" (Epstein 1996:5).

The standardization and generalisation of sustainability reporting and the translation of its impacts into financial terms are a critical precondition for the integration of sustainability into the decision-making processes of companies and financial markets, as well as towards the development of a model for the financial analysis of sustainability that helps to uncover the true financial, environmental and social situation of the company and therefore leads to better decisions being made, and contributes towards the simultaneous attainment of financial and sustainability objectives.

3. FINANCIAL ANALYSIS, PERFORMANCE MEASUREMENT AND RATIO ANALYSIS

Financial analysis is the assessment of a company's past, present and future financial conditions in order to detect its financial strengths and weaknesses. Although it has been argued that it is past-focused, and its reliance on accounting measures has been criticized (Cohen 1994, Mattessich 1995), financial analysis provides the context for the current performance of the company by showing where it is now, and has an influence on its expectations by showing developments that will change future performance.

The aim of financial analysis varies according to the strategic objective pursued:

- When the aim is to bring about a change in the company in order to develop a project, the purpose of financial analysis is to detect strategies and possibilities for internal development, i.e. the creation of value
- When the aim is to solve problems within the company, the primary objective of the diagnosis will be to clarify the causes of the symptoms that are destroying value

Financial performance measurement is a well-established process in business management, although a continually evolving one and with no universally accepted measurement framework (Ranganathan 1998). Sustainability performance measurement is a relatively new area of research that has fundamentally experienced important advances in the measurement of the environmental perspective of sustainability, while the social perspective has been comparatively underdeveloped, resulting in a measurement debate about social performance "in an early conceptual level" (Wagner and Schaltegger 2003:10).

Environmental performance measurement has been mainly developed under the framework provided by environmental accounting and reporting. James (1994) suggests that six distinct frameworks for environmental performance measurement can be identified – production, auditing, eco-logical, accounting, economic and quality – and identifies six types of environmental performance indicators (EPIs) that are suited for some or all of the frameworks – resource use, efficiency, emissions/waste, risk, impact and monetary indicators.

Bartolomeo (1995) defines EPIs as the quantitative and qualitative information that allow the evaluation, from an environmental point of view, of company effectiveness and efficiency in the consumption of resources. EPIs thus have the aim of evaluating company efficiency (economical and environmental) and effectiveness in achieving environmental objectives and allowing (Skillius and Wennberg 1998):

- The adoption of the most appropriate measures of environmental protection in terms of effectiveness and efficiency
- The empowerment of environmental policy by a better definition and monitoring of environmental objectives
- An effective definition of responsibilities and an aid for the implementation of the environmental management systems
- The improvement of external and internal communication on environmental achievements and programs

EPIs can be absolute or relative measures, physical or monetary, quantitative or qualitative. While absolute measures describe the level of pollution, relative measures show whether the environmental actions undertaken by a company improve its efficiency. Physical EPIs are concerned with the quantities of materials and energy inputs and outputs from production process, while monetary EPIs refer to the costs and benefits associated to the environmental impacts and the environmental management of the firm (actually this measures should be integrated into the accounting system of the firm). Finally, apart from quantitative EPIs, qualitative EPIs should add valuable information to the environmental and economic evaluation of a company.

Relative indicators or 'ratios' are particularly important in both financial an environmental analysis. As it is well known, the concept of eco-efficiency (Schaltegger and Sturm 1990, 1992:4, 1995:6, Schaltegger and Burritt 2000) is based on the construction of ratios that bring together the economic and environmental dimensions of sustainability. In order to analyse a company's sustainability performance, relative indicators seem suitable methods for capturing the environmental and social stewardship provided by the firm. For instance, a company with high absolute emissions and high levels of production may still be more environmentally friendly than a company with lower absolute emissions but very low levels of production. On the other hand, absolute emissions are the correct way to measure the results of environmental protection, since environmental degradation depends on the mass of pollutants rather than their ratio in terms of production (Earnhart and Lízal 2002).

The ratio or mathematical relationship between two quantities is of paramount importance in financial analysis as it injects a qualitative measurement, precisely demonstrating the adequacy of one key financial statement item as compared against another and providing comparisons between companies in the same industry as well as year-to-year comparisons within a single company. In this sense, it is generally assumed that financial ratio analysis can be developed from two perspectives (Marion 1999):

- A diachronic perspective (trend analysis): where it is necessary to gather information on the temporal evolution of the essential variables of the diagnosis
- A synchronic perspective (benchmarking): where the value of the company's ratios is compared against the equivalent figures for the sector to which it belongs in order to draw conclusions on each individual ratio, and to determine whether the company's situation is good, regular or bad. Pyle and White (1974) argue that sector membership is the best base for comparisons.

Unfortunately, earlier attempts to relate important elements of financial statements through key financial ratios have suffered from a lack of systematic application, due to a lack of awareness of the main principle of cause-and-effect. Essentially, most analysts have given equal weight and value to all ratios, simply creating a “laundry list” of calculations with no indication of which ratios may be the most important (Miller and Miller 1991).

The cause-effect financial ratio analysis is derived from the following assumptions:

- Not all ratios have the same importance for analysis. Even disregarding the factor of sector membership, some key ratios are primary and drive changes in the other relevant measures of the economic performance and financial structure of the company. Identifying the former as causes and the latter as effects proves to be the best way of reflecting the different relative weight of each ratio.
- The analysis acts inductively: The immediately visible situation is the effect; the cause or causes must be sought out.
- Understanding the meaning and significance of each individual ratio is not sufficient to ensure appropriate use of the ratio analysis, nor simply developing it through diachronic and synchronic comparisons. The ratio analysis potential and its strategic value for financial analysis are based on two basic methodological principles: the breakdown of each ratio into its main components (ratio decomposition), and the definition of relationships between the different ratios.

GEMI (1998) distinguish two types of EPIs: Lagging indicators and leading indicators. Lagging indicators “measure the results of environmental practices or operations currently in place” (GEMI 1998:4), while leading indicators “measure the implementation of practices or measures which are expected to lead to improved environmental performance” (GEMI 1998:6). It seems that environmental ratio and financial ratio analysis are quite easy to integrate. In fact, White and Wagner (1996) talk about an environmental ratio analysis that is “akin to financial ratio analysis”.

4. CONCEPTUAL AND PERFORMANCE MEASUREMENT FRAMEWORKS FOR THE FINANCIAL ANALYSIS OF SUSTAINABILITY

As already explained, the proposal of this paper is based on the belief that it is necessary to adapt the existing tools and models of financial analysis in two directions:

1. To incorporate the impact of environmental and social issues on economic and financial performance
2. To implement the cause-and-effect rationale

The three-dimensional framework for the financial analysis of sustainability presented in this paper is embedded in a conceptual framework that links some key drivers of sustainability with the shareholder value concept and in a performance measurement framework that applies the fundamental principles of cause-and-effect and ratio decomposition.

4.1 Conceptual Framework for the Financial Analysis of Sustainability

In order to link sustainability issues to shareholder value through their integration into traditional financial analysis, we need to define some kind of theoretical or conceptual framework that guides the process. Schaltegger and Synnestvedt (2002:340) stress "the lack of a clear theoretical framework within which to investigate the links between environmental performance and economic performance". A more causal model should be used to explain how the relationship between sustainability performance and economic success is brought about through a firm's environmental and social management (Wagner and Schaltegger 2003:12).

The concept of 'shareholder value' coined by Rappaport (1986) was applied for the first time to the environmental field by Schaltegger and Figge (1997), who considered which types of corporate environmental management are able to help improve shareholder value, and which are capable of destroying it. Later on, these authors proposed a complementary concept, that of 'stakeholder value' (Figge and Schaltegger 2000), focusing on who creates added value, how it is distributed, and to whom. Although the concept of stakeholder value is not a method for evaluation, the authors propose a methodology to measure it, in an attempt to incorporate a perspective other than that of the shareholder in the value-oriented management of a company, according to the principles of sustainability.

Figge and Hahn (2002, 2004) propose an integrated measure of sustainability, the 'sustainable value added', based on a monetary assessment of how much the change of social and environmental performance of a company between two periods has contributed to making a national economy more sustainable. This measure is based on an assessment of a firm's efficiency relative to that of the total national economy as a benchmark.

Without rejecting the addition of a new perspective focused on other stakeholders or the development of a new measure of value, the conceptual framework for the financial analysis of sustainability is based on the incorporation of sustainability issues into the traditional shareholder perspective. SustainAbility (2001) has identified six financial drivers of sustainable value creation: Customer Attraction, Brand Value and Reputation, Licence to Operate, Human and Intellectual Capital, Innovation and Risk Profile. These six value drivers can be integrated into Rappaport's Model of Shareholder Added Value (Figure 4-1) as further evidence of the link between the environmental management of a company and its ability to create value. This makes it possible to define the framework through which the model of financial analysis of sustainability through cause-and-effect ratios will be developed.

The six financial value drivers of sustainability may be considered as catalysts in the sustainability decision-making processes of the company's management, aimed at creating sustainable shareholder value. These six indicators should drive its operating, investment and financing decisions which will ultimately result in a specific value of all the measures (ratios, in the model) that explain the company's financial, environmental and social performance, with the final result being some type of measurement of the value created (shareholder value, share price, etc.). The six drivers do not influence decisions only individually, but also as a result of their interrelationships.

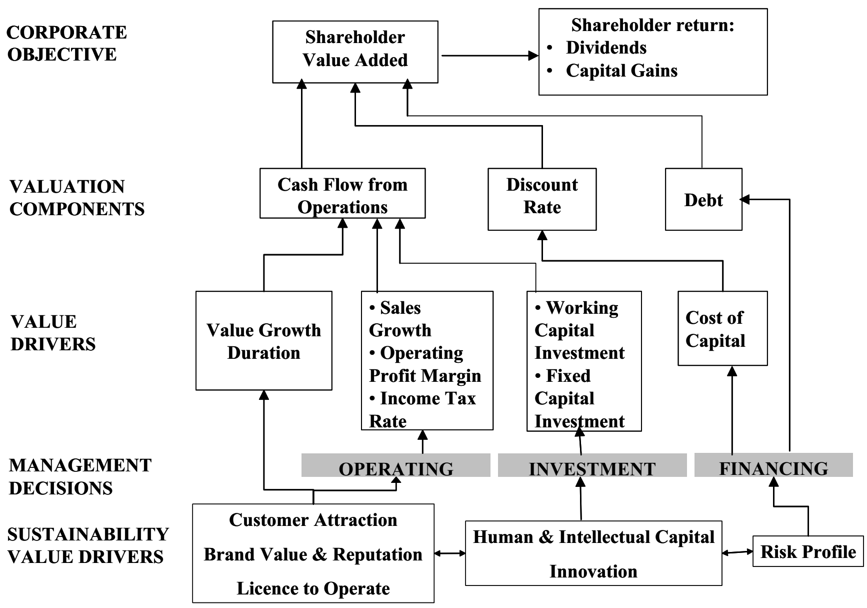

Figure 4-1. Conceptual model of the financial analysis of sustainability.

4.2 Performance Measurement Framework for the Financial Analysis of Sustainability

The design of performance measurement systems appropriate for modern businesses has been a topic of increasing interest in late years (Neely 1998, Neely et al. 2000). Between the shortcomings of traditional performance measurements systems is their narrow or uni-dimensional focus (Neely et al. 2000). Various authors have proposed alternative performance measurement frameworks (Brown 1996, Fitzgerald et al. 1991, Kaplan and Norton 1992, Keegan et al. 1989, Lynch and Cross 1991) but few provide any insight into how these frameworks can be populated (Neely et al. 2000).

One of the most widely recognised performance measurement frameworks is Kaplan and Norton's Balanced Scorecard (BSC, Kaplan and Norton 1992, 1996, 2001) that is based on the establishment of cause-effect relationships between key strategic indicators through four managerial perspectives within companies (financial, customer, learning and growth and internal business processes), with the financial perspective as the end point. It is aimed at making explicit, and therefore controllable, the contribution and the transformation of 'soft factors' and intangible assets into long-term financial success.

Brignall (2002) indicates that in the BSC specification there are two notable omissions: environmental and social issues. As sustainability issues often fall into this category of 'soft factors' and intangible assets (Senn (1986) cited by Figge et al. 2002), several authors have suggested the application of the Balanced Scorecard approach to sustainability (Elkington 1997, Figge et al. 2002, Hahn and Wagner 2001, Johnson 1998, Schaltegger and Dyllick 2002) in order to select and develop environmental and social performance indicators. These could be considered in the balanced scorecard by being integrated within the four standard perspectives, or through the creation of an additional perspective (Brignall 2002, Figge et al. 2002). A third possibility would be to formulate a specific environmental and/or social scorecard, but this should be done only after the development of one (or both) of the former variants (Figge et al. 2002).

At a later date, Kaplan and Norton (2000) introduced the concept of *strategy mapping* to give a visual form to the chains of cause-and-effect, linking actions through learning and growth, internal processes and customer perspectives to financial results. Brignall (2002) argues that the linear causal chain that is claimed to link the four perspectives of the BSC through the strategic maps is an over-simplification of reality, as "the population of all possible relationships among performance-related phenomena could not be represented by a universal, linear one-way chain" (Brignall 2002:90).

Furthermore, the definition of a hierarchical chain of cause-and-effect relationships proposed in the BSC methodology lacks a systematic procedure for the construction of the leading and lagging indicators defined throughout the perspectives. It provides little guidance on how the appropriate measures may be identified, introduced and ultimately used to manage business (Neely et al. 2000). This is where financial analysis using cause-and-effect ratios, as defined above, provides the most valuable contribution to the management and assessment of the impact of sustainability issues on shareholder value.

The performance measurement framework for the financial analysis of sustainability proposed in this paper is based on the principle of ratio decomposition that has been widely applied to financial analysis, and that is also known as the DuPont system (Chandler 1977). This is used to dissect the financial statements of a company and to assess its financial condition, decomposing certain key ratios into successively more detailed ones. It merges the income statement and the balance sheet into two summary measures of profitability, ROA (Return on Assets) and ROE (Return on Equity), which are broken down into other ratio figures:

$$ROE = \frac{\text{Net Income}}{\text{Total Assets}} \times \frac{\text{Total Assets}}{\text{Common Equity}} \qquad (1)$$

$$ROA = \frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total Assets}} \qquad (2)$$

$$ROE = \frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total Assets}} \times \frac{\text{Total Assets}}{\text{Common Equity}} \qquad (3)$$

This process is used to build a pyramid of financial ratios (Courtis 1978, Bayldon et al. 1984) that has an explicit hierarchical structure and links measures at different organisational levels (Figure 4-2).

Two of the main contributions of this approach towards financial analysis are that it helps to identify the sources of strength and weakness in current performance, and to focus attention on 'value drivers'. However, its critics have claimed that its focus on costs provides a historical view, giving little indication of future performance and encouraging 'short-termism' (Bruns 1998).

Under a conceptual framework that links management decision-making with the simultaneous achievement of financial and sustainability objectives through six financial value drivers of sustainability, and under a performance measurement framework based on the definition of cause-effect relationships between a series of relevant ratios that reflect the financial, environmental and social performance of the company, a model of financial analysis is developed in next section.

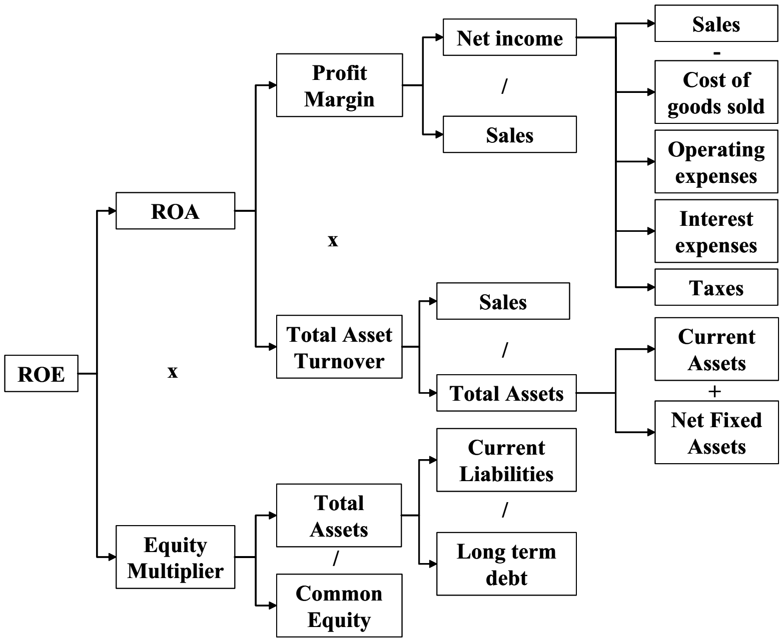

Figure 4-2. DuPont ratios pyramid.

5. A THREE-DIMENSIONAL MODEL FOR THE FINANCIAL ANALYSIS OF SUSTAINABILITY

The model (though in an early stage of development) proposed in this section suggests a number of conceptual relationships between some significant ratios reflecting the financial as well as the environmental and social performances of a company, linked by mathematical expressions (multiplicative or dividing ratios), so that the relationships defined are far from subjective (which is a clear advantage over the BSC approach).

There is little consensus about the best way to evaluate a company's financial performance. The choice between using an accounting rate of return or a share market return is not without controversy, and the two sets of measures represent different perspectives on how best to assess performance.

Accounting measures capture past performance and therefore indicate how that historical record has been influenced by, or has gone on to influence, social and environmental performance (there is no strong agreement about the direction which causality between sustainability and financial performance takes). On the contrary, market measures are forward-looking, and are considered to reflect estimates about the net present value of expected future earnings. Share market returns are considered a better measure of firm performance, as they represent true gains to shareholders (both through dividends paid out and appreciated stock prices), are more directly comparable across firms (they are not subject to accounting manipulation), and are a good measure of future profits (in the context of the efficient market theory). Some examples of market value ratios are Price to Earnings Ratio (P/E), Price to Sales, Price to Free Cash Flow, Price to Book Value, Beta and Dividend Yield.

Furthermore, between accounting and market-based measures there is another type of performance measure based on the fundamental concept of cash flow, which has been widely recognized as a key element in value creation analysis that makes it possible to overcome some of the handicaps attributable to accounting measures (Cohen 1994, Mattessich 1995). Any cash flow figure (operating cash flow, equity cash flow, free cash flow, etc.) is calculated through a number of adjustments to accounting measures, and building upon them a number of ratios can be proposed that improve the financial analysis of the firm, such as the Cash Flow from operations to Current Liabilities Ratio or the Cash Flow Return on Investment (CFROI). These ratios can also be organized following a pyramid of cause-and-effect relationships that would be linked to the accounting and market perspective as well. Furthermore, the future/estimated values of cash flows are discounted to provide analysts with different measures of a company's shareholder value creation (many different metrics exist based on the discounting of cash flows, such as Economic Value Added (EVA) , Market Value Added (MVA) and the general concept of Shareholder Value Added) and are therefore the basis for analysing its market value.

As Brealey and Myers (1996) suggest, share value can be seen as the present value of all expected future dividends (market perspective), as the present value of the free cash flows (cash flow perspective) and as the present value of the future benefits under a non-growth policy *plus* the present value of the growth opportunities of the company (accounting perspective). Therefore, a three-dimensional model for financial diagnosis is proposed, based on three perspectives (Figure 4-3):

1. The accounting perspective, based on the analysis of ratios defined from the information contained in financial statements and subject to

the shortcomings of accounting methods and conventions (i.e., depreciation schedules, accrual based numbers or inventory valuation)
2. The cash-flow perspective, where the cash-flow reflects the "real cash" flowing in and out due to operations, investing, and financing activities
3. The market perspective, that takes into account investor expectations about the company's value and risk.

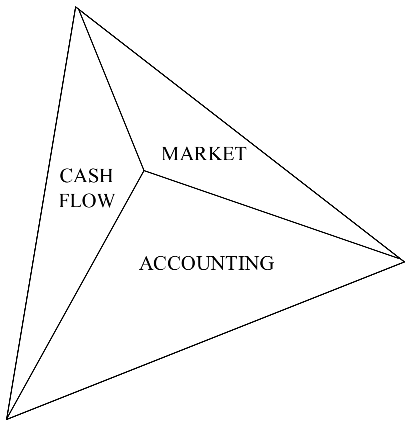

Figure 4-3. An integrated model of the financial analysis of sustainability.

The three perspectives complement each other and contribute to the comprehensive analysis of the shareholder value creation process. The accounting perspective is the more important one, as it will contain the most part of information and, particularly, the information on the environmental and social performances of the company. The cash flow perspective provides a "real cash" measure of shareholder value (built on both past and future/estimated information) and the market perspective provides a future-oriented measure of shareholder value.

The upper ratio selected for the top of the pyramid as a measure of shareholder value is an alternative measure of the Price to Earnings Ratio (Fernández 2002), which is essentially a combination of a market measure (share price) and an accounting measure (earnings per share).

The integration of these three perspectives is not difficult to define. In fact, cash flow is no more than a measure which is constructed on the basis of accounting information:

Free Cash Flow = Profit after tax *plus* Depreciation *plus* Increase in debt *less* Increase in working capital requirements *less* Investment in fixed assets

From the market perspective, the value of a share for an investor who requires a return of r is the present value of dividends which is expected to be paid on that stock:

$$P_0 = \sum_{t=1}^{\infty} \frac{DIV_t}{(1+r)^t} \tag{4}$$

In this equation, in efficient markets the expected dividend (DIV) will be the result of the company's dividends policy:

$$\text{DIV} = \text{ROE} \times \text{d} \tag{5}$$

Finally, the creation of sustainable shareholder value requires active managerial control over different sustainability issues, meaning the optimal exercise of sustainability real options. A further extension of the model of financial analysis of sustainability, once this three-sided integrated model has been developed, will borrow a methodology from real option theory to obtain a measure of sustainable shareholder value that takes into account the value that sustainability can add to traditional shareholder value (SV), as long as sustainability is considered to be an important source of strategic value and its active management is considered to encompass different real options (sustainability investment projects can present options such as to defer, expand, stage, alter the project scale, abandon, switch outputs or inputs, etc.). Following Trigeorgis (1995) this Sustainable Shareholder Value could be calculated as:

> Sustainable SV = Traditional SV *plus* Sustainability option premium (value of operating and strategic options from active management)

In order to show how the model is constructed, and for the sake of clarity, next section will focus on the accounting perspective, which is also the one that will contain the measures related to the environmental and social performances of the firm.

6. THE ACCOUNTING PERSPECTIVE

This section shows an example of how the model is constructed with a focus on the analysis of financial and environmental performances, which are the most easily quantifiable as for many years they have been a topic of research in the field of (environmental) management accounting, whereas the assessment of social added value is quite a new field (Maas and Bouma 2004).

The importance of taking social issues into account cannot be denied. Social measures can be divided into two groups (Maas and Bouma 2004): Internal measures such as education and training, safety and health care, employee retention and job satisfaction levels; and external measurements such as sponsoring, volunteer work, investment in society, and the involvement of stakeholders. Both measures, internal and external, influence the financial performance of the company. However, social performance measurements are often not easily quantifiable, if at all, and to attach a separate financial or monetary value to the social performance of companies is highly questionable.

The inclusion of qualitative measures proves difficult in the model as it is defined (based on mathematical relationships between the ratios), although it is important to recognise that these qualitative factors should be considered, as many exert a significant influence over these mathematical relationships. Nevertheless, the final aim of the model is to translate all these factors into quantitative measures. For example, the value growth duration of the company, which is subjective and qualitative to some degree, is transformed into a quantitative measure by making it dependent on the rate of growth of the sector, the company's market share goals, and its growth capacity, which is measured by the profit that has not been distributed as dividends to its shareholders. It is worth noting that in this way the model makes it possible to consider actions and interactions among competitors, which is one of the main objections raised against the BSC model (Brignall 2002).

Following the claims that indicate the importance of using both monetary and physical information (Burritt et al. 2002), embraced under the concept of eco-efficiency, some ratios are created based on the data that can be obtained from sources as an eco-balance, an environmental profit and loss account, and internal/cost/environmental accounting systems. Eco-efficiency ratios may be defined as value per environmental influence (with an increasing efficiency ratio reflecting an improvement in positive performance) or as environmental influence per unit of value (with a declining intensity ratio reflecting an improvement in positive performance). Measuring eco-efficiency performance makes it possible to identify and prioritize opportunities for improvement, and to identify potential cost savings and other benefits related to improving eco-efficiency.

Obviously, the list of ratios that could be created breaking down ratios by defining mathematical relationships is almost infinite. It is necessary to identify in each particular case which are the most relevant, depending on variables such as sector/sub-sector membership, company size, etc. Obviously, not all the ratios will be "business specific", but many will have a "generally applicable" character. Both the ratio selection and the relationships identification should be articulated through a doubled-sided process combining both a deductive and an inductive approach:

- A deductive approach based on the derivation of rules from theoretical considerations and conclusions of financial ratio analysis. It is important that this is done as the ratios are often used intuitively, without sufficient consideration of their theoretical meaning. The 'classic' method for deductive approaches goes as far back as 1919, with the DuPont Pyramid system. This approach requires the cause-and-effect rationale to be applied, in order to derive rules that explain how changes in specific cause ratios will affect, *ceteris paribus*, the effect ratios.
- An inductive approach, characterized by an emphasis on data and statistical methods. The empirical rather than theoretical foundations for grouping financial ratios are central to this approach. This approach could be articulated through the use of some instrument from the field of artificial intelligence and machine learning, applied to a properly constructed database with financial and sustainability information for a number of companies. Although it is usual to assume that the learning system is able to acquire all necessary knowledge from the relationship with its environment, the system generally starts out from an initial knowledge that is sufficiently evolved to permit it to develop correctly. The framework for the financial analysis of sustainability resulting from the deductive approach would lead the learning process through the database, searching for relevant connections and identifying the more significant ratios. In this way it may be observed that both approaches are interdependent and mutually reinforcing. For more information on machine learning, see Quinlan (1993).

The result of the identification of the relevant ratios and the definition of relationships between them can be modelled in the form of a pyramid, similar to that of the DuPont methodology, in which the main causes that deliver the results shown at the top can be found at the base, with the final effect ratio being the relative price per share (which is considered to be a measure of shareholder value), which is directly dependent on the ROE, the cost of equity capital, and the rate of future growth. Some ratios or measures come from or go to other perspectives of the three-dimensional pyramid: for example, the systematic risk measured by the Beta should come from the market perspective, while the Value Growth Duration will be an input data for the analysis inside the cash-flow perspective. Note that Figure 4-4 is only an extract of the model.

Once the relevant ratios and relationships have been identified, the next step is to formulate the rules or heuristics that explain the company's strengths and weaknesses and guide its strategic decision-making processes.

These rules will be based on the synchronic and diachronic analysis of the relevant ratios, and the analysis of the cause-effect chains that link them, also taking into account conclusions from conventional financial theory and general environmental and social knowledge.

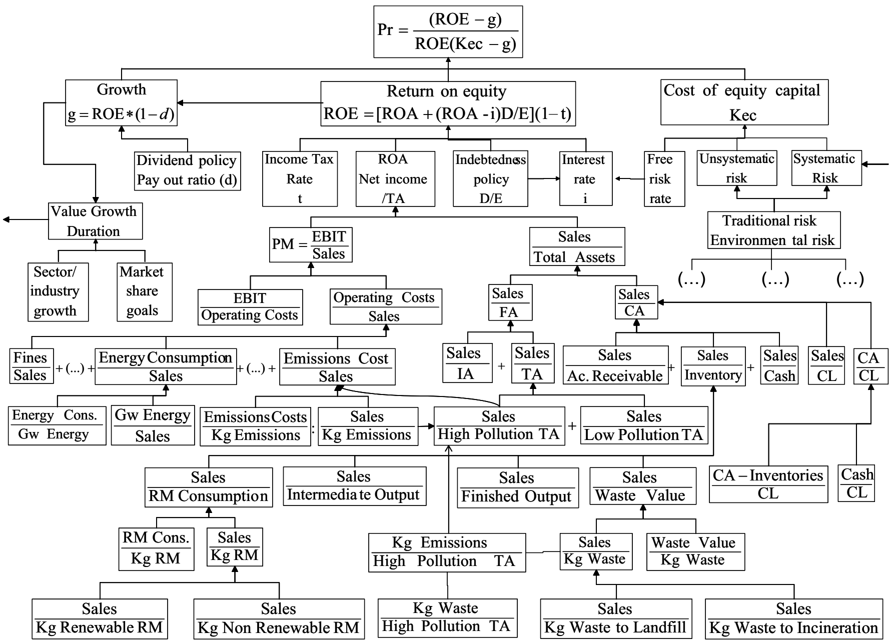

Figure 4-4. Model for the financial analysis of sustainability.

In order to clarify how this methodology of financial ratio analysis based on cause-and-effect relationships may improve financial analysis by taking environmental issues into account, as well as how it contributes to the analysis of the relationship between the environmental and financial performances, allowing to consider what kind of environmental management is being implemented at the firm, let us think about a company that has been investing in 'end-off-pipe' processes for the control of emissions (e.g., a scrubber) and that has experienced a decrease of its ROE. If the financial analyst only focus his evaluation on this effect ratio, it is likely that he will conclude that the improvement of the environmental performance is worsening the financial performance of the firm. But a look into the bottom part of the pyramid could show a picture similar to this:

- Trend analysis could reveal an increasing value of the ratio *sales/tons of emissions* (with constant sales), that reflects the reduction of emissions, and also an increasing value of the ratio *operating costs/sale* (as well as of some of its components).

- Benchmarking analysis could reveal a low value of the ratio *sales/kg emissions* (reflecting higher emissions than the sector average) a low *sales/high pollution assets* (reflecting a dirtier technology or a higher investment in it) a high *emissions costs/kg emissions* (reflecting the higher costs of the emissions control) and even a low *sales/chemical substances* and high *m3 of water/sales* (because of the use of water and chemical substances to spray the gases when they are inside the scrubber).

This analysis should suggest that the firm is implementing measures for the control of emissions that are neither environmentally effective nor cost efficient when compared with the sector, and should make the analyst conclude that is not environmental management, but the kind of environmental management what is damaging the financial performance of the firm.

The analysis of ratios is useful only when all influencing factors are interpreted skilfully and intelligently. This is, by far, the most difficult aspect of ratio analysis. Through the application of artificial intelligence tools it would be possible to validate empirically the results of the deductive analysis through the model, this is, to test the soundness of the relationships found between the ratios as well as identify the more relevant ones in order to refine the model and contribute to a better understanding of the financial implications of sustainability.

7. SUMMARY AND CONCLUSIONS

Once it has become evident that the financial objective of maximizing shareholder value cannot be considered on its own, and that companies and financial markets need to embrace sustainability principles in order to achieve this objective, managerial theory will start to integrate sustainability issues into its different areas (accounting, finance, marketing, etc.) and to develop new tools and instruments, as well as to adapt those already existing, to permit the strategic management of sustainability by companies and the capital markets.

Financial analysis, despite the criticism that it has frequently received for its reliance on past and accounting information, has traditionally been considered a suitable tool for assessing a company's financial and economic situation, and so could also provide valuable information when analysing the company's environmental and social performance and its relationship with financial performance. Ratio analysis and the cause-and-effect rationale are valid alternatives for developing the financial analysis of sustainability, as they make it possible to identify those sustainability activities that generate significant financial and/or non-financial benefits, and provide the financial community with an appropriate decision-making tool for evaluating a company's sustainable management system and the impact of sustainability issues on financial performance.

In order to develop this model for the financial analysis of sustainability a double-sided process has been defined: on the one hand, a deductive process deriving relevant relationships between ratios following the cause-and-effect rationale; on the other, an inductive process of learning from real data using artificial intelligence. After integrating the accounting, market and cash flow perspectives, the model will be extended to introduce a measure for sustainable shareholder value by applying real options theory. Finally, through constant testing and refinement in the real world, the critical relationships between the key factors of financial, environmental and social performance will be identified, organized, and explained for immediate use.

Providing that environmental reporting becomes the rule and not the exception, and that the availability of information is no longer an obstacle for the strategic management of sustainability and its integration into the decision-making processes of companies and financial markets, the model for the financial analysis of sustainability depicted above will help to uncover the true financial, environmental and social situation of the company and therefore lead to better decisions being made, and contribute towards the simultaneous attainment of financial and sustainability objectives.

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Chapter 5

THE CONCEPT OF CORPORATE RESOURCE EFFICIENCY ACCOUNTING

A Case Study in the Electronic Industry

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Abstract: Macro-economic statistics illustrate that economic growth and the use of natural resources have not yet been sufficiently decoupled. Therefore the issue has to be considered: what are the reasons for this failure at the micro level? In order to improve the support for a company's decision-making process, three main requirements can be identified: successful tools have to be (1) user-friendly, and provide effective outcomes in terms of (2) accountability and (3) transparency. This paper discusses how the complexity of environmental impact data can be reduced in an appropriate manner through the use of materials intensities, and explains the basic motivation and the general assumptions of the "Resource Efficiency Accounting" instrument. The methodological assessment approach is then described in the light of environmental management accounting. Finally a case study in the electronic industry illustrates the advantage of this concept in a practical application.

1. INTRODUCTION

The European Commission's Spring Report of 2004 states, under the aspect of GDP developments and sustainability, that economic growth is not yet sustainable (Commission of the European Communities 2004:14). Despite a relative decoupling in several countries, materials use still remains at unsustainably high levels (European Environment Agency 2003:15). Presently,

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rebound effects are emerging as less intensive use of nature is more than offset by increasing consumption of resources (Larderel 2004). In this context, Ehrlich and Holdren (1971) identified the ratio between the overall population combined with consumption patterns on the one hand, and technological development on the other hand, as crucial for an effective decrease in environmental impacts whilst avoiding rebound effects.

What kind of conclusion can be drawn from these macro-economic conditions with respect to Environmental Management Accounting (EMA)? Apparently the necessary decoupling of economic growth and the use of natural resources has not succeeded sufficiently at the micro-level. According to Sturm and Müller (2000:17) the tools fail to consider the importance of the implementation process. A discussion is therefore needed on the effectiveness and interaction of existing accounting methods and whether these provide sufficiently precise and transparent information for practical use. The need for this debate is also supported by the new guidelines on corporate environmental accounting published by the United Nations Conference on Trade and Environment (2004).

In order to meet the objectives of both the economic and the ecological dimension, the relevant measurement of performance is economic-ecological efficiency, or 'eco-efficiency' (Schaltegger et al. 2003:65). However, a closer examination of management attitudes towards ecological issues reveals different understandings of the underlying business strategies:

(1) A fundamental-normative attitude towards eco-efficiency is seen as a core component of business. This is the case in specialised eco-niche markets, for example, in which good environmental performance is used for labelling environmentally sound products. Thus, for this type of company the question of whether eco-efficiency is important is not appropriate: it is part of their basic corporate philosophy.

(2) Reactive-protective attitudes are mainly based on a company's fear of losing its licence to operate. As a kind of precautionary measure, companies try to act and interact in as environmentally sound a manner as possible. The term 'eco-efficiency' is commonly used as a marketing-oriented buzzword, without a differentiated and detailed definition of the underlying strategies and measures. This – unfortunately wide-spread – understanding of sustainable issues is limited, as it is based mainly on rather intangible assets such as reputation. The cause-and-effect chain can hardly be quantified, and there is no direct link to the profit and loss statement. Furthermore, the entire strategy is often seen as an optional luxury feature for a small niche market (Kurz 2004); imperative and unforeseen cost reductions usually represent the end of sustainable activities and measures.

(3) Proactive-rational attitudes consider environmental management to be a part of the overall management strategy. Eco-efficiency therefore contributes

to a company's success, to steady cost reductions, and to the creation of value. However, established management systems only rarely have an understanding in this latter sense. Reasons for this can be seen in (a) a lack of awareness, capacity, or knowledge, (b) an insufficient motivation and management commitment (DeSimone and Popoff 1997:91), or (c) different cognitive and institutional perspectives of eco-efficiency (Bleischwitz 2003).

This paper concentrates on eco-efficiency as a management tool in the latter sense, and therefore as "a management approach that allows enterprises to carry out environmental protection measures from a market-oriented point of view" (Weizsäcker et al. 2001:11). To this end, eco-efficiency can be derived as the ratio of economic value creation to environmental impact added (Schaltegger and Sturm 1990). For practical application, a definition is needed of how the numerator and denominator can be explained and measured.

Economic value creation by means of eco-efficiency derives mainly from (1) savings through the more efficient use of materials and energy, (2) reduced costs through less end-of-pipe remediation, (3) proactive and voluntary actions that make costly retrofits redundant, and (4) new business opportunities which are made possible by responsible corporate governance and a good reputation. Different methodologies have been developed in order to determine the economic value which is created, such as discounted cash flows (Rappaport 1986, Brealey and Myers 1996, Schaltegger and Figge 1998).

Evaluating the environmental impact added, the economist's answer to these questions is: if the costs of every environmental activity could be quantified exactly, different environmental impacts could be compared on the basis of their monetary costs. However, there is neither a common scientific agreement nor an adequate practical approach (Bebbington et al. 2001) on how to overcome the problem of assessing different environmental impacts in monetary terms (such as climate change, lost hectares of wetlands, shrinking bio-diversity). The focus of this paper is therefore on physical scales as a more tangible measurement of environmental impacts.

Schaltegger and Sturm (1990) define environmental impact added as the measure of environmental interventions, which are assessed according to their relative environmental impacts. As most of the existing models "provide information about only potential environmental impacts" (Sturm and Müller 2000:14), the main task is to define a methodology which is based on physical indicators and which delivers reliable information about actual impacts, as well as comparable results in quantitative metrics. Furthermore, because of the cost-value ratio it has to be applicable without excessive efforts in terms of data collection.

Moffatt et al. (2001) analyzed seven existing methodologies for measuring resource efficiency according to their robustness, practicability, and usefulness to policymakers. One sub-criterion was the concept's applicability at a company level. The results show that there are three approaches which deliver feasible results in this manner. (1) The "Y/e measure" conducted by Pearce (2001) is a tool that determines how much economic output is obtained from a given level of emissions (e.g. CO_2). (2) Wackernagel and Rees (1996) developed the method of assessing the Ecological Footprint, in which ecological impacts are measured as the area of biologically productive land and water which is required in order to produce the resources which are consumed and to assimilate the wastes, under given management and production practices. The results are expressed in standardised hectares. (3) Another, more comprehensive methodology is based on the materials intensity (Schmidt-Bleek 1993, Weizsäcker et al. 1997). This approach uses life-cycle-wide environmental impact data and accumulates materials intensities as an assessment result.

How to utilise the latter approach and implement the results in management decisions was the focal point of the research project "Computer Aided Resource Efficiency Accounting", which was founded by the German Ministry for Education and Research (Busch et al. 2004, Busch and Beucker 2004). Based on the project's outcome, the following chapters present the basic methodology and the practical application.

2. RESOURCE EFFICIENCY ACCOUNTING

Bennett et al. (2002:1) defined EMA as "the generation, analysis and use of financial and non-financial information in order to optimize corporate environmental and economic performance." At the corporate level, Resource Efficiency Accounting considers life-cycle-wide environmental information and cost aspects simultaneously. Furthermore, Resource Efficiency Accounting fulfils the three value propositions of EMA (Bennett et al. 2003:6) in the internal and external dimensions by raising management's attention towards environmental issues and the organisation's potentials for impact reductions. In terms of the third proposition, cost accounting and environmental information and issues are integrated into management decisions. According to Fussler et al. (2004:126), Resource Efficiency Accounting can thus be contemplated as an instrument for EMA.

The purpose of this concept is to integrate Monetary Environmental Management Accounting and Physical Environmental Management Accounting, so that emphasis is put on one main aspect of the eco-efficiency analysis, the evaluation of environmental impact data (Orbach and Liedtke

2002). For this purpose three main requirements are considered necessary in order to generate an effective and efficient instrument: (1) user-friendliness – i.e. frugal procedures and manageable outcomes; (2) accountability – i.e. comparability and reduced complexity; and (3) transparency – i.e. concise environmental impact assessments and identification of cost reduction potentials. However, it seems that there is a contradiction between these requirements in certain areas. In order to manage this issue, Resource Efficiency Accounting uses materials intensities.

2.1 Materials Intensities: Life-Cycle-Wide Assessments in the Ecological Dimension

EMA usually encompasses the internal accounting of physical units, with the results being expressed in units such as kilograms or joules. Resource Efficiency Accounting extends these results along the life cycle perspective in order to support the application and highlight the transparency of environmental impacts. This approach is not new, as it is the basic idea of every Life Cycle Analysis (Ciambrone 1997). But most impact assessment methods require the collection and quantification of huge and complex amounts of data along the life cycle that depend upon defined assumptions on factors such as system boundaries and toxicity (see e.g. Stahl 1998 or Christiansen 1997). Thus, Resource Efficiency Accounting uses life-cycle-wide flows based on materials intensities (Wuppertal Institute 2003).

Materials intensities are a well-known and broadly accepted approach to quantifying environmental impacts at the macro level by accumulating all the materials inputs of an economy (Adriaanse et al. 1997, Bringezu et al. 2003, Matthews et al. 2000). In order to compare various materials alternatives, the life-cycle-wide materials input is calculated of a specific quantity such as one ton. The materials input in relation to weight units is then called 'materials intensities' (Ritthoff et al. 2003).

The main advantage of the use of materials intensities at the company level can be seen in the less complex application of the impact assessment and in the generation of comparable and manageable outcomes. This is in line with the two requirements of user-friendliness and accountability respectively. The sum of the resulting mass-equivalents is described by the total materials requirement indicator (Bringezu et al. 2003), which encompasses abiotic materials, biotic materials and soil (Schmidt-Bleek et al. 1998). Practical applications have demonstrated that for most optimisation decisions this indicator is sufficient to describe the materials intensity. In cases where water or air seem to be relevant, a simultaneous or additional consideration is recommended.

Materials intensities are user-friendly as they are publicly available and utilise aggregated data; furthermore, they give consolidated information on complex life-cycle-wide environmental impacts. The method neither assesses the toxicity of a material nor considers emissions in an explicit way. However, emissions are included by materials intensities, as for example in the case of CO_2, the carbon inputs of fuel and gas (Ritthoff et al. 2003). Even though conceptually this approach might be considered to be an oversimplification, the results can still be considered as a plausible directional sign. Thus, they fulfil the purpose of reducing the complexity of ecological economic assessments to a level at which this can be managed in a simple and comprehensible way.

Applying the concept at the company level, the first step is to analyse and structure existing corporate materials and energy flows. A materials flow analysis focuses on the modelling, analysis and assessment of materials and energy flows in a company and aims to identify potentials for optimisation. It requires activity-based and contemporary data on materials inputs and outputs and can be applied to single processes, whole companies or production networks (see Bullinger and Beucker 2000). As discussed in contemporary EMA literature, concepts of flow management aim to organise the whole of a company's production function in terms of all its physical and information flows in an efficient and objective-oriented manner (Fichter et al. 1997, Schaltegger and Burrit 2000, Schaltegger and Müller 1998, Strobel and Redmann 2002). Corporate materials and energy flow accounting is a sophisticated method of analysing a company's structure and processes; it is therefore used as a supporting method for Resource Efficiency Accounting.

Based on this kind of detailed information, specific materials consumptions, energy use, and flow rates can be classified and assigned to individual production processes. In the next step, single output components can be defined (e.g. end-products) and individual materials and energy balances can be allocated.

This is usually the final stage at which existing concepts of flow management are relevant, as their inherent underlying concept is to generate eco-efficient solutions by reducing materials and energy flows and simultaneously their associated costs. Here, the assumption is made that reduced flows always deliver better solutions in terms of improved eco-efficiency, due to both lower environmental impacts and lower costs. Admittedly, from the financial point of view this assumption is correct in most of the more straightforward cases, since reduced materials or energy flows do usually entail fewer costs. But from the ecological perspective, one basic fact is inconsistent with this assumption, at least under certain conditions: slimming down materials or energy flows per product or service unit does not result automatically in an improvement in overall ecological impacts (Braungart et al. 2004:147). Under miscellaneous circumstances and multiple alternatives it is not always definite which strategy provides the optimal solution, so that it is necessary to analyse the hidden flows of alternative solutions. Notably, several options are possible in which cost optimisations result in barely distinguishable outcomes but differ meaningfully in options for: (1) alternative use of materials inputs, (2) amounts of related energy consumption, (3) transportation requirements, or (4) impact-shifting to preliminary or downstream production processes within the supply chain. The Resource Efficiency Accounting approach embraces these options as it takes into consideration the ecological impacts of life cycle aspects.

2.2 Integrating the Cost Accounting Dimension

The overall objective of the Resource Efficiency Accounting approach is to highlight the internal and external environmental aspects of eco-efficiency in a non-complex way for critical optimisation issues. In terms of consistency with established management procedures, the Resource Efficiency Accounting concept combines ecological data with related cost data. Existing environmental cost accounting approaches can be divided into four categories, which are defined by the tasks of cost management (Loew 2003:43): (1) determining environmental protection expenditures by environmental protection cost accounting, (2) discovering internal savings by materials and energy flow-oriented accounting, (3) supporting investment decisions by environment-oriented investment accounting, and (4) evaluating external effects by external cost accounting. Basically, the Resource Efficiency Accounting approach is not limited to any single one of these assessment categories, but provides a new framework for these established environmental cost accounting approaches.

Concerning the requirements of user-friendliness and accountability, the cost accounting system which already exists within a company is considered first. In order to identify potential cost reduction opportunities, the second step focuses on the well-known problem of cost misallocation (Schaltegger and Müller 1998, US Environmental Protection Agency 1998). Based on the scale and sophistication of the established system, an evaluation is needed of the extent and in which direction the cost accounting system should be reorganised and adjusted. As the environmental dimension is based on a materials flow analysis, procedures of the second category are usually suggested such as activity-based costing or flow cost accounting (Jasch 2002:47).

Assuming the existence of alternative cost-efficient strategies, the simultaneous consideration of both life-cycle-wide environmental data and the cost data which is available constitutes an eco-efficient objective function.

This economic and environmental function provides a basis for a company's decision-making process. It recognises the occasional tension between economic performance and environmental impacts, and integrates both within a single management function. The results are illustrated by an eco-efficiency portfolio, which is a common way of illustrating potential opportunities for ecological and economic performance optimisations (Ilinitch and Schaltegger 1995, Saling et al. 2002). The basic idea is derived from the Boston Consulting Group growth/share matrix (Collis and Montgomery 1998:16). Based on this eco-efficiency portfolio, management strategies can be analysed and investment decisions can be evaluated (see Figure 5-1).

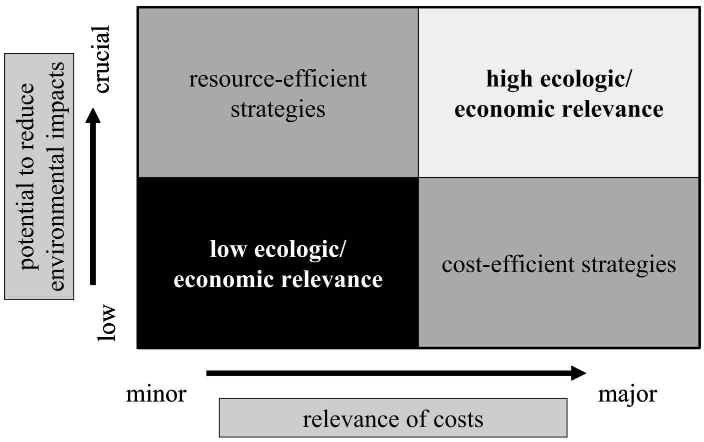

Figure 5-1. Eco-efficiency portfolio analysis (source: Busch et al. 2004:93).

2.3 Levels of Application of Resource Efficiency Accounting

The eco-efficiency portfolio analysis based on Resource Efficiency Accounting can be utilised at different levels within a company. It is possible to consider either the entire company, or single processes or products.

An assessment of the entire company is the easiest option in Resource Efficiency Accounting. The result describes the overall environmental impact and profitability of a company; however as this is a single figure, it does not offer any insights into potential internal improvement opportunities. Corresponding assessments can be incorporated, for example in capital market analysis for Socially Responsible Investments, or the benchmarking procedures of rating agencies.

For the application of Resource Efficiency Accounting at the process level, a detailed analysis identifies different processes within the company and their relative portion of the overall costs (derived from the Profit & Loss Statement) and the relative portion of the company's total material requirement (derived from an input-output analysis and materials flow accounting). Processes with a significant potential for eco-efficiency improvements are marked as so-called 'hot spots'.

In the next step, the same procedure is applied at product–level which means that single output components have to be defined. In most cases these are end products or services that fulfil an identical, or at least very similar, utility for the consumer or sub-purchaser. At this stage, the hot spot analysis is then focused on identifying utility-indifferent products with a relatively high total materials requirement score. The optimisation strategy can then either focus on producing products with relatively low scores, or on optimising the identified hot spots.

2.4 Data Requirements for Resource Efficiency Accounting

The data which is required for the detailed analysis of production processes and products can be obtained from a variety of different sources. Industrial sector and company-specific input/output data can be derived from supply chain analysis, and detailed information on individual cost accounting, internal materials flows, and materials properties, can be generated from a company's information system and the transaction of data, based on its Enterprise Resource Planning system. In the practical application of Resource Efficiency Accounting, the table 5-1 is helpful for identifying individual sources, accumulating different types of data, and processing the resulting information.

2.5 Supporting Information Systems

Many of the aforementioned data can be obtained from a company's Enterprise Resource Planning (ERP) System. Hence, ERP Systems and their data are a valuable information source for the support of Resource Efficiency Accounting application.

The amount of data which is necessary for a significant implementation of Resource Efficiency Accounting demonstrates the need for the application of software within the assessment process. From a theoretical point of view, different approaches can be utilised to integrate environment-related data into the information technology infrastructure of a company by adapting or enhancing the existing information system without re-engineering (Rikhardsson 1998). The use of the existing IT infrastructure is only one of four different strategies to set up an Environmental Management Information System (EMIS) as described by Rikhardsson. Within this strategy, the four approaches include (1) the use of office application software, (2) the use of a company-wide software system without major modifications, (3) the use of an EMIS, and (4) the use of a Data Warehouse. Other strategies include the design of a new EMIS, the re-engineering of an existing corporate information system, or the implementation of a standard system package.

Table 5-1. Data requirements for Resource Efficiency Accounting.

Needed data	Data sources & steps to obtain needed data
Structure of production processes	The structure of production processes including the connections between the individual processes can usually be identified from work plans. These often also contain information on personnel and machinery expenses and allocations to work places. However in small and medium-sized enterprises in particular, it is often necessary to generate a totally new coherent structure plan.
Data on materials and energy consumption of the company	This type of data can be found in the profit and loss statement, bookkeeping, cost accounting, and storage and purchase systems. For example, the data can provide insights into the company's overall consumption of the main component and its related purchasing expenditures. In order to obtain a clear aggregated picture it is practical to sum up all data in a separate input-output sheet.
Consumed materials, substances and energy per process/ product	Process-related materials inputs and outputs are usually available from work plans/routings or internal production orders. Specific outputs such as waste are often recorded since they are required by environmental laws. Energy inputs are mostly not recorded and allocated at the process level, prevalent in small and medium sized companies. The specific consumption has to be measured plant-specific, derived from instruction sheets, or estimated individually. Finally, all information has to be accumulated and assigned to single end-products/service units. Additional product/service-related information can be obtained from invoices or claims.
Costs per process/ product	If a good cost and activity accounting exists cost allocations per process or product can be. Nevertheless, it is advisable to confirm that the established accounting system is working in a reliable and concise manner, especially in terms of the accurate assignment of materials and energy-related overhead costs.
Masses per process/ product	Mass allocations are usually not available and have to be generated based on the collected data.
Materials intensities	Materials intensities have to be added for all different kinds of materials which are used, and their specific energy consumption (at process or product level). The web page http://mips-online.info provides a compilation of main materials intensities and a general introduction into how to apply the concept.

Using existing ERP Systems without major modifications was the basic approach used in the practical application of Resource Efficiency Accounting.

This was possible due to the technological advances of ERP Systems that have been achieved in the last few years. Presently, they can be considered as versatile tools that are easy to extend, also in view of the implementation constraints of Resource Efficiency Accounting. Nevertheless, another important category for the analysis of life-cycle-wide data and processing of information which can be obtained from Resource Efficiency Accounting is EMIS. The availability of specific evaluation functionalities enables the simultaneous assessment of costs and environmental impacts categories. In particular, some EMIS are developed specifically for balancing purposes, which makes them especially suitable for the implementation of Resource Efficiency Accounting.

A so-called Publicly Available Specification (PAS) was developed for the data exchange between ERP-Systems and EMIS (PAS 1025, 2003). This PAS can be seen as pre-standard, since in contrast to a regular standard it does not include all relevant stakeholders and organisations in the discussion process. The aim of the specification is to serve as a basis for future normalisation processes. The PAS describes and defines the exchange of materials flow data between ERP Systems and EMIS via a generic interface. An example of such a data exchange with relevant data categories obtained from a Resource Efficiency Accounting is given in Figure 5-2 below.

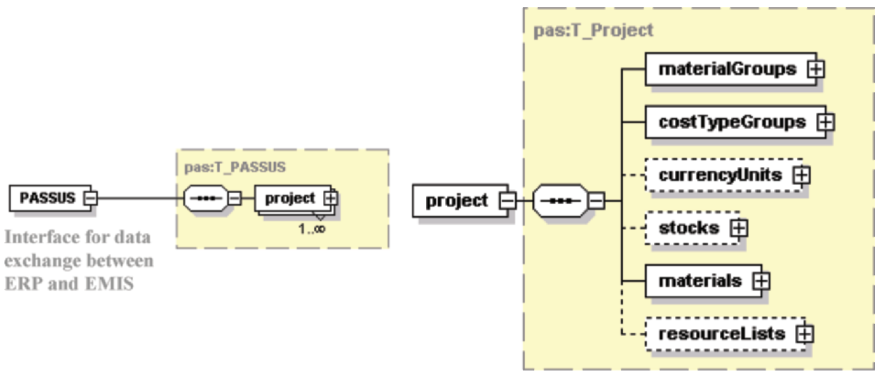

Figure 5-2. Data exchange between Enterprise Resource Planning System and Environmental Management Information Systems.

3. A CASE STUDY IN THE ELECTRONIC INDUSTRY

During the conceptual setup of the Resource Efficiency Accounting approach, the theoretical findings were applied and tested in selected companies. This section describes the results of the practical application in the electronic industry in a Toshiba computer-production site in Regensburg.

3.1 Status Quo and Motivation

Toshiba Europe GmbH (Regensburg, Germany) is a subsidiary of the worldwide Toshiba Corporation. The subsidiary is responsible for the final assembly and testing of computers (notebooks, desktops and servers) for the European market. Key components and semi-finished goods are delivered from different countries (mainly East Asia) to Regensburg, where they are finally mounted and tested. Suppliers of the key components vary frequently as a result of technical specifications, market prices and company policy. Changes of suppliers and sourcing from different countries tends to result in diverse forms of transport and packaging materials, which makes it difficult to plan actions concerning disposal issues and especially the handling of packaging materials.

The particular interest of this case study within the Computer-Aided Resource Efficiency Accounting project was to test whether the application of Resource Efficiency Accounting could help to identify potential opportunities for reductions in environmental impacts and costs deriving from materials sourced from different suppliers. A specific challenge for the application of Resource Efficiency Accounting in this case was to prove that information about suppliers which could be derived from the company's ERP System could serve to improve the accounting process.

As the Toshiba Corporation and the Toshiba site in Regensburg has a long and profound experience in environmental management and accounting, their specific interest in the case study was to refine and improve their environmental accounting and to allocate environmental impacts to the processes from which they originate.

3.2 Analytical Assessment and Identification Improvement Potentials

As described in Section 2.1, the first step in the application of Resource Efficiency Accounting at company level consisted of a materials flow analysis. The results of the analysis showed that the packaging materials deriving from different suppliers entail both significant financial and environmental impacts. Thus, an optimisation strategy focused on the assessment of specific suppliers of key components, and the effects deriving from their packaging materials and transportation processes. The following sections describe the detailed proceedings and the results of the analysis for the packaging materials and methods of transport which were used in the delivery of key components of laptops. The identified supplier corresponds to the 'hot spots' mentioned in Chapter 2.3.

In a first step, existing sets of a packaging material for key components were identified and classified. At the Regensburg site a certain number of changing suppliers deliver several key components with technically similar specifications and varying prices. The related packaging materials used for the key components varied between different suppliers. Therefore in the second step, the different sets of packaging materials were mapped by taking into account their number, volume, weight and the type of material. The classification of key components on the basis of the packaging materials which were used, in combination with the underlying materials intensities, led to scenarios ranging from worst case (up to six different packaging materials for one key component) to best case (only two different packaging materials). Based on these scenarios, opportunities for ecological and financial improvements were identified.

The relevant financial effects caused by packaging materials were:

- Costs for unpacking and re-packing (caused by re-packing processes, which are necessary to deliver the components to the production lines within the site)
- Costs for handling (caused by sorting and transportation of the different packaging materials within the site)
- Costs for disposal (caused by the disposal of the packaging material itself)
- Costs for transportation (mostly caused by air transportation depending on the distance, the volume and the weight of the packed components)

The costs were summed as the total costs of packaging materials per component and per supplier.

The environmental effects of the packaging materials which were identified derived from the composition and consistency of the materials, the transport intensity of the packed components, and the disposal and recycling features. In the case study, the different packaging materials were assessed according to Streamlined Life Cycle Assessments (LCA) using materials intensities for the impact assessment of the production, use, and disposal phases (Christiansen 1997). Environmental effects were calculated for single packaging materials as well as for all kinds of used sets of materials. The Streamlined LCA approach was used for the assessment of the environmental effects because of its relatively simple and efficient application. Basically this aims to provide the same results as a detailed LCA but with significant reductions in expenses and time (dk-TEKNIK and SustainAbility 1997).

3.3 Assessment Results

The assessment results showed that the costs for transportation and for un-packing and re-packing were the cause of the largest cost effects of all cost categories which have been mentioned. The cost differences which were evaluated between existing sets of packaging materials were the motivation for a regular monitoring of cost effects, and an assessment of suppliers of key components according to their differences in packaging materials. Costs for handling and disposal itself accounted for rather a small percentage; less than 1% of the total cost of packaging materials.

A significant environmental impact caused by packaging materials was due to the air transportation of the key components. On the other hand impacts deriving from the production and disposal of the material itself were relatively small (<10%) in comparison to the total effects. The overall results of the Resource Efficiency Accounting-based assessment suggested the following optimisation strategy:

- The reduction of mass and volume of the packaging could be identified as the ‘hot spot’ of both cost and environmental impact optimisation. The weights and volumes of the packaging materials had a positive correlation with the costs of transportation and of un-packing and re-packing, and environmental effects. Thus, a detailed analysis of existing and optional alternatives for these aspects had a high priority.
- Due to industry-specific constraints, the effectiveness of airborne transportation was not open to question as it could hardly be substituted, so its efficiency had to be considered for concrete optimisations. Two aspects seemed to be apparent: on the one hand reductions in the volumes, and on the other hand the avoidance of excessive landings and take-offs.

The results from the financial and the environmental assessment of suppliers’ packaging materials can be used for a standardised assessment of suppliers’ performance, as described in the next section.

3.4 Using the Results from Resource Efficiency Accounting for Supplier Assessment

The results of the analysis were used for the assessment of different suppliers of key components and their financial and environmental performance. To establish a standardised supplier assessment procedure, a continuous supply of information on supplier-related financial and environmental performance caused by packaging materials and transports is necessary. At the Toshiba site in Regensburg, this required the permanent supply to the environmental management and accounting functions of actual data on the environmental and financial effects of key components that result from changes in the composition and consistency of packaging materials.

For this purpose, data had to be integrated and compiled into the company's ERP System to create a consistent and current database containing all relevant information for assessment and accounting objects. Thus, the underlying calculations and rules of the financial and environmental assessment process which has been described were implemented into a Microsoft Access® Prototype. By this means, the assessment functionality was combined with real-time data on the key components which were used at the Toshiba site and materials intensity values for the assessment of environmental impacts. The prototype will be implemented into the company's Oracle®-based Enterprise Resource Planning System to enable the link with real-time supplier data (e.g. quantities and costs) and to ensure the availability of the assessment data for different company departments (environmental and quality management, purchasing department, etc.).

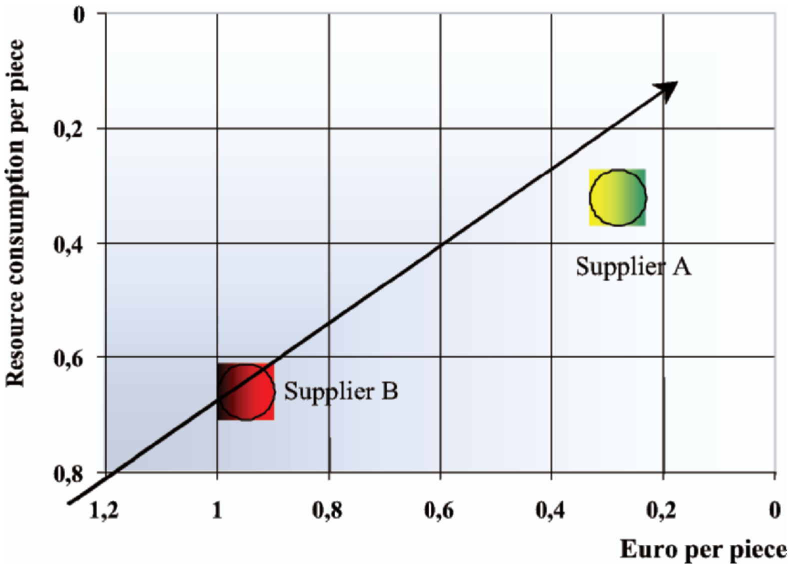

Figure 5-3. Comparison of two suppliers in a resource efficiency portfolio.

To ease the supplier assessment, the results from the financial and the environmental impacts assessment are visualised in a two-dimensional resource efficiency portfolio (see Chapter 2). Based on this portfolio, different suppliers can be compared under cost restraints (expressed in Euros per packageing set) and environmental aspects (illustrated by materials intensities per packaging set). Figure 5-3 visualises the assessment process. It shows the comparison of two suppliers rated according to their environmental performance (measured in resource consumption as materials intensities per packed component) and their financial performance (measured in total costs of packaging materials per packed component in Euros) with the resource efficiency portfolio (similar to the eco-efficiency portfolio, e.g. Ilinitch and Schaltegger 1995, Schaltegger and Sturm 1992). Supplier A is in both cases a better choice as they produce both lower costs and lower resource consumption.

4. CONCLUSIONS

This paper has discussed the application of the macro-economic instrument of materials flow accounting as a management approach for companies in terms of measuring, assessing, and improving eco-efficiency. From an EMA perspective, the Resource Efficiency Accounting tool which has been developed integrates the ecological component into the company's cost and activity accounting. Therefore, it complements existing models of the company's materials and energy flow accounting by life-cycle-wide environmental impact data based on materials intensities. By this means, this approach fulfils three main requirements of a successful EMA tool: user-friendliness, accountability and transparency.

Incorporating materials intensities leads to a reduction in the inherent complexity of physical environmental impact data. The practical application is supported by utilising already established systems within companies. This delivers a manageable, i.e. user-friendly, procedure. Assessment results illustrate that (1) Resource Efficiency Accounting enables an effective and appropriate eco-efficiency analysis in terms of accountability, (2) the results provide precise and transparent information for practical use, and (3) the computer-based implementation supports standardised eco-efficiency optimisations.

In this paper, the cost-value ratio has been mentioned as a crucial requirement for operational management tools. To start a project, based on the suggested concept, requires both financial input and efforts by the company's personnel. However, these efforts are not due to the integration of life cycle data, as the materials intensity data can be obtained via the Internet. It is a matter of fact that materials flow accounting and input/output analysis are a rather time-consuming business. The time which is required for collecting the necessary data depends on both the individual company's information system and the industry-specific types of materials flows. However, once the new system is installed within a company, Resource Efficiency Accounting reflects an optimal functionality: assessment results for different alternatives (products and processes) can be generated automatically by the use of computer-aided systems, and new components can easily be added subsequently.

To sum up the benefits of the resource efficiency accounting approach, enterprises obtain a concise and thorough assessment of their products and production processes as well as previous procedures within the supply chain. This information can be used for an eco-efficiency performance evaluation. Furthermore, the results can lead to an improvement in a company's financial performance by utilising cost reduction potentials as well as by stimulating innovation processes at the product and production levels. In cases where companies communicate information about their efforts and successes, customers and consumers obtain new information about the purchased products and services. This could stimulate supply chain-wide decision-making processes in terms of fostering eco-efficiency as an indicator of product quality and an excellent management effort. The latter is also of particular interest for financial markets, since investors and analysts are able to consider new information about companies with which they are involved in through money transaction processes. With these primary non-financial details they are able to gain a deeper insight into companies' overall performance. Ultimately, increased eco-efficiency of the entire economy is an objective of policy-makers and governments. Resource efficiency accounting provides a feasible instrument for individual actors within the economy to measure and improve their impacts, and thus to contribute to the overall policy objective.

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Chapter 6

ACCOUNTING FOR HEALTH AND SAFETY COSTS

Review and Comparison of Selected Methods

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Abstract: A part of the emerging sustainability management accounting is corporate health and safety performance. One performance dimension is the costs of occupational accidents in companies. The underlying logic for calculating these costs is that if occupational accidents are prevented then these costs could be avoided. This chapter presents and discusses selected methods for calculating the costs of occupational accidents. The focus is on presenting the characteristics of each method and disclosing the benefits and drawbacks of each method.

1. INTRODUCTION

Management accounting could be defined as the process of identification, measurement, accumulation, analysis, preparation, interpretation, and communication of financial and non-financial information used by management to plan, evaluate, and control within an organization and to assure appropriate use of and accountability for its resources. For other definitions see e.g. Atkinson et al. (2004).

Management accounting as a corporate function has changed over the years in a number of ways (see e.g. Neely 2003, Read 2003). First of all it has moved from being a purely controlling and reporting function to a value creating function delivering information and analysis to other functions in the company. Secondly, with the advent of ERP (Enterprise Resource Planning) systems many of the manual processes have been automated so management accountants can allocate their time to analyzing, planning and

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 129-151.

supporting business units (Poston and Grabski 2001). Thirdly, management accountants no longer only focus on financial numbers but also on non-financial information such as that necessary to make a Balanced Scorecard function or implement Business Process reengineering projects (Kaplan and Norton 1997). Finally, management accountants have roles to play in fields like project evaluations, strategic planning and stakeholder relations thus extending the reach and influence of management accounting techniques and methods. An example of a field in which management accounting has also come to play a role is environmental management. Environmental management accounting, as defined by e.g. Bennett et al. (1998) and Bartolomeo et al. (1997), focuses on supporting management decision making regarding issues such as environmental costs, environmental investment evaluations and environmental taxes by the identification, measurement, accumulation, analysis, preparation, interpretation, and communication of financial and non-financial environmental information.

As sustainability becomes the benchmark for societal development it could be argued that managers need information about sustainability issues other than just the environment. Thus environmental management accounting could be extended to include other sustainability issues as well. The challenge is to integrate the dimensions of sustainability – i.e. the economic, environmental and social dimensions. For an interesting discussion of the dimensions of sustainability and how these relate to business companies see e.g. Reid (1995) or Welford (1995). An early indication that this is important for management accounting can be seen from the papers included in Bennett and James (1999) in which a number of the contributions address the need to broaden the scope of performance measurement towards sustainability issues (see. e.g. Ranganathan 1999). This trend has continued to grow and in 2004 the EMAN-EU network held a conference dedicated to the issue under the title Sustainability Accounting and Reporting (for further information see Internet URL <:http://www.eman-eu.net/>) in which a number of contributions addressed the need to broaden the scope of environmental management accounting. The prefix “environmental” might thus be too narrow to capture the future development of environmental management accounting and sustainability management accounting might be more appropriate. This trend is also apparent in external environmental reporting frameworks such as the Global Reporting Initiative framework published in 2002 (GRI 2002) where social and financial issues are included as elements in what is called sustainability reporting.

One of the issues being addressed as part of the company’s sustainability performance is Health and Safety (H&S). H&S as a function focuses on securing and promoting safety and health, including both physical and mental health, of the persons working for the company (Holt 2002). Like most other management functions this includes developing and implementing H&S strategies, measuring and following up on performance issues and reporting on these issues to internal and external stakeholders.

Ignoring Health and Safety can be expensive. Resulting effects such as occupational accidents cost money for the companies in which they happen, they lead to financial losses for the employees to whom they happen and they cost society money in e.g. health care and loss of working capacity. The European Agency for Safety and Health at Work has estimated that 4.6 million occupational accidents happen every year in the EU resulting in 146 million lost working hours (EU OSHA 2001). This means that approximately 2.6 to 3.8% of the collective EU Gross National Production (GNP) is lost every year. However, it seems logical that these costs might be avoided if accidents could be prevented. Preventing occupational accidents should therefore make good economic sense for society as well as being good business practice for companies (Dorman 1997, 2000). Occupational accidents are generally defined as unforeseen sudden events that result in a physical injury to an employee (Dorman 2000).

Traditionally the information collected regarding occupational accidents has been e.g. frequency, types, location, employee groups, length of sick-leave, etc. This information has been put in context with e.g. number of employees, numbers of hours worked, number of sites, etc. (Holt 2002). However, when viewing H&S issues and occupational accidents in an accounting context then the costs of these accidents, the value that the company loses in the course of occupational accidents and the value that is created though prevention initiatives become of interest.

2. APPROACHES TO MEASURING HEALTH AND SAFETY COSTS

Evaluation of the business costs of occupational accidents has been the subject of numerous research projects in the past. Dating back to the 1920s a study by Herbert Heinrich documented that the costs of occupational accidents in American companies were substantial and that many costs were hidden from the view of management (Heinrich 1959). Following Heinrich's studies there have been many similar studies carried out in a number of countries (see e.g. Grimaldi and Simons 1984, HSMO 1993, Larsson and Betts 1996, Monnery 1998). These studies document that there are can be significant costs associated with occupational accidents.

The often stated reason for measuring H&S costs is that if these costs are made explicit, then this will motivate managers to take H&S issues into account in their decision making. That is to say H&S issues will become more business related and affect management decision making to a larger extent. However this is by no means certain. Consider these questions (see Aaltonen 1996):

- Are H&S costs significant in relation to other cost categories or turnover in the company or the department?
- Can management affect H&S costs through their actions?
- Is the period between management action and the effect on H&S costs short enough so that managers can see the benefits of their actions?
- Does management have access to information about the effects of management initiatives on H&S costs?

If the answers to some of these questions are negative then it is not certain that calculating H&S costs will have an effect on management decision making.

H&S costs include a number of diverse issues but can be classified into two overall categories:

- The costs of running an H&S management system and the initiatives associated with promoting and securing H&S in the company: These costs are usually relatively stable as they do not vary with the occurrence of negative effects such as occupational accidents and work related illness.
- The costs of the consequences of e.g. occupational accidents or work related illnesses: These costs can be in the form of direct expenditures, increases in existing costs, potential reduction in income as well as opportunity costs. These costs vary with the type and number of consequences.

This categorisation is reflected in a number of studies of H&S costs. Andreoni (1988) and HMSO (1993) use the terms prevention costs and accidents costs where prevention costs are not affected by individual accidents. This is somewhat comparable with the terminology used within quality costing systems (Dale and Plunket 1997). It should be noted however, that some costs fall within both categories such as some insurance costs where there can be a fixed annual cost and a variable costs which increases as the insurance is used.

Consequence costs are, like other costs in a company, to a large extent contingency based – i.e. there is no general determinant of how high these costs are. Some of the factors affecting the costs of the consequences of occupational accidents are (based on Dorman 2000, HMSO 1993, Rikhardsson et al. 2002):

- Type of accident and length of absence: industries differ regarding work characteristics and thus number and types of accidents. Companies in accident-prone industries are therefore more likely to have higher accident costs.

- Wage structure and policies: a large portion of the total accident costs in each company is often sick pay during absence. However, this can vary according to the injured workers' position and wage, as well as structure of the social security system and local labour agreements. Danish companies for example are required by national law to pay full wages for the first 14 days after the accident. After 14 days the Danish social security system takes over but the rates are often lower than the full wages of employees. Thus some companies choose or were bound by union agreements to pay supplementary amounts to the employee so full wages were guaranteed for the whole duration of the sick leave. This meant that some companies had significantly higher costs of absence. Other countries such as USA and the UK do not have the same social security regulations which mean that the company either carries the costs itself or has to pay an insurance company to have them covered.
- OHS management system scope: in larger companies the Occupational Health and Safety department is a staff function manned with a number of specialists and secretaries and functions under numerous policies, rules and regulations. Thus when an accident occurs in larger companies more formal activities are initiated than in smaller companies. There are more people involved, there are more internal administrative processes that have to be complied with and more organizational levels have to be informed.
- Production process vulnerability: A very important determinant of occupational accident costs is what function the employee has in the company and how difficult it is to replace his or her function and competencies. If the employee is responsible for a key function in the production process or has key responsibilities and there is no immediate replacement available, then the accident costs are higher. Furthermore, in companies selling the work of their employees, absent workers means lost revenues which have to be added to the total cost of the accident.

H&S cost studies often fall into two categories (see e.g. Aaltonen et al. 1996, Lanoie and Trottier 1998, Söderquist et al. 1990):

- Consequence studies: evaluation of the costs of the consequences of negative H&S events such as occupational accidents
- Effect studies: evaluation of the costs and benefits of implemented H&S measures

In the literature there is a predominance of studies within the first category. There are numerous effect studies about but very few have systematically focused on the economic consequences of H&S initiatives. Effects that are documented usually include e.g. reduction in sick days, number of occupational accidents, changes in attitudes towards safety measures, etc.

Looking at consequence studies, these can broadly be classified into two different approaches. Here these are called the insurance based approach and the activity based approach

2.1 The Insurance Based Approach to Consequence Studies

The origins of the insurance based approach can be traced back to work done by Herbert Heinrich in the 1920s. Heinrich documented that the costs of occupational accidents in American companies were substantial and that many costs were hidden from the view of management (Heinrich 1959). Heinrich used data from insurance cases and divided costs into direct and indirect costs where the main classification criterion was whether these costs were refunded under the insurance. The costs that were not refunded by the insurance were termed indirect or hidden costs and were, according to Heinrich's study of selected occupational accidents, approximately 75% of the total costs of an average occupational accident. To express this distinction Heinrich developed the iceberg metaphor where the larger hidden part of the iceberg represented the indirect costs. One example of direct costs is e.g. sick pay and examples of indirect costs are e.g. the non-productive time of colleagues, administrative costs, production setbacks, replacement hiring costs, fines and investments in extra safety measures (Andreoni 1986).

Using a similar methodological approach as Heinrich numerous studies have been carried out in various countries. These studies document that there are significant costs which are not insured in any way and constitute a loss to the company. However, the ratio between these costs is dependent on a number of contingent factors such as company size, accident type, industry, accident frequency, etc. Monnery (1998), for example, documents that the ratio of insured and non-insured costs due to work related ill-health in a bank cheque clearing department constitute 1:3.3 – i.e. for every dollar covered by the insurance 3.3 dollars are not. A study conducted by the United Kingdom Occupational Health Authorities and published in 1993 documents different ratios ranging from 1:1 to 1:11 which depend on factors such as accident type, industry and company size. Other studies show similar conclusions (Grimaldi and Simons 1984, Larsson and Betts 1996).

The common theme in these studies is the fact that they try in some way to distinguish between hidden and visible H&S costs and usually apply the insurance criteria to do so. That is to say costs are analyzed from an insurance perspective and there is a lot of weight placed on what costs are refunded and what costs are not. This in turn often implies that the cost categories used are defined beforehand and often require some knowledge of insurance issues before they can be applied consistently across industries and companies. In some of the studies cited above this has meant that the analysis is carried out by academics or outside consultants rather than by e.g. safety managers.

2.2 The Activity Based Approach to Consequence Studies

In the 1970s and 1980s another approach to consequence studies emerged. In 1987 Laufer publishes a study of the costs of occupational accidents in which he distinguishes between controllable and non-controllable costs (Laufer 1987a, 1987b, see also Leopold and Leonard 1987, Mossink 1997a, 1997b, Pawlowska and Rzepecki 1997, Thiehoff 1997, Wallach 1977, Zwetsloot and Evers 1997). This marks the start of a more management orientated approach to consequence studies and has had an impact on empirical studies undertaken by e.g. Aaltonen (1996, 1997), Rikhardsson et al. (2002), Söderquist et al. (1990) and Uusi-Rauva et al. (1998).

Thus the activity based approach has its focus on management and how management can use measurements of H&S costs in their decision making ultimately to help to avoid these costs. Consequently there is more focus on involving management in these studies and developing tools and techniques that can be applied by management. Therefore, many activity based consequence studies are carried out in close cooperation with management. As insurance does not play as significant part in consequence based studies, management involvement is often cited in the literature as being more prominent.

The centre of the activity based approach is the causality chain between the, for example, accident and the consequences of that accident which then are valued in economic terms. In the insurance based approach the costs is somewhat identical with the consequences of the event but the activity based approach focuses on the activities that happen after the event and the economic impact of those activities. Thus stringent costs categories are seldom used in the activity based approach, but the analysis is based upon documenting the activities that the event in question has led to and then evaluating the costs of these activities. Insurance as such does not play any a priori role in the activity based approach, which leads to another distinction between visible and hidden costs. Activity based studies often do not apply the insurance criteria but base their distinction between hidden and visible costs on whether management has ready access to these costs from the accounting systems of the company (see e.g. Aaltonen 1998, Aaltonen and Miettinen

1997, Hinze 1991, Lanoi and Trottier 1998, Naquin 1975, Neville 1998, Rikhardsson et al. 2002).

The following section describes selected consequence based methods for estimating costs of accidents. It should be noted that these methods only focus on the internal costs of companies and exclude e.g. social costs.

3. SELECTED ACTIVITY BASED METHODS FOR MEASURING H&S COSTS

3.1 The Accident Consequence Tree (ACT) Method

The ACT method was first introduced in Uusi Rauva et al. (1988) and in Aaltonen (1996, Aaltonen et al. 1996). The method focuses on the consequences an event such as an occupational accident has on society, the company and the injured worker. The methodology assumes a common procedures for all three "payees" – i.e. that the event has consequences that prompt activities that have financial impact on the company. This basic chain of events that is captured by the ACT methodology is:

- An event takes place
- Consequences and activities are identified and registered in real time
- Consequences are quantified in e.g. number of hours, number of visits, quantity, etc.
- Unit prices of quantities are identified
- Cost calculations are made

The social costs are the direct costs that result from the accidents i.e. the costs of an ambulance trip, the costs of the doctors involved, etc. The costs related to the injured worker include the reductions in income and any extra costs incurred by the worker or his/her family due to the accidents. The following will focus on the company costs.

There are 6 main categories used in the ACT method to classify consequences of e.g. occupational accidents. These are:

- Lost working time which includes e.g. sick pay to the injured worked for which the company gets no work value in return, lost working time due to production disturbances, etc.
- Loss of short term assets: loss of e.g. raw materials and products because of the event
- Loss of long term assets: includes loss of e.g. machines or tools because of the event
- Diverse short term costs such as costs of transport, consultants and fines
- Lost income such as lost contracts or price reductions

- Income such as reimbursements from insurance companies
- Other costs such as changes in insurance premiums

Figure 6-1 shows an example of an accident tree based on Aaltonen (1996).

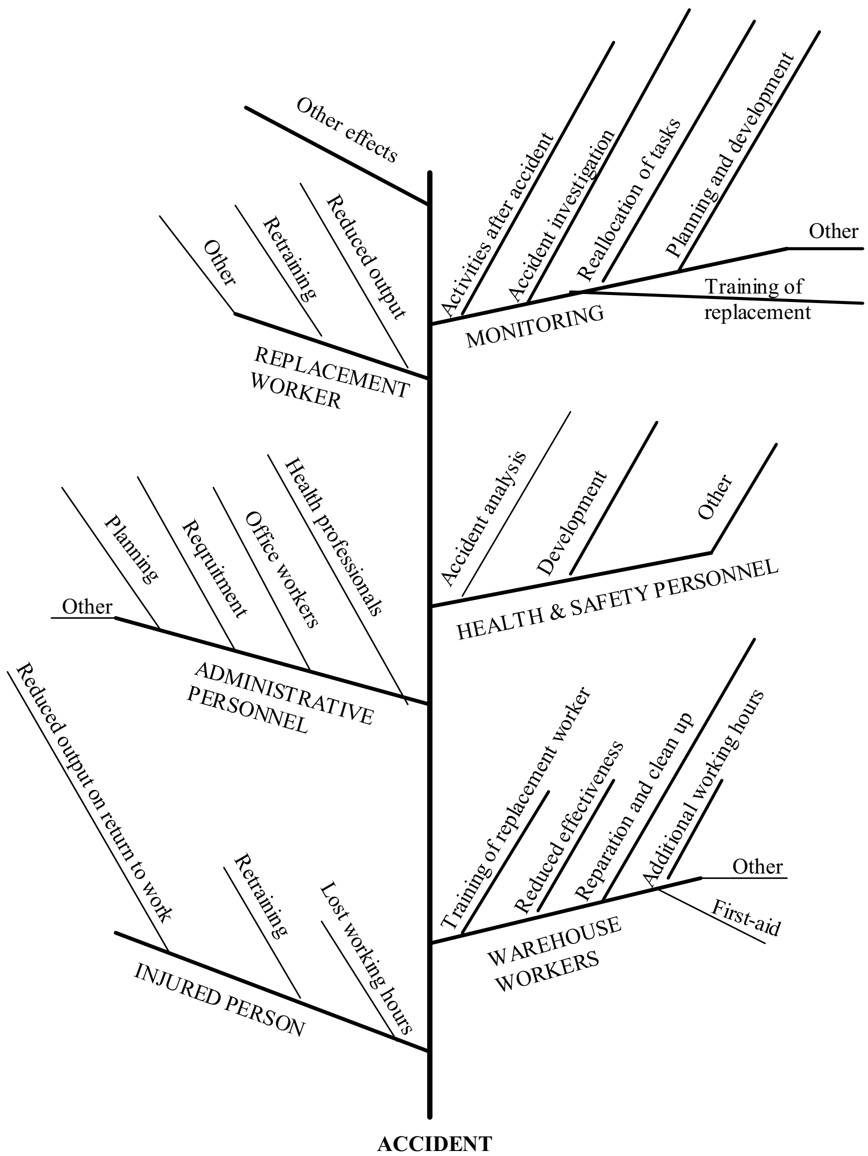

Figure 6-1. Example of an accident tree based on Aaltonen 1996.

One characteristic of the ACT method is that it occurs in real time – i.e. registrations of consequences and costs are made immediately after the accident occurs. Users are trained in the application of survey forms which are then used just as soon as the event being studied occurs. Usually it is foremen and middle managers who are trained in applying the ACT method over a period of time. This poses some challenges and methodological considerations. For example the method only looks at the events that take place during a certain period of time – for as long as the method is applied. If the application of the method is limited to one time period and if the events that occur in this period are atypical for the company then the results will be biased. Also the real time aspect of the method is dependent on the users of the method actually filling out the forms when the event occurs. If this is not done then the results could become biased by forgetfulness and other events.

The method has been tested in the Scandinavian furniture industry where 214 occupational accidents in 18 companies were analysed (Aaltonen 1996, Söderquist et al. 1990). The application resulted in average costs being calculated for occupational accidents at the societal, company and employee level. In all, 70 accident related consequences were identified implying the loss of more than 9500 working hours. One of the conclusions of the studies using the ACT method was that costs of occupational accidents were markedly lower in companies where there were problems in producing the data. This might mean that costs of accidents are undervalued in companies where information about costs and consequences is not available.

3.2 The Riel and Imbeau ABC Method

Riel and Imbeau (1995a, 1995b, 1995c, 1995d, 1996, 1998) base their method (here called the R&I method) on the activity approach but in a somewhat different manner than the ACT method described above. Their method focuses on calculating accident costs with the purpose of using these costs as an allocation base for insurance costs. This is then used for evaluating the effects of ergonomic investments on insurance costs. This method thus combines to a degree both a consequence and an effect study. One issue is however, that the author's definition of "ergonomics" is rather broad and includes both workplace design as well as accident prevention measures.

Riel and Imbeau develop their method on the basis of Activity Based Costing (Kaplan and Norton 1997). Activity-based costing (ABC) reflects the same approach as the ACT method in that it values in financial terms the activities that are generated by an event. This application defines the event as a cost object and the measurements concern the resources that are consumed by the activities that are related to this event.

The method is based on the following stages:

1. Evaluation of H&S costs. An important criterion is that the cost generated could have been avoided if the accident did not occur. These costs are evaluated through interviews and analysis of cost registrations.
2. Identification of cost behaviour – i.e. the cost drivers and the causal relationships with the costs in question. The R&I method distinguishes between three drivers which are resource drivers, activity drivers and cost drivers.
3. Cost allocation where the costs identified in stage 2 are used for allocating a cost pool which in the case of the R&I method are insurance costs but could in principle be any other type of cost provided there exists a causal relationship.
4. Cash flow calculations for the investment or initiative that is to be evaluated.
5. Investment evaluation involving calculation of e.g. Return on Investment or Internal Rate of Return.
6. Investment evaluation which is carried out after the investment has been carried out and looks at whether the investment has been successful in relation to the chosen criteria.

When evaluating the costs of occupational accidents Riel and Imbeau use a framework where costs of accidents are linked to production disturbances. The costs of these disturbances are classified into:

- Over consumption of materials and assets – i.e. use of materials, etc., which would not have taken place if the disturbance had not happened
- Over consumption of time – i.e. payment for employee time conducting activities that would not have been conducted if the disturbance had not taken place
- Lost working hours – i.e. payment for working hours where no activities are carried out
- Lost production – i.e. lost raw materials, capacity, products etc. due to the disturbance

The R&I method has been tested in an aerospace company in Canada where insurance costs where allocated between 6 departments on the basis of accident costs. Previously these insurance costs had not been allocated but were accounted for as factory overhead. By allocating these costs on the basis of where the cost claims where generated the company was able to get a more accurate picture of the costs structures involved.

3.3 Systematic Accident Cost Analysis (SACA) Method

The SACA method was developed by the Aarhus School of Business and PricewaterhouseCoopers in Denmark (see Rikhardsson 2004, Rikhardsson et al. 2002, Rikhardsson and Impgaard 2004).

Being a consequence based methodology like the ACT and the R&I method the SACA method focuses on the consequences of occupational accidents and the costs of these consequences. The main procedure is first identifying the activities generated by the occupational accident being analysed and the next step is calculating the costs of these to the company. There is no allocation of costs as is used in the R&I method and there is solely a focus on company costs and not on societal costs or the costs to the injured employee as occurs in the ACT method.

The SACA method is based on a number of forms and checklists which are intended for guidance only. The main aim of the method is to provide managers with a tool for identifying accidents costs without them having to have a lot of experience in accounting or financial analysis to be able to do so. The method is based on interviews and workshops and is not intended to be used in real time.

The costs of occupational accidents are classified into six overall categories:

- Costs due to the absence of the injured employee: includes e.g. payment of sick pay and payment of supplementary sick pay
- Communication costs: includes e.g. formal communication to employees, staff, and general management as well as informal communication between employees
- Administration costs: includes payroll administration, administration regarding health and safety regulations and reporting requirements, follow-up activities and meetings
- Costs of prevention initiatives: includes e.g. purchase of machine components and training initiatives
- Operation disturbance costs: includes e.g. training of replacements, revenue loss, co-workers overtime, and production reductions
- Other costs: includes costs such as e.g. fines and gifts to injured employee

The actual costs measured within these categories are grouped into four categories:

- Time: hours used by employees and management on activities related to the accident as well as hours for which the company pays wages without getting any work effort in return including standstill periods in production and employee sick pay

- Materials and components: costs of any materials and components acquired or lost due to the accident such as spare part for machines, replacement for damaged materials, and value of products not produced
- External services: costs of external services bought due to the accident such as temporary replacements, consultants and legal support
- Other costs: costs of other activities more infrequently incurred by the company such as fines and rehabilitation

The method has been tested in a number of companies (Rikhardsson and Impgaard 2004, Rikhardsson et al. 2002) in relation to different accident types and contexts. The main results were that:

- Calculating occupational accident costs can illustrate and visualize the value created by the OHS department by preventing accidents
- The costs of occupational accidents in a company can be significant depending on the type of accident, sick leave payments, and how the accident affects e.g. the production process and the scope of administration and information activities
- Accident costs vary between companies and depend on accident type, wage structures and policies, OHS management system scope, and production process vulnerability
- Smaller companies had on the average higher accident costs per accident than larger companies
- Hidden accident costs, defined in relation to their visibility in the accounting information system, amounted to 35% of the total accident costs on average. This could vary from 2% - 98% depending on accident characteristics

3.4 The Health & Safety Executive (HSE) Method

This method was developed by the Health & Safety Executive in the UK in the early 1990s (HMSO 1993). As such it differs from the three methods above as is focused on insurance costs and uses the insurance criterion to distinguish between hidden and visible costs. Furthermore, it not only includes H&S costs but focuses on material damage costs as well, even though no injury is associated with this damage. The cost definitions of the HSE method are shown in Figure 6-2. It distinguishes between direct and indirect costs which may, or may not, be refunded by the company insurance. Furthermore, the method is applied in real time like the ACT method.

The method also distinguished between what it terms financial costs and opportunity costs. Financial costs are defined as the costs incurred due to the necessary activities resulting from the accident and opportunity costs are costs for which the company gets no value in return. This is not quite the usual accounting definition of the term opportunity costs and the term non-value added costs might have been more appropriate. The method also stresses that only costs which could have been avoided if the accident had not happened should be registered.

The method has been tested on a number of companies in the UK where the main focus was on calculating the total costs of accidents in the selected period and calculating the ratio between insured and non insured costs. These ratios varied from 1:8 to 1:36. These costs also included material damage which in some cases was a significant part of the total cost.

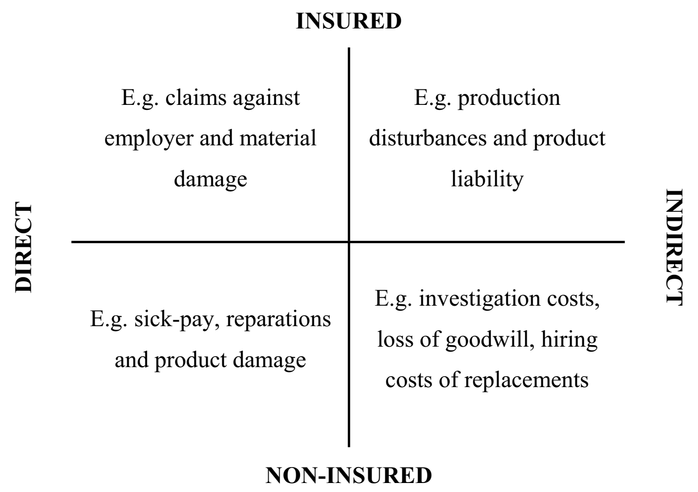

Figure 6-2. The cost classification used in the HSE method (HMSO 1993).

One of the most comprehensive uses of the method took place in a construction company where the total accident costs were calculated to be £700,000, which amounted to 8.5% of the total contract fee of the building site investigated. In total, 3500 material damage incidents and 56 occupational accidents were registered. The ratio between insured costs and non-insured costs was 1:11. That is to say for every £1 that was refunded from the insurance company a cost of £11 was generated that was not refunded.

4. COMPARISON OF THE SELECTED METHODS

The four methods described above are compared in general terms in Table 6-1.

Another way of comparing the methods is by assessing their strengths and weaknesses as shown in Table 6-2. It should be noted that this assessment is

Table 6-1. General comparison of the selected methods.

	ACT	R&I	SACA	HSE
Primary focus	1986	1995	2002	1993
Basic measurements	Costs of occupational accidents for society, companies and injured persons	Costs of occupational accidents Allocation of insurance costs Ergonomic investment evaluations	Costs of occupational accidents	Costs of occupational accidents Material damage
Application	Consequences and activities	Consequences and activities	Consequences and activities	Consequences and activities
Assumed level of accounting skills required[1]	Real time	Post hoc	Post hoc	Real time
Extensive methodological descriptions and checklists available	Low	High	Low	Middle
Primary focus	**No**	**No**	**Yes**	**Yes**

[1] This is a subjective evaluation by the author of this chapter

Table 6-2. Potential strengths and weaknesses of the different methods.

	ACT	R&I	SACA	HSE
Potential strengths	Can potentially be integrated into the continuous data collection regarding accidents	Incorporates newer management accounting techniques (ABC)	Simple non-accounting approach to cost classification	Can be integrated into the continuous data collection regarding accidents
	Real time application which can enhance validity – i.e. minimize the risk of some costs and activities to be left out	Post hoc application which can enhance representativeness – i.e. offers the possibility of selecting a portfolio of accidents so they are representative of what accidents actually happen in the company in a certain period.	Post hoc application which can enhance representativeness – i.e. offers the possibility of selecting a portfolio of accidents so they are representative of what accidents actually happen in the company in a certain period.	Real time application which can enhance validity – i.e. minimize the risk of some costs and activities to be left out

continued on next page

Table 6-2. Continued.

	ACT	R&I	SACA	HSE
Potential strengths	Graphical presentation of consequences for easy overview	Can be applied for evaluating investment effects	Comprehensive support forms and checklists tested in practice could make implementation easier	Comprehensive support forms and checklists tested in practice could make implementation easier
	Training of employees in applying the method puts focus on costs of accidents	Can be used as a basis for cost allocation	Can be communicated in the organisation to increase the focus on costs of accident	Training of employees in applying the method puts focus on costs of accidents
Potential weaknesses	Requires training of the persons responsible for applying the method in real time which can be expensive	If cost allocation is not an issue then other methods might be more relevant to apply	Post hoc application that can bias the results through the time lag between the accident and consequence review	Requires training of the persons responsible for applying the method in real time which can be expensive
	Requires stringent definitions of the cost categories employed to secure validity	Requires an understanding of management accounting techniques	Requires stringent definitions of the cost categories employed to secure validity	Uses insurance criteria that might vary between countries and industries
	Only tested in Scandinavian companies	Only tested in a few Canadian companies	Only tested in Danish companies	Only tested in UK companies
	Focuses only on a limited period and the accident occurring in that period which might threaten validity. Also real time registration might not capture costs that emerge some time after the accident.	Registers consequences some time after the accident occurs which could lead to bias due to forgetfulness or subjective interpretations	Registers consequences some time after the accident occurs which could lead to bias due to forgetfulness or subjective interpretations	Focuses only on a limited period and the accident occurring in that period which might threaten validity. Also real time registration might not capture costs that emerge some time after the accident.

subjective and based on an evaluation of the methodological descriptions and cases detailing the experiences of the companies that have applied the methods.

In general there are a number of issues that have to be considered when choosing and applying a method for measuring costs of occupational accidents. These issues are discussed below.

4.1 Definition of H&S Costs

One of the dimensions separating the methods in question, which is important to consider for a company wanting to apply a method, is the definition of H&S costs. Is the method focused on company costs or does it include societal and employee costs as well? Is the company interested in calculating the costs of occupational accidents, occupational illness, damage to materials, assets, etc. or all of these? Regarding costs of work related illness a few methods have focused on systematically calculating the costs of occupational illnesses. One of these applied the HSE method for calculating the costs of several work related illnesses in UK water supply companies (IRS 1999). This survey showed that measuring the costs of occupational accidents can be difficult because of long time periods, unclear causal relations, unclear consequences and thus indefinable costs.

Regarding material costs – i.e. costs not related to injured persons - it is worth considering whether these are to be included in the calculations of H&S costs. These costs can often be high compared to the direct costs of the accident itself and thus bias the total costs calculated. The causal relationships might also be difficult to untangle as well if the e.g. accident is due to second or third stage effects of a material damage that even might be distant in time and space. The argument for including material damage however can be based on the so called accident pyramid, which is another of Heinrich's influential metaphors (Heinrich 1959). This metaphor states that for every occupational accident leading to serious injury there are a certain number of accidents not leading to serious injury and for every one of those there are an even greater number of accidents leading to material damage accidents – thus the pyramid metaphor. So the total costs of material damage might tell decision makers something about the potential for accidents involving persons and what value is created through avoided costs by preventing material damage.

4.2 Definition of Cost Categories

All methods focusing on the costs of occupational accidents have some sort of a distinction between direct and indirect costs. Most methods are alike in that direct costs are considered visible in some way while indirect costs are in some way hidden from management view. There is however a difference between how this visibility criterion is defined. Some of the methods and resulting studies are based on Heinrich's methodology. These use insurance refunds as criteria for visibility i.e. costs that are covered by the insurance are defined as direct and visible but costs not covered are defined as indirect and hidden. This might, however, not always be relevant for companies that want to monitor their e.g. accident costs and use this as input to management decision making due to the fact that insurance coverage is not used when the costs are registered as such in the company accounting system. Other methods like the SACA method have thus used the accounting system as a criterion for when costs are visible and when they are not. That is to say the costs that are defined as visible in the accounting system are accounted for in such a way that they are traceable to the accident in question and can thus be identified and pulled out of the accounting system with a minimum of work. Other costs – i.e. the hidden ones - are registered in overhead accounts or other cost pools and thus hidden from view. These costs have to be "carved out" of these accounts by applying e.g. a consequence based analysis such as the one used in the SACA or the ACT method (Rikhardsson and Impgaard 2004). It might be argued that these types of methods are more practical if insurance coverage is not an important issue and the focus is on management usability of the information generated.

4.3 Data Collection Procedures

The data collection procedure used in the methods is either data collection in real time i.e. immediately following the accident and as activities and consequences unfold, or post hoc i.e. some time after the accident has taken place. These approaches have their benefits and drawbacks. Methods employing the real time approach are based on someone registering the consequences of e.g. accidents at the same time they occur. This implies training of e.g. foremen or other employees in applying the forms needed to register the information. Also it presupposes that those responsible for registering the information do so in a timely manner. The benefits of this are e.g. that there is strong focus on the registration of consequences and cost data in a period and that most consequences are registered and accounted for. The potential drawbacks are that the persons involved might not register the consequences in time due to oversight, not recognizing the consequences as being related to the accident, due to not understanding the method or because the accident itself takes focus away from applying the method. Another drawback is that real time methods are dependent on the types of accidents occurring in the period they are applied. If the intention is to generalize about the total accident costs of the company and the company in the period examined does not experience any serious accidents, or that if the accidents that occur are significantly different from the accidents that usually occur then this might bias the results and lead to the wrong conclusions being drawn regarding the total accident costs of the company.

Methods using post hoc data collection approaches use interviews and workshops to collect information some time after the accident has taken place. The benefit is that these workshops or interviews are independent of the accidents. A representative sample of accidents can be selected so that the average costs can reflect e.g. different accident types, time periods and locations. Furthermore, the accident is not as emotionally near those involved so that other aspects and consequences can be identified than those that are immediately apparent when the accident occurs. The drawbacks are that forgetfulness or different interpretations of events can create omissions or bias.

4.4 From Loss Management to Value Creation

In the literature surrounding the methods described above there is a certain trend where the loss management perspective inherent in these methods is developed further. Loss management as an H&S perspective is traditionally focused on minimising the risk of accidents happening through e.g. prevention initiatives, training and control. As such this is seen as a cost in itself as these H&S initiatives cost money. However, a company creates value for a number of stakeholders. It creates (economic) value for e.g. customers, suppliers, for employees, for owners and for society. A company can thus be seen as a collection of resources focused on creating value. When a negative event like an occupational accident happens then value is lost or the ability of the company to create value is lost. This perspective broadens the focus of loss management somewhat. If, for example, prevention initiatives are viewed from this perspective then they not only minimise the risk of an accident happening in the future but also prevent economic value from being lost and the value of these initiatives are automatically made visible through the identification of costs.

5. CONCLUSIONS

Comparing the four methods above indicates that a company might want to assess the reason for wanting to calculate accident costs. Is it to increase visibility, enhance decision making, provide a vehicle for increasing employee or management focus on costs, to evaluate accident prevention initiatives, or is it for making cost allocations more precise? Whatever the reason the four methods above have their strengths and weaknesses that might have to be assessed by the company.

Another conclusion is that methods for calculating accident costs are evolving in a similar manner to the way management accounting is evolving (Read 2003). That is to say there is an increasing focus on value creation, on activity costs and on usefulness for management decision making. Given that this increases the focus on the prevention of accidents as a value creating activity then this evolution can only be termed as positive.

Future research challenges for further evolving the calculation of H&S costs generally could be:

- Systematically evaluating any changes in practices of companies that have applied the methods described above regarding e.g. increased focus on accident prevention, changed management behaviour, etc.
- Evolving these methods further towards calculating the costs of other H&S issues such as work related illness, mental work environment, etc.
- Identifying how and if the integrated IT systems (ERP systems) currently being implemented in many companies can support the calculation of H&S costs.
- Conducting a representative study of accident costs across countries and across different industry segments, as most of the methods have only been applied on a country specific and company specific basis.

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Chapter 7

IMPLEMENTING STANDARD COSTING WITH AN AIM TO GUIDING BEHAVIOUR IN SUS-SUSTAINABILITY ORIENTATED ORGANISATIONS

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Abstract: Succeeding environmental cost accounting's evolutionary development, cost accounting oriented to sustainability now turns to a greater consideration of social costs. With this turn, in addition to ecology and economy the third major factor in a sustainability program, a factor that has been ignored, now becomes accessible to cost accounting. Yet, an innovative, sustainability-oriented cost accounting must also support the dynamics of traditional cost accounting systems in their development toward cost management with appropriate instruments. Changing environmental factors require that cost accounting undergo a change from a centralised system to a decentralised concept of control. Systems strongly influenced by Taylorism and based on the division of labour cannot do justice to the increasing dynamics of the market. The literature on management has already shifted its emphasis from hierarchical control to more up-to-date mechanisms of control and coordination such as 'intrapreneurship'. Here, the success of an organisation is directly connected to the success of its employees and departments. Only to the extent that employees can and do become active in an entrepreneurial sense can the organisation achieve economic success. This entails more flexible work schedules, more comprehensive development of personnel, less obtrusive management at the higher levels, and the utilisation of autonomous organisational units through innovative approaches to cost accounting and control.

This article focuses on examining the standard costing approach in the light of sustainability. It will introduce a programmatically necessary, dynamic concept of environmental and social costs. This concept – to be distinguished from the references to "external costs" prevalent in the current literature – facilitates guiding employees toward social and ecological goals. Thus, employees in decentralised systems can effectively help reduce ecological and social costs or can increase their efficiency.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 153-180.

1. INTRODUCTION: FROM COST ACCOUNTING TO SUSTAINABILITY ORIENTATED COST MANAGEMENT

Within the development of a scholarly discourse which has already lasted thirty years, economically orientated cost accounting has increasingly turned its attention to ecological and social aspects. Starting from a legal obligation for special cost accounting imposed on industry (UstaG 1973), ecological aspects of environmental cost accounting first became a major focus of cost accounting systems based on full and partial costs (Bennett and James 1998, Bennett et al. 2002, 2003, Bouma and Correljé 2003, James 2003, Letmathe 1998, Loew 2003, Schaltegger and Burritt 2000, Schaltegger et al. 2000). More recent approaches such as target costing and activity-based costing have also been transformed into integrated environmental cost accounting systems (Herbst 2000, Heupel and Wendisch 2003). The introduction of emission trading has intensified the revival of a debate on external costs that was originally stimulated by the work of Kapp, Coase, Marshall and that of Pigou at the beginning of the 20th century (Coase 1960, Kapp 1963, Marshall 1890, Pigou 1929). In the aftermath of the predominance of a view of external costs limited to ecological and economic costs (Müller and Wenk 1978, Schaltegger 1993, Schaltegger and Sturm 1992a, 1992b), scholarship and practice have now refocused their attention to include both internal and external social costs.

In addition to this major tendency, the further development of sustainability orientated cost accounting must also relate to current developments of internal accounting. While conventional cost accounting was able to fulfill its purpose solely by ensuring control of the economic viability of the production process, with a view to the changing factors in an organisation's surroundings, the following additional aspects must be included in the broadened focus of conventional and environmental cost management:

- *Necessity of appropriate instruments for strategic orientation:* One major task attributed to modern cost accounting systems is the generation of information relevant to decision making. Since with the reduction of product and market life cycles, even entire locations and markets have joined technologies and processes as elements accessible to multiple-period observation, cost accounting must provide links to capital budgeting, strategic orientation and life-cycle costing (Bennett et al. 2002, Cooper 2000, Cooper and Kaplan 1988, Fichter et al. 1997, Figge et al. 2003, Krasowski 2002, Krcmar 2000, Ministry of Economics, Transportation, Urban and Regional Development 1999, Schweitzer and Küpper 2003, Seidel 2003, Strobel 2001).

- *Use of new technologies:* As a result of technological and organisational developments, altered cost structures have emerged over recent decades. In this way, investments in the automation of production, for example, have led to a substitution of cost types. Direct costs of personnel have been replaced by increased costs of equipment and indirect salary costs concluding environmental and social costs. The use of new technologies with increased automation has led to an increased concentration of equipment and thus to an intensification of the problem of indirect costs (Krumwiede 2000, Miller and Vollmann 1985, Seuring 2003).
- *Compilation of data with electronic data processing:* The continuously increased performance of computers in very short-term cycles facilitates dealing with ever more comprehensive amounts of data. A broad range of basic accounting approaches is already available through the standard electronic cost accounting systems on the market. In addition, Enterprise Resource Planning (ERP) systems generate further information that can be integrated into cost accounting and then allow more comprehensive variance analyses (Küpper 1994, Scheer 1992). The large options for analysis resulting from the EDP-technical connection in cost accounting systems is also evident within environmental cost accounting implementation, e.g. within the practical projects of flow cost accounting (Ministry of Economics, Transportation, Urban and Regional Development 1999, Strobel 2001, Wagner and Strobel 1997) and the projects of IÖB (Heupel et al. 2003). An environmentally based data evaluation is supported by standardised software solutions like UMBERTO.
- *Paradigm switch in controlling:* During the last two decades, several notable developments in controlling have occurred:
  - Control has refocused its attention from the isolated valuation of inputs to include volume components (Müller 1996, Scapens 1989, Strobel 2001, Wolf 1982)
  - In addition to staff-based and centralised control, there is an increasing tendency toward decentralised approaches to control. Functional and departmental thinking must now yield to more process-orientated observation (Fichter et al. 1997, Heupel et al. 2003, Stürznickel and Letmathe 2003, Wagner and Strobel 1997)
  - More dated approaches to controlling dominated by a financial perspective are being replaced by integrated approaches like the Balanced Scorecard (BSC) that, in addition to the quantitative figures, also collect qualitative data (Figge et al. 2003, Hahn et al. 2002)
- *Shift in organisational structures:* With the increasing dynamics of the market, functionally structured organisations have resorted to team-related divisional structures. The cost centres in these organisations require precise budget specifications, clearly defined cost responsibility,

and specialised instruments in order to come to terms with the scope of action determined by the market (Bromwich 1992, Womack et al. 1990). A current study (Franke 2004) demonstrates that the top 100 medium-sized German companies achieve nearly 50% of their turnover with products that are less than three years old (This statement also applies to large-scale businesses such as Siemens. Here, too, more than 50% of sales turnover is achieved with products that are less than three years old. C.f. Hersteiner 2004). This dynamic has to be generated. The potential for such development is available in the many small improvements that are brought into effect by autonomous organisational units and that, in their entirety, can represent comparative know-how and cost advantages. But in traditional hierarchies, the path an innovative idea must take spans a long distance and is full of risks. While a positive decision must meet with favourable appraisals at any number of levels, one negative assessment will often be sufficient to reject a suggestion for improvement. If an organisation wants to take advantage of the potential for improvement at all levels in the hierarchy, decision-making competencies and scope for development must be assigned to these levels. In this way, approaches emphasizing 'intrapreneurship' can make the potential for increasing efficiency available that has hitherto remained undetected.

The developments listed above warrant a transformation of established cost accounting systems: Systems strongly influenced by Taylorism and based on the division of labour cannot cope with the high pressure emanating from today's market. In reaction to this deficiency and with the use of such fashionable concepts as "modular" organisation (Wildemann 1988), "lean management" (Womack et al. 1990), "fractal factory" ("*fraktale Fabrik*", Warnecke 1992) and "business process reengineering" (Hammer and Champy 1994), management consultants and scholars have begun to propagate a changed form of the organisation and, subsequently, the support of the organisation, through innovative cost accounting and control instruments. The organisational form propagated in this way is characterised by the division of already existing larger units into relatively autonomous subunits. Instead of detailed centralised planning and control, these autonomous subunits are allocated an extensive amount of responsibility and flexibility.

Within the top 100 medium-sized German organisations mentioned above, around 25% of the employees make suggestions for improvement each year. Decentralised and convenient instruments can help employees at lower and intermediate levels of the hierarchy to act as, for example, 'workplace experts' and to conceive of product innovations or to propose process improvements.

For these reasons, a form of cost accounting is necessary that, in addition to centralised planning and control tasks, also takes decentralised issues into account and is accessible to persons engaged in lower-level and intermediate-level management. If existing cost accounting systems that have become much more substantial sources of information through the use of electronic data processing are complemented by decentralised applications orientated to guiding behaviour, then, hitherto undetected potential can be unleashed for increasing efficiency in relation to social and ecological concerns.

2. DECENTRALISED COST MANAGEMENT THROUGH STANDARD COSTING

2.1 Preliminary Remarks

Decentralised cost accounting tools can make a substantial contribution to improvement at the cost centre level whenever, for example, cost centre managers require some instrumental support in order to reduce variable costs through an ecologically motivated optimization of processes and reduction of input materials (Letmathe 2002, Strobel 2001, Wagner and Strobel 1997). This potential, which is to be attributed to the decentralised instruments of cost management, became apparent during the authors' work on a research project sponsored by the German Federal Foundation for the Environment (*Deutsche Bundesstiftung Umwelt*) and concerned with the establishment of environmental cost accounting. Collaboration with interdisciplinary teams revealed a broad spectrum of potential for reducing costs, a spectrum that could only be more clearly defined in decentralised ways by an employee (acting as a 'workplace expert').

Potential comparable environmental discharges in individual cost centres could be exposed within the context of the Wagner and Strobel research project, as well as during the implementation of resource cost accounting supported by *Effizienz-Agentur NRW* (Letmathe et al. 2002). In these projects potential cost reduction could be identified by interdisciplinary teams. In addition, a reduction of material consumption and optimisation of operational processes were possible.

Subsequent research at our institute, including a project in cooperation with Bilsing Automation Ltd., an international supplier of automobile parts, facilitated the development of sustainability orientated standard costing as it is described here. Within the context of this project, special consideration has been given not only to the efficient use of materials and energy (to reduce environmental costs), but also to the net product. With the aid of specifically adapted cost accounting systems, intermediate-level teams become able to assign costs in ways that are both strategically and operatively effective.

There are numerous cost accounting systems available to complete the tasks of cost management. Instruments for the planning and control of costs range from single-period standard costing through prognostic cost accounting, activity-based costing, and principal-agent approaches all the way to methods of capital budgeting (Horngren et al. 1997). This article focuses on standard costing (Drury 1992, Gillespie 1962, Harrison 1930, Kilger et al. 2002, Longmuir 1902, Whitmore 1908), but includes a complementary description of the future potential of other decentralised cost accounting approaches. In particular, with a view to the strategic decisions in autonomous organisational units, the prognostic cost accounting approach (*Prognosekostenrechnung*) developed in Germany but not yet a focus of the international debate, is also introduced here (Schweitzer and Küpper 2003).

Environmentally based direct costing cost accounting systems and the initial approaches of ecologically orientated standard costing have influenced this concept.

As the following illustration demonstrates, from a long-term perspective several systems are suitable for decentralised approaches to control. Yet, in order to sensitize lower-level persons hitherto not involved in control, approaches that are common, readily comprehensible, and, thus, highly practicable are necessary. In practice, standard costing is one of the most widespread systems for accounting orientated towards planning and is technologically well-equipped with data processing systems like that of SAP. Prognostic cost accounting is based on the same approach, but takes fixed costs into consideration to a greater extent. In the long term, other approaches such as life-cycle costing (Krasowski 2002), target costing (Monden and Sakurai 1989, 2000), or various methods of capital budgeting should also be made accessible to intermediate-level management.

For example, the aim of the next step of the research project mentioned above is to equip the decentralised organisational units with a sustainability orientated and decentralised form of target costing, with activity-based costing and department-specific methods of capital budgeting. In future, project managers are to negotiate their team's goals with the organisation's management (in accordance with the concepts of 'intrapreneurship' and 'ecopreneurship'). Then, by implementing target costing, they take responsibility for planning, directing, and controlling those goals. Moreover, decentralised activity-based costing allows each team to evaluate indirect services. In this way, budgeted services necessary for achieving the project's goal, such as designing and managing the project, development, etc., can be more readily controlled. In a further (third) step, the teams also come to terms with complex decisions on investments necessary for the delivery of commissioned products and services (e.g., purchasing special machinery) in decentralised ways. Thus, an awareness of costs results that also becomes a significant basis for planning future projects. Finally, experienced members of the teams can also deal with ecological and social aspects of life-cycle costing in the long term. The teams are instructed in life-cycle costing so that they can respond appropriately to emerging needs of the automobile industry. The sequence of steps, forming the basis of this research project, with their differing objectives can be adapted to further develop decentralised cost management.

Figure 7-1 summarises this path of development once again. The discussion then centres on standard costing and its enhancement to prognostic cost accounting.

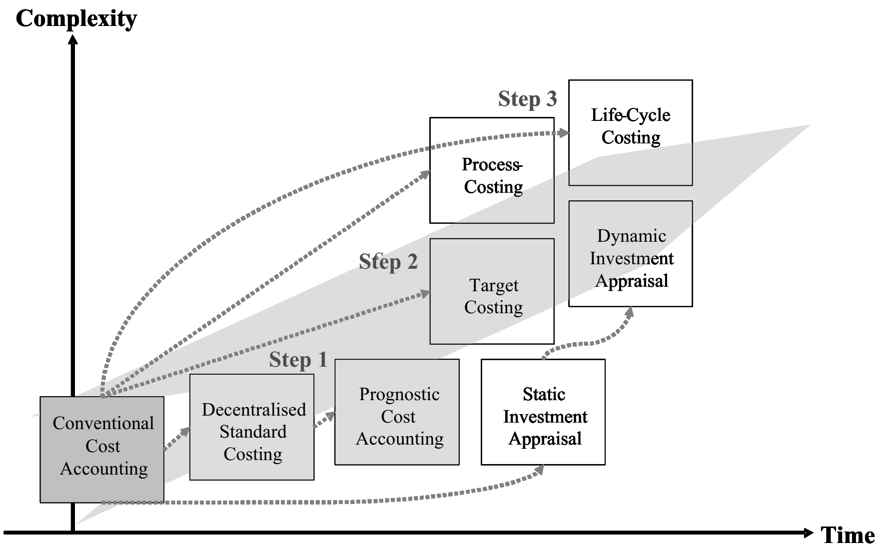

Figure 7-1. Future developments of decentralised cost accounting.

2.2 Discussion of Selected Approaches

As indicated in the previous section attention will now be given to the systems of standard costing and prognostic cost accounting. One the one hand they have been selected out of a multiplicity of conceivable cost accounting concepts because they are both in common use and EDP-technically supported. On the other hand they can easily be modified and realised in co-operation with middle management. Here, good experience has resulted from several projects carried out by the IÖB.

In the following, special attention is given to the conventional concept. Later, description of the extension of prognostic cost accounting as well as extension of the term social costs will form the basis for development of a sustainable cost accounting concept.

2.2.1 Standard Costing

The general concept behind standard costing includes all systems of cost accounting that, in addition to documenting actual costs incurred in the past, also establish planned information for future periods. Budgeted costs result from usage analyses. The usage of input factors in the past is not the starting point for such analyses. Instead, the matter in question is how much material or how much time is necessary for certain output quantities in terms of products or services. Three aspects of standard cost accounting systems can be distinguished according to the scope and degree of detail the approach attributes to the task of planning and to numerical data:

- Whereas cost accounting in most organisations is only concerned with planning in a very rudimentary way, it includes methodological consideration of detailed technical and economic analyses (Drury 1992).
- Standard costing procedures can also be divided with respect to an orientation towards full absorption costs, or to partial costs. With standard costing based on full absorption of manufacturing costs, all of the budgeted manufacturing costs of a period are directly or indirectly assigned to the product or product series as cost objects, whereas with partial costing, a differentiation between fixed and variable partial costs also takes place during the planning (Gillespie 1962). Here, fixed partial costs are to be covered by the contribution margin of a product. In flexible standard costing, costs are broken down into fixed and variable components (Kilger et al. 2002). With this approach, a variable standard costing rate, the target costing rate, is determined for the variable costs. This calculation is used for planning indirect services. In addition, this approach exhibits a certain affinity to activity-based costing (Bromwich 1992, Cooper and Kaplan 1991, Müller 1996).
- A further distinction can be drawn with respect to static and flexible budgets. A static budget is a budget that is based on the level of output; it is not adjusted or altered after it is set, regardless of ensuing changes in actual output (or actual revenue and cost drivers). A flexible budget is adjusted in accordance with ensuing changes in actual output. Flexible budgets enable managers to compute a richer set of variances. (Horngreen et al. 1997)

What follows is a closer look at flexible standard costing and its development into prognostic cost accounting.

2.2.2 Determining Standard Costs

In standard costing, the costs of a future period are derived from planned volumes and consumption of inputs evaluated at a fixed price. The budget's quality is, above all, dependent on knowledge of major cost determinants and the underlying cost functions. The following costs are budgeted: direct costs (e.g., direct material costs and direct labour costs that can be assigned directly to the cost objects), special direct costs (special tools, licenses, etc. that can often only be determined for specific groups or types of products and must be assigned to product units), direct special sales costs (costs dependent on orders), costs associated with scrap (which will probably be incurred for an inevitable amount of volumes despite exact specifications). Also, indirect costs are budgeted, some as costs that can be affected (e.g., indirect labour costs, additional labour costs, auxiliary materials, operating materials, tooling costs), others as costs that cannot be affected, including direct labour costs and imputed costs (imputed interest and depreciation).

2.2.3 Variance Analysis

Within the variance analysis framework, the specifications of standard costing are compared with the actual values realised. The goal of such an analysis is to discover which cost variances have occurred in a particular budgeted period and which determinants and behaviour have been responsible for this (Drury 1992, Kaplan 1975, Magie 1976, Rouen 1979). Here, the main focus is on price and volume variances. The significance of price variance is a subordinate one because of the definition of fixed prices. Volume variance, on the other hand, can be split into an activity variance and a usage variance. Activity variance, in turn, corresponds to the idle-capacity costs of the period's actual level of activity, which is not subject to the influence of cost centre managers. Finally, usage variance is always a responsibility of the people working in a cost centre. An exact analysis of this variance results in the following components: intensity variances, batch size variances, cost variances associated with unbudgeted orders, and process variances (Kilger et al. 2002, Schweitzer and Küpper 2003).

For those cost categories v ($v = 1, \ldots, z$) of a cost center, the standard cost C(s) at the standard level of activity A(s), broken down into fixed (C_F) and variable (C_V) cost components, is as follows:

$$C^{(s)} = \sum_{v=1}^{z} C_{Fv}^{(s)} + \sum_{v=1}^{z} C_{Vv}^{(s)}\left(A^{(s)}\right) \qquad (1)$$

If the resulting standard level of activity $A^{(s)}$ is replaced with the actual level of activity $A^{(a)}$, this results in the following target cost function $C^{(t)}$:

$$C^{(t)} = \sum_{v=1}^{z} C_{Fv}^{(s)} + \sum_{v=1}^{z} C_{Vv}^{(t)}\left(A^{(a)}\right) \qquad (2)$$

Figure 7-2 shows a graph indicating this function.

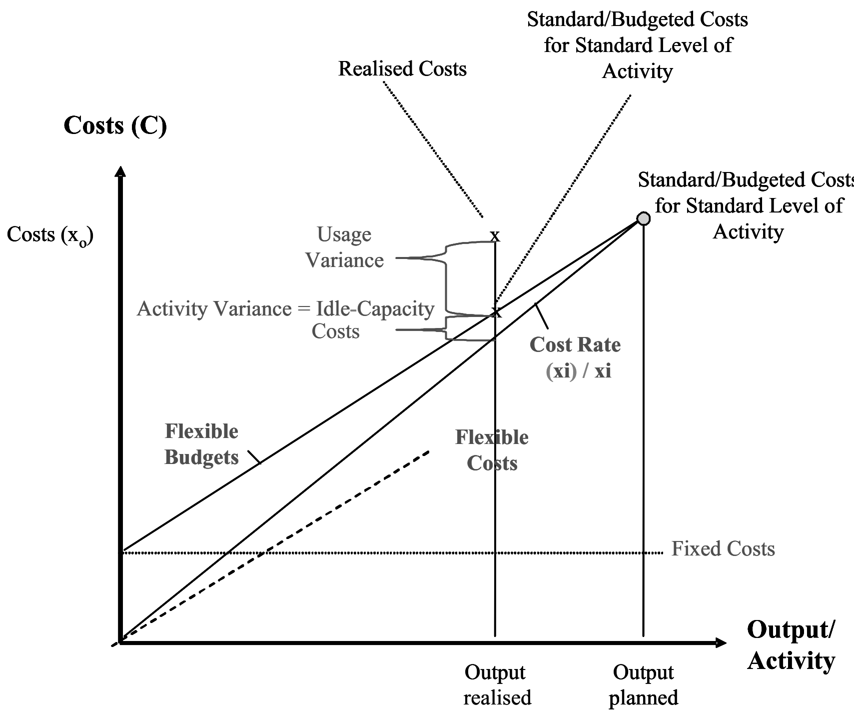

Figure 7-2. Variance analysis.

2.2.4 The Shift toward Prognostic Cost Accounting Approaches

Changes in market structures in the last ten years have increasingly reduced the relevance of the standard costing systems described above and have encouraged the development and implementation of prognostic cost accounting. Since, with the intensified use of new production techniques the proportion of costs able to be influenced in the short term decreases and the fixed indirect costs increase, prognostic cost accounting orientated to decision making is needed to close the gap between capital budgeting and cost accounting. Even a 'flexible' form of standard costing is simply not flexible enough to come to terms with these more formidable requirements (Schweitzer and Küpper 2003).

Standard costing takes its starting point from given quantities of labour and machinery, thus, from fixed costs. In contrast, processes, products, and entire strategic business units are subject to the tactical planning of cost management with its long-term perspective. As indicated by the concept of cost 'management' itself, conventional cost accounting thus enters the management cycle of planning, realisation, and control and is committed to providing information for control.

By comparing budgeted costs with expected revenues, prognostic cost accounting facilitates predictions of the success of a future period in planning. Since revenue forecast is included, this accounting system becomes a planning instrument for entire operational processes and offers assistance in detecting problems and seeking alternatives for evaluation and performance control. The planning of costs is subject to the following main factors: production program, type and quality of materials, level of activity, general technological conditions, capacity of machines utilized, performance abilities and motivation of employees, production costs of raw and auxiliary materials, and of operating supplies and semi-finished products.

Advantages of the approach described here in comparison with conventional standard costing:

- *More differentiated cost analysis:* By means of a differentiated process analysis (step 1 below), there can be direct focus on losses in net product. Employees become sensitized to the effective cost drivers in their respective areas of responsibility. With further differentiation in assigning cost categories, costs that were previously hidden under the mass of total costs now become transparent. While conventional standard costing turns towards a global usage variance this new concept offers a more detailed analysis. The usage quantities of each cost type are considered in detail and are compared with the requirements of best technology. Considering normal, budget, basic, best practice and optimal costs will lead to an increase in the resource efficiency of material and human production factors.
- *More exact planning specifications and identification of cost drivers:* Allowing intermediate-level employees to participate in determining planning specifications within the context of an integrated approach to

planning that involves 'intrapreneurship' (steps 2-5 below) promotes a more active identification with the goals of both the organisation and the department.

- *Continuous improvement through decentralised analyses*: If variance analysis and the assessment of errors are carried out at centralised staff levels, there can be no improvements at cost centre levels that would be relevant to a socially or ecologically orientated perspective. If, on the other hand, employees can participate in variance analysis, both monetary incentives and a continuous process of improvement result.
- *Integrating employees:* In the approaches described above, members of the teams are to be involved in both the central budgeting and in subsequent control processes. This will enable them to make changes in the processes they are responsible for and thus to achieve ecologically relevant cost reduction and socially desirable improvements. Through measures such as job-enlargement and job-enrichment, processes become more efficient. Through process improvement the departments themselves exert influence on social costs.

Before commencing with a more detailed description of the approach to be applied, a definition of the concept of environmental and social costs is in order. To promote the active performance of employees, a concept is required that is orientated to guiding behaviour.

2.3 Introduction of a Dynamic Concept of Environmental and Social Costs

The cost accounting approaches described above can make a substantial contribution to a cost accounting orientated towards sustainability. The concept of 'social costs', as it has thus far been employed in the relevant literature (Coase 1960, Kapp 1963, Pigou 1920 etc.), results in a conceptual void that needs to be filled. Before variance analysis concerned with a loss in efficiency can be undertaken, the conventional static concept of environmental and social costs must be transformed into a dynamic one.

A new conceptualisation of "social costs": The term "social costs", as applied in the relevant literature to date (Arnold 1995, EPA 1997, Hazilla and Kopp 1990, Hufschmidt et al. 1983, Pyatt and Round 1985, Zerbe and Dively 1994), stands for social, uncompensated, and, thus, external indirect costs. Other common terms such as 'external costs' (Scitovski 1954) or 'social costs of externalities' (Bartelsman et al. 1994, Caballero and Lyons 1990, Coase 1960) indicate that these costs are by no means costs that are to be accounted for and documented at the internal level of the organisation's operations. Thus, 'social costs' in current usage are costs emerging from operations but costs of so-called 'external effects' to be covered by third parties.

In addition to the tendency toward internalisation of environmental and social targets, there are also costs related to the human factor that are incurred within internal operations and should also be subsumed under the generic term of 'social costs':

- Production factors to be mentioned here are labour, capital, and real estate as the input factors an organisation can use to provide a certain service or product. If in the age of an expanding fourth sector of the economy we include individual knowledge, the human factor attains a decisive significance for an organisation's success (Abowd and Kramarz 1999, Acemoglu 1996, Benhabib and Spiegel 1994). For such human resources, costs are incurred that we can designate within a broad conceptualisation as 'human capital costs', 'labour costs', or 'internal social costs'; costs that can unambiguously be assigned to this third major factor in a sustainability program. Thus, in a first step, any wages and salaries are to be included among internal social costs as 'direct labour costs'.
- Furthermore, social expenditures such as contributions to retirement plans, unemployment compensation, and health and nursing care insurance are, by definition, to be differentiated from other 'social costs' as social security benefits or as 'indirect labour costs'.
- In addition to this first level of mandatory social benefits, there are other levels of recommended and optional benefits that also effect costs. These include all of the costs resulting from additional payments negotiated in wage settlements (e.g., danger money, shift rates, holiday bonuses, Christmas and vacation bonuses) and costs arising from voluntary payments (e.g., compensation for waived home flights, subsidised meals, company retirement plans).
- As a complementary consideration, costs resulting from accidents, computed at either the individual organisation's level or on the national economic scale, also involve the human factor and connect internal and external costs previously presented as separate entities. Such costs demonstrate an orientation to the human factor and the possible increase in net product related to this factor.

As these brief remarks illustrate, the concept of 'social costs' is a multifaceted one. For the remainder of this chapter, any use of the human factor is immediately linked to the idea of 'social costs'. If these costs are covered by an organisation itself, they are designated as 'internal human capital costs'. If, on the other hand, these effects are only compensated for at the level of the national economy, these impairments of the human factor are called 'external human capital costs'. A closer examination of 'internal' and 'external' environmental costs can complete the conceptual pairs. The former have been described by various authors in their development of the term 'environmental costs' (Fichter et al. 1997, Heupel et al. 2003, Loew 2003, Schaltegger et al. 2000, Seidel 2003); the latter combine with the external human capital costs to form the group of external costs.

Figure 7-3 demonstrates this new conceptualisation.

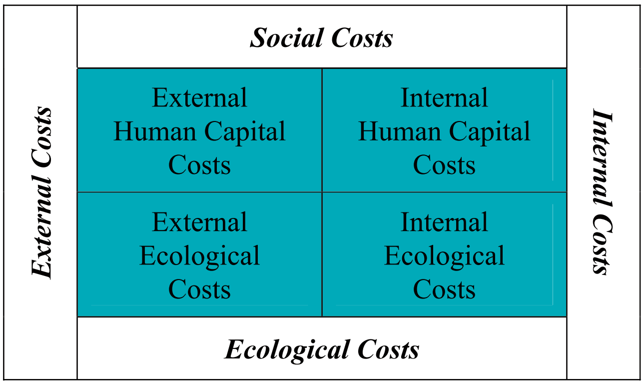

Figure 7-3. Social and environmental costs.

If we assume that any use of the human factor leads to 'social costs' (as demonstrated above) and that any input of materials and energy leads to 'environmental costs', this context can readily be communicated. The human and material inputs that are at the organisation's disposal can be subjected to an assessment of the degree of resource effectiveness in order to promote efficiency (Letmathe 2002) In this way, cost centre managers are urged to achieve a specified goal (a predetermined output) with a given amount of input. If comparison with other cost centres or the realisation of suggestions for improvement facilitate a reduction of the consumption of input for the same output, this leads to a reduction of environmental and social costs which should prove beneficial to all of the teams involved.

With the determination of normal ecological or social costs, the autonomous teams have referential information on the costs incurred in producing a certain output in the past. These costs can be used as the basis for planning future outputs, but they do also contain cost components resulting from process errors, avoidable scrap and spoilage, lacking motivation, etc. A different solution is possible if ecological and social standard costs (at the individual level) are used. These are determined by an analytic method and reveal grave process errors. Here, only the costs dependent on technology and process methods are the basis of calculations for a desired amount of output. If learning-curve effects are also taken into consideration, over the course of time standard costs are to be reduced by the effect of the learning curve. The resulting costs are designated as basic costs. With all of these sub-categories of standard costing, the point of departure has been the conditions of the individual operation. If, on the other hand, a benchmark is used to estimate costs for optimum production, applying modern methods and assuming optimised processes can result in lower costs for producing the desired output. Such 'best practice costs' can be determined according to data from the most economical organisation in a specific line of business. Finally, to dispense with process-dependent ecological and social costs that, at least theoretically, need not be incurred in a production process that would be free of scrap and spoilage, the theoretical construct of ecological or social optimal costs can be applied. These costs, then, are cost specifications along the lines of an absolute optimum, a goal that cannot be attained in practice, but is at least conceivable. In the approach presented here, any deviations from such optimal costs are considered to be idle-capacity costs. Thus, for implementing standard costing related to sustainability, the following concepts are to be introduced into the current discussion:

- *Normal ecological costs/normal social costs:* Upon examining the actual costs incurred during several periods, average costs for the implementation or consumption of ecological or social factors can be determined; multiplication by the activity level of a cost centre results in normal ecological or social costs.
- *Standard ecological costs/standard social costs (at the individual level):* Technical and analytical planning of acceptable input consumption multiplied by the desired level of activity results in standard ecological or social costs. These are 'individual' standard costs for a particular organisation that are dependent on the equipment, technologies, and employee qualifications available.
- *Basic ecological costs/basic social costs:* As a result of a positive spiral development of human capital, learning-curve effects lead to potential for economising. If individual standard costs of a certain organisation are reduced by such potential for economising generated over a period of time, the resulting costs are the basic ecological or social costs of an individual organisation.
- *Best practice ecological costs/best practice social costs:* If the best available technology on the market and the highest degree of qualification of employees provide the basis for analytical planning and consideration is given to the technically inevitable proportions of scrap and spoilage, the resulting costs are the permissible best practice ecological or social costs.
- *Optimal ecological costs/optimal social costs:* Finally, if all of the technically inevitable scrap and spoilage costs are subtracted from the best practice costs as specified above, the resulting costs are the optimal

ecological or social costs. Here, the only input consumption evaluated is that which, under the application of the best procedural techniques and qualifications, actually goes into the product.

In consideration of the variance analysis to be undertaken later, the following cost concepts can be added:

- *Idle-capacity ecological costs:* A comparison with the amount of resource efficiency possible in the use of the best technology available and the same organisational structure establishes a benchmark related to the equipment used (thus, to the fixed costs); and a comparison with the actual degree of resource effectiveness for a specific organisation can result in 'idle-capacity ecological costs'.
- *Idle-capacity social costs:* If human input in the production process is understood as a mid-term and essential part of an organisation's fixed capital stock, then, here too, resource efficiency is to be measured by the degree of resource effectiveness. For systems involving interaction with other people or the operation of machines, human output under ideal conditions with respect to qualification, procedures, and structural organisation is the benchmark for all other comparable units engaged in processses involving products or services. The effectiveness of the use of resources can also be determined here, but in this context, explicit mention should be made of the differences between short-term optimisation and orientation to sustainability.

Figure 7-4 shows the varied cost levels of the concepts introduced here and also demonstrates the interconnections mentioned above.

What are the advantages of these new terms and the multi-level analysis possibilities?

By dealing with standard and budget costs as well as with basic, best practice and optimal costs improvements and economising possibilities of resources will be highlighted for the person responsible for each cost centre in the organisation. If actual costs exceed the optimal and best-practice costs by a significant amount the basis for possible action is given. During this dynamic process environmental and social costs can constantly be saved. As 'workplace experts', members of the middle management make contributions to greater sustainability. Here, achieving the eco-efficiency target is followed up by a dynamic and continuing process. This method will now be described in detail.

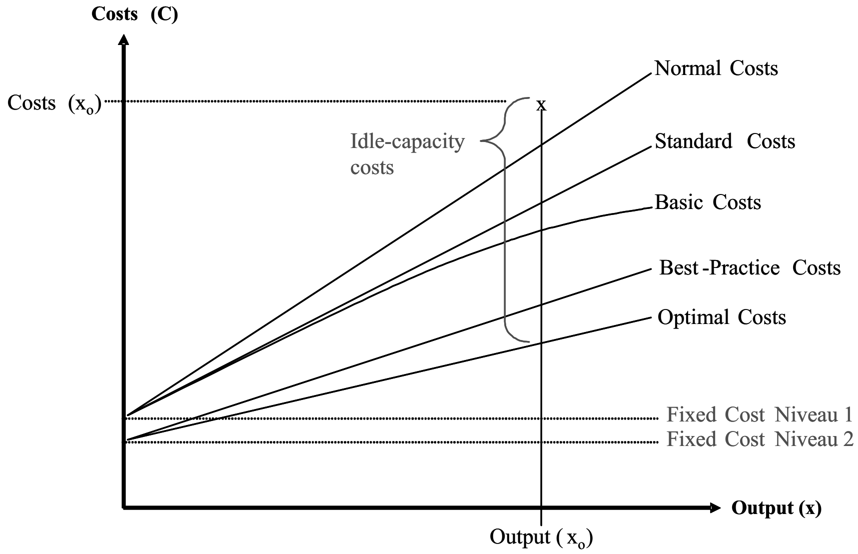

Figure 7-4. Range of idle-capacity costs.

2.4 Configuration of Sustainability Orientated Standard Costing

Step 1: Process analysis: As a first step, a process analysis of both the direct and indirect production and service divisions of an organisation must be carried out. Cost centre managers can only then incur costs in their centres and be made responsible for them if exact information on the functional organisation of the cost centre structure is available and processes beyond the scope of the cost centre are also clearly defined. Cost centre accounting is of decisive importance for standard costing. In cost centres and the processes initiated there, both the causes of costs and cost control materialize. Thus, structuring cost centres in a functional and organisational way appropriate to competencies and processes is an essential prerequisite of this system. Only if cost centre managers and their teams must take responsibility for what corresponds to the actual scope of influence and responsibility assigned to them can the system described here be successful.

Step 2: Determining planning specifications and cost drivers: The subsequent planning specification of costs requires knowledge of cost relationships and period volumes. This information consists of figures from past periods or hypothesized figures. Planning reliability is improved with precise knowledge of the cause-effect relationships between production and costs and available empirical confirmation of the production and cost functions applied.

Next, direct costs are determined for the planned cost objects. The planning of indirect costs is completed for cost centres or for processes in which several cost centres actively participate. Linear cost functions are determined for indirect costs with reference to cost drivers; in these linear functions an independent variable (the cost driver) exhibits a specific relationship to the cause of the cost. The following factors are to be specifically examined as possible cost drivers: production program, type and quality of inputs, activity level, technical characteristics and capacity of machines used, abilities and performance of labour, and the cost of goods (Schweitzer and Küpper 2003). In addition, attention should also be given to effects of production methods, work and machine-operation schedules, amount of scrap, and determinants of capital requirement (Fandel 1991, Gutenberg 1983, Heinen 1978, Henzel 1964, Schmalenbach 1963, Schweitzer and Küpper 2003).

The cost driver should provide a criterion for the performance of cost centres (activity): a percentage change in output volume should result in a corresponding proportionate change in costs. Also, cost drivers are referred to for the calculation of cost objects. For example, if production hours are chosen as the cost driver of a cost centre, the cause of costs is homogeneous as long as a common cost driver for the cost categories in a cost centre can be found. Characteristic of this type of causal relationship is the fact that cost drivers can be changed without leading to different results. In other cases, several cost determinants operate simultaneously, e.g., varying batch sizes, varying production and operating conditions, varying orders and commissions. Then, several cost drivers are necessary (heterogeneous cost causes) for budgeting. Wages, for instance, can be viewed in relationship to time, and the materials used in relationship to weight.

Step 3: Determining the standard level of activity for all cost centres: The standard level of activity can be planned separately for each cost centre relative to the optimum capacities to be realised. But the determination of this level can also be orientated to bottlenecks (e.g., operating capacities, purchasing costs and expected sales) or to normal levels of activity in the past. (Drury 1992, Gillespie 1962, Kilger et al. 2002) In contrast with suggestions in the relevant literature, the most important cost determinant, activity, should not be examined with a view to changing between the optimum level and the normal level of activity (Schweitzer and Küpper 2003). For decision making, specification of the normal level of activity provides a realistic incentive for cost centre managers and their teams. Although these specifications below capacity limits still require an extended idle-capacity cost analysis, the specifications are feasible and results can even remain below them.

But to avoid an exclusive long-term orientation to sub-optimum results and to keep maximum specifications in perspective, the optimum level of activity should be maintained. Here, technological advances and refinements in production processes can help to bring the normal level of activity closer to the optimum level.

Step 4: Determining usage volumes and periods for each cost category of a cost centre in reference to the standard level of activity: With reference to the standard level of activity determined in step 3, the resulting usage of factors and the required temporal capacity can now be determined.

Step 5: Valuation of planned usage volumes and periods with fixed prices: In this way, the standard costs for each cost type (including direct costs of cost objects) within a cost centre can be determined (e.g., labour time * wages; repair labour hours * fixed price of repair labour hours). Here, standard costing must include all costs that the cost centres are actually responsible for. External influences, such as price fluctuations for input materials, are to be eliminated for the short-term observation of standard costing approaches (Cheatham 1996).

In addition, flexible standard costing requires breaking the indirect costs down into fixed and variable cost components. This breakdown of costs can be carried out either with reference to analyses of expected cost dependencies (analytic-synthetic method) or with statistical methods orientated to data from former periods. Due to the fixed prices, variances between the standard and actual costs cannot be attributed to price variances.

Step 6: Analysis within cost centres for establishing basic, best practice, and optimal costs: Steps 1-5 are identical to the application of conventional standard costing and are to be carried out by the central accounting department. The result is a budget that is made available to the team for achieving a predetermined amount of output. Stimulated by incentives and aided by their familiarity with decentralised standard cost accounting, the autonomous organisational units will then apply their expert knowledge to the tasks posed during the period in order to arrive at more efficient and economic solutions of how to attain the desired output.

In addition to varying and reducing material inputs (to achieve ecologically desirable results), collaborative groups, job enrichment, and job enlargement can also have an impact on the human side of an organisation's work and help increase its quality. Both comparisons with other solutions to similar problems (best practice) and research into totally new methods (e.g., through attendance at industrial and technological fairs and exhibits) provide the teams with an orientation in their search for ecologically and socially relevant improvements. The entire spectrum of possible method changes, modified amounts of input materials, and smaller-scale investments are taken into consideration by the teams and may enter the decentralised costing process.

With a view to learning-curve effects (Gillespie 1981), optimised work procedures (determination of basic costs), the application of best practice solutions (determination of best practice costs) and the calculation of production processes without scrap or spoilage (determination of optimal costs), teams are provided with benchmarks they can approach on their own initiative with the improvements mentioned above (Letmathe 2003). In their application of standard costing, employees – as experts with respect to their own workplace – have the opportunity to evaluate their own work and can independently examine alternative techniques and alternative inputs in relation to costs. If, in addition, new forms of performance-related compensation have been established in the organisation, the employees also take part in the organisation's success they have helped promote. In consideration of this last aspect, it is very important that employees check the variance between the cost centre's specification and the lower level of costs that they have been able to realise. This is carried out with the help of variance analysis (Horngreen et al. 1997, Schweitzer and Küpper 2003)

Step 7: Variance analysis: Here, the specifications of centralised standard costing are compared to the actual values realised. Such an analysis reveals which cost variances have occurred in a particular budgeted period and which determinants and behaviour have caused the variances. The main focus is on price and volume variances. In short-term standard costing, price variance is relatively insignificant because of the definition of fixed prices. As a complement to standard costing and in addition to the other variance types, prognostic cost accounting also analyses the effects of purchasing price fluctuations.

At the next level, volume variance can be split into an activity variance and a usage variance. For short-term standard costing, activity variances, in turn, correspond to the idle-capacity costs of the period's actual level of activity, which is not subject to the influence of cost centre managers. Finally, usage variance is always the responsibility of people working in a cost centre. A more exact analysis breaks the usage variance down into the following components: intensity variances, batch size variances, cost variances associated with unbudgeted orders, and process variances.

The application of decentralised cost accounting systems combined with innovative systems of incentives provides employees with opportunities to detect potential for improvement in the production process and to increase work quality. In addition to the employees' own monetary advantages, this is also beneficial to the environment and improves the quality of the workplace. More leeway for competencies and decisions means reduced sick leave, increased profitability of the organisation, and relief for the environment through the more efficient use of inputs.

With problem-solving and socially competent action, employees at all hierarchical levels can make valuable contributions to the realisation of an organisation's strategy. Across all functional divisions, 'intrapreneurship' provides for continuous improvement of internal workplace processes. In this way, elements such as decentralisation and the creation of incentives can make the knowledge of each and every employee conducive to the organisation's performance goals. The organisation, then, can reduce costs, improve the quality of its products, increase its reliability to meet deadlines, and thus, on the whole, bolster its competitiveness (Letmathe 2003).

3. EXAMPLE

An example can now be presented to help clarify the approach described above. This illustration follows the same steps listed in the description of the general approach, here applied to cost centre P (a manufacturing cost centre for a hydraulic press in a metalworking plant).

- *Step 1: Process analysis:* In connection with the analysis of material flows, materials entering into and discharged from this production department are recorded in terms of amounts and costs. The analysis reveals that the oils used involve high purchase costs and that oily scrap press pieces must be disposed of at high costs.
- *Steps 2 and 3: Determining planning specifications and cost drivers/ Determining the standard level of activity for all cost centres:* A production volume of 3 million press pieces has been estimated for the following period. The volume is expected to consist of 2,000 batches with an average weight of 13.5 kg per press piece. This weight is the determining factor for the amount of oil consumed.
- *Step 4: Determining usage volumes and periods for each cost category of a cost centre in reference to the standard level of activity:* A volume of (3 million * 13.5 kg/1000 =) 40,500 tons corresponds to a demand for ca. 20,000 litres of oil (0.5 litres per ton). Furthermore, estimating 2 percent scrap means expecting approximately 810 tons of scrap that must be appropriately disposed of.
- *Step 5: Valuation of planned usage volumes and periods with fixed prices:* Calculating € 0.80 per litre of oil and a disposal cost of € 5.00 per ton results in a budget of € 20,050 for an output of 3 million press pieces.

- *Step 6: Analysis within cost centres for establishing basic, best practice, and optimal costs:* The sum of € 20,050 was calculated on the basis of values from earlier periods and, thus, signifies a budget specification of normal ecological costs to the cost centre. A more exacting technical analysis reveals that the pieces are too liberally coated with oil; thus, if the oiling process was optimised, a budget of € 18,000 could be calculated (ecological standard costs). Since, in future, collaborating groups can also help to reduce the percentage of scrap involved when production of a batch is started, lower costs of disposal and, thus, lower budgets of € 17,000 for the first year and € 16,500 for the following year can be calculated (basic ecological and social costs). In numerous trial runs, ecologically admissible materials for micro-coatings have been applied that require significantly less material and result in lower purchase costs and significantly lower costs for disposal. This method would allow for calculations of a budget of € 14,000 for 3 million press pieces (best practice costs). If, finally, total avoidance of errors and scrap is assumed, production of the press pieces with a budget of € 12,000 is conceivable. Idle-capacity costs are then 40 percent.
- *Step 7: Variance analysis:* At the end of the period, the cost centre records costs of € 17,000 for the application of micro-coatings, for the disposal of scrap press pieces, and for cooperation with external technological consultants. For the following period, learning effects and the fact that external consultants will no longer be necessary allow for the calculation of a further cost reduction. Using prognostic cost accounting and relatively simple methods of capital budgeting, the cost centre team also decides to plan the purchase of new oiling equipment in a decentralised way. In this way, the team participates in planning the budget in accordance with the concept of 'intrapreneurship'.

4. BENEFITS OF A DECENTRALISED COST ACCOUNTING SYSTEM - ORIENTATED TOWARDS GUIDING BEHAVIOUR

The procedure presented in this chapter has proved viable in practice in connection with several projects initiated by the *Institut für ökologische Betriebswirtschaft* (*IöB*: Institute of Ecological Economics) and by the *Siegener Mittelstandsinstitut* (*SMI*: Center for the Study of Medium-Sized Organisations at the University of Siegen). This approach aims at guiding behaviour and for this reason involves intermediate-level employees in cost management and is concerned with detecting further potential for ecological and social betterment. The advantages of the approach can be summarised as follows:

- *More detailed analysis of processes and procedures (as a result of step 1):* The in-depth examination of processes and activities and the corresponding visualisation of material and energy flows from their entry into the organisation until they leave as a product, as waste, as effluent, or as emissions, can at the outset disclose potential for economising and encompass such advantages as more efficient use of materials, higher process reliability, better achievement of full capacity, reduction of waste disposal costs, greater transparency in cost classification, and increased security in legal matters. With step 1 of the procedure outlined above, an organisation can readily produce a flow chart of a single manufacturing process, of a product line, or of the entire production process. With a view to adapting the costing system, such a visualisation can already help to identify major and minor processes for activity-based costing implementation at a later date.
- *Systematic detection of potential for improvement (as a result of steps 2-6):* With the definition of normal, standard, basic, best practice, and optimal costs, the autonomous collaborative groups are purposefully led to discovering potential for improving efficiency from both an ecological and a social perspective. Wherever high idle-capacity costs can still be discerned, there is automatically an urgent need for decisive action.
- *Decentralised acceptance of responsibility for costs (as a result of step 7):* The specifications provided by a standard costing system can make a decisive contribution to guiding employees in accordance with the organisation's goals. Employees are responsible for a cost centre or for partial or entire processes completed by their departments. If these responsibilities are also coupled with incentives along the lines of the 'intrapreneurship' mentioned above and if decentralisation provides employees with certain substantial competencies, they will contribute responsibly to resource efficiency and explore possibilities for economising. As specialists in their own work areas, individual cost centre members with responsibilities can go beyond the short-term control of standard costing and also provide assistance for prognostic cost accounting. With appropriate recommendations, they can have a positive influence on budgeting. This could include the use of new technologies in manufacturing, avoiding scrap by opting for better inputs, etc.

5. POTENTIAL FOR FURTHER DEVELOPMENT OF THE APPROACH

After employees have been sensitised to the problems and goals, there is further potential for development in cost accounting and control instruments that have hitherto only been used in a centralised way:

Prognostic cost accounting can demonstrate the monetary effects of management options in their entirety. Thus, alternative measures can be evaluated in light of their ecological and social consequences relevant to the organisation's goals. The organisation achieves greater certainty for planning and can budget costs and revenues for various scenarios. Then, using competitors' products or processes as a benchmark, the organisation's own processes may prove to be too cost-intensive. Thus, in future, the respective autonomous collaborative groups can internally define sub-modules of an outstanding order or of project management in accordance with the organisation's management staff and apply target costing to these sub-modules. A long-term goal could be the decentralised application of life-cycle costing to assembly parts or other components by the respective team. In principle, numerous conventional cost accounting approaches (target costing, life-cycle costing, both static and dynamic methods of capital budgeting, etc.) can be adapted to such decentralised application.

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PART II

LINKING ENVIRONMENTAL AND SUSTAINABILITY ACCOUNTING WITH ECONOMIC SUCCESS

Chapter 8

ACHIEVING ENVIRONMENTAL-ECONOMIC SUSTAINABILITY THROUGH CORPORATE ENVIRONMENTAL STRATEGIES

Empirical Evidence on Environmental Shareholder Value

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Abstract: This paper discusses the relationship between environmental and economic performance, and the influence of different positions on corporate environmental strategy. After formulating a theoretical model, results are reported for two empirical analyses: of the European paper manufacturing industry, and of a set of British and German manufacturing firms, respectively. It is found that the potential for different industries to realize a win-win relationship between environmental and economic performance differs, but that a pollution prevention-oriented approach as supported by the Environmental Shareholder Value concept, for example, enables a type of integrated management which enables firms to move closer towards environmental-economic sustainability.

1. INTRODUCTION

The effect of strategy considerations on the link between the environment and firm performance has been a focus of scholarly research for some time (Aragon-Corea 1998, Reinhardt 1999). The question addressed in the following is: "What is the relationship between the environmental and economic performance of firms in specific industrial sectors, and what is the influence of corporate environmental strategies on this relationship?". The type of relationship is distinguished in this research by means of two differently shaped curves, representing idealized functional relationships between

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environmental and economic performance. Corporate environmental strategies (CES) are distinguished here in terms of end-of-pipe and integrated pollution prevention strategies, based on the actual physical environmental performance of companies and following the Environmental Shareholder Value (ESV) concept (Schaltegger and Figge 2000) which will be detailed below.

This research applies multiple regression analysis to the data in order to address the above research question and to identify a possible relationship between the environmental and economic performance of firms. The analysis takes into account the influence of a number of important control variables such as country, the processes operated by firms, and firm size. The results of the analysis indicate that corporate environmental strategies (CES) may have an important influence on the relationship between environmental and economic performance.

The paper follows the argument made by Lankoski (2000) and Schaltegger and Synnestvedt (2002) that an inversely U-shaped curve ("Type 2" in Figure 8-1 below) would represent the "best" possible case for the relationship between environmental and economic performance, and it allows for the existence of win-win situations with profitable environmental performance improvement activities. For a firm facing a "Type 2" curve, the optimum level of environmental performance would be the one which maximises economic performance, i.e. the maximum point of the "Type 2" curve in Figure 8-1. Over time, technological progress moves the curves towards the right (as is indicated in Figure 8-1 for the "Type 2" curve): i.e. for the same level of environmental performance, a higher level of economic performance can be realised. This can also result in the optimum level of environmental performance moving to higher levels of environmental performance as indicated in Figure 8-1.

If environmental performance improvements only increase costs and reduce profits for an individual firm, this would not be possible and would thus result in the relationship represented by the "Type 1" curve in Figure 8-1 below. Under "Type 1" conditions, the optimal level of environmental performance for a firm would be the one prescribed by environmental regulations, i.e. compliance without over-compliance. Figure 8-1 below summarises these considerations by showing both relationships in a single graphic representation. A monotonously increasing curve is not included since this would imply decreasing marginal benefits from environmental improvements which would be inconsistent with economic theory.

The two types of curves can be distinguished in that the "Type 1" curve is continuously decreasing, whereas the "Type 2" curve first increases to an optimum point and then decreases continuously beyond this point. In the multiple regression analysis applied to the empirical data, the type of curve can be straightforwardly tested for by including the linear and squared term of the environmental performance variable. So far, such a specification of the relationship between environmental and economic performance consisting of a linear and a squared term has not been tested in empirical analyses. The next section introduces the two empirical analyses which were carried out to answer the question raised in the beginning taking into account Figure 8-1.

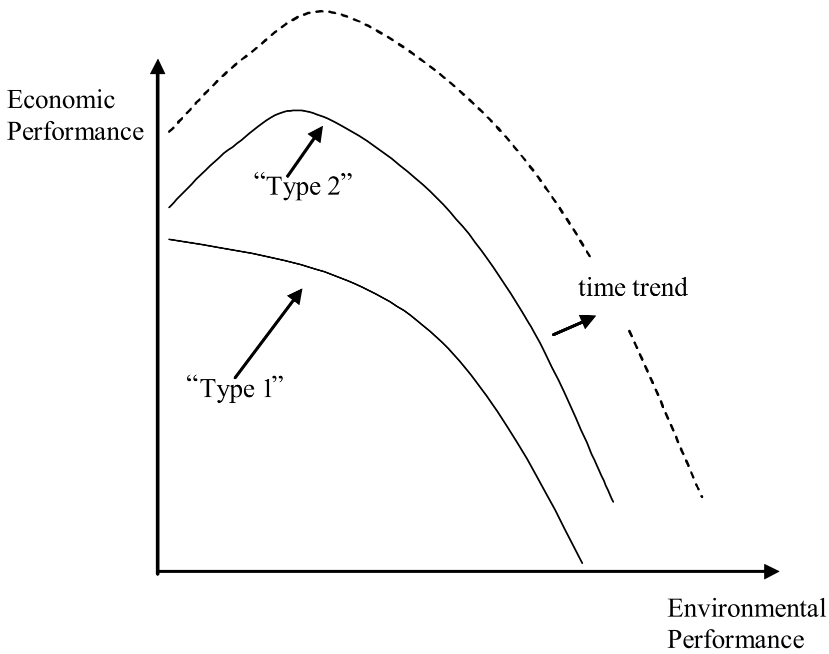

Figure 8-1. The link of environmental and economic performance (source: adapted from Lankoski 2000, Schaltegger 1988, Schaltegger and Figge 2000, Schaltegger and Synnestvedt 2002, Wagner 2003, 2005).

2. METHODOLOGICAL FOUNDATIONS

2.1 Methods of the 1st Empirical Analysis

This section introduces the two empirical analyses used to address the question stated in the Introduction. The research design of the first empirical analysis uses purposive survey methodology for the paper industry and focuses on firms from four European countries (Germany, Italy, the Netherlands and the United Kingdom) in the pulp and paper sector as defined by the 2-digit NACE code. For all firms, data on various environmental performance indicators (EPIs) and financial ratios was collected. The main EPIs were SO_2 emissions, NO_x emissions, COD emissions, total energy input, and total water input, all per ton of paper produced. In order to use these in the regression analyses, two composite indices of these EPIs had to be calculated (due to the multi-collinearity between these basic indicators), using a method initially developed by Jaggi and Freedman (1992) in the adaptation used in Tyteca et al. (2002). The indicators used to calculate scores for the first (outputs-oriented) index score were SO_2, NO_x, and COD. For the second (inputs-oriented) index score, total energy input and total water input were used. The reason for using two indices was that the inputs-oriented index relates more to pollution prevention (which, as will be shown later, is also linked to a strongly ESV-oriented position, which may be either the result of conscious action or an unintended emergent result of a set of activities), whereas the outputs-oriented index mainly reflects end-of-pipe activities. This is because pollution prevention activities by definition have a stronger effect on inputs to production than do end-of-pipe programmes. Therefore, an inputs-oriented index captures mainly the effect of integrated pollution prevention strategies on economic performance. The ESV concept (Schaltegger and Figge 2000) argues that their effect on the latter should be more positive than that of end-of-pipe activities. Since both end-of-pipe and pollution prevention activities both decrease emissions, an (undesired) outputs-based index of environmental performance will reflect both strategies. Since ESV argues that end-of-pipe activities generally have a negative effect on economic performance, the relationship of such an index with the latter should be more negative.

CO_2 was not included as an EPI since the paper cycle is relatively carbon-neutral in the long term, at least as concerns wood as the basic production input. Given this, an indicator for CO_2 would have little relevance for the environmental performance of paper firms.

Given that economic performance in the short term can be approximated through profitability, it is measured in terms of profitability ratios such as return on sales (ROS), return on capital employed (ROCE) and return on equity (ROE). The first empirical analysis of the relationship between the environmental and the economic performance of firms involves an estimation procedure which is based on a panel data model in which environmental and economic performance are considered to be in a causal relationship, i.e. the EPIs are considered to influence the economic performance variables which are hence the endogenous variables. For the analysis, a pooled model based on Ordinary Least Squares (OLS) regression and ignoring the panel structure, a random effects panel data model and a fixed effects panel data model are used and compared. For testing the above research question using this (panel) regression framework, incomplete panel data was used on a set of 37 paper firms in four EU countries (Germany, Italy, Netherlands and United Kingdom) over the period from 1995 to 1997. Table 8-1 summarises all variables of the first empirical analysis and their definition for better overview.

Table 8-1. Summary of variable definitions for all variables used in the first empirical analysis.

Concept	Variable	Description	Type[1]
Economic performance	ROCE	Return on capital employed [%], defined as: (profit + interest) / (shareholders' funds + non-current liabilities)*100	Cont.
	ROE	Return on equity [%], defined as: pre-tax profit (loss) / shareholders' funds*100	Cont.
	ROS	Return on sales [%], defined as: pre-tax profit (loss) / operating revenue * 100	Cont.
Environmental performance	COD	Emission of chemical oxygen demand per output [kt/t]	Cont.
	SO_2	Emission of sulphur dioxide per unit of output [kt/t]	Cont.
	NO_x	Emission of nitrogenous oxides per unit of output [kt/t]	Cont.
	Energy input	Total energy input per unit of output [GWh/t]	Cont.
	Water input	Total water input per unit of output [1000 litres/t]	Cont.
Control variables	Capital gearing	Ratio of shareholders' funds per total assets [%]	Cont.
	Asset turnover	Ratio of total assets per operating revenue [%]	Cont.
Country	UK	Firm located in the United Kingdom	Dum.
	Italy	Firm located in Italy	Dum.
	Netherlands	Firm located in the Netherlands	Dum.
	Germany	Firm located in Germany (reference group)	Dum.
Sub-sector	Industrial	Packaging corrugated and other boards	Dum.
	Cultural	Newsprint, magazine-grade, graphics fine paper (reference)	Dum.
	Mixed	Cultural and industrial paper production combined	Dum.
	Other	Other paper production	Dum.
Other	Firm size	Number of employees (thousands)	Cont.

[1]In the table, cont. and dum. refer to continuous (interval scale) type and dummy type variables respectively.

Panel methods are appropriate to analyse the above data since firms in the data set are observed over several years. Given that the characteristics of a single firm tend to be more similar over time than those of several different firms, a bias could be introduced using standard OLS estimation, especially concerning levels of statistical significance. Panel estimation however accounts for this potential bias. Since this research is more explorative in terms of the magnitude of any effects of environmental on economic performance (i.e. it does not make specific assumptions on the magnitude of the influence of any of the explanatory variables, but only on their likely direction, and whether this is positive or negative), statistical significance is an important aspect on which to focus and thus the choice of panel data analysis seemed appropriate. It is also justified by the fact that data availability could be improved by taking into account several years' data for each firm, since firms which have started to report on their environmental performance in terms of emissions and resource inputs usually tend to continue to do so in subsequent years, thus enabling a more precise estimation of the parameters involved.

2.2 Methods of the 2nd Empirical Analysis

The second empirical analysis uses data for European manufacturing firms from the European Business Environment Barometer (EBEB) survey. The EBEB is a bi-annual survey of the state of environmental management in practice carried out in several European countries (Baumast and Dyllick 2001). The data used here refers to the last survey round in 2001. EBEB uses several item batteries, all of which are based on the opinions/attitudes of firms rather than on their actual performance. One of these batteries allows corporate environmental strategies to be distinguished in terms of companies' positions towards shareholder value (based on the self-reported perceived effects on shareholder value of a firm's activities in the area of environmental or sustainability management). The approach which is chosen to measure corporate environmental strategies (CES) with this item battery is based on the concept of ESV developed by Schaltegger and Figge (2000). Basically, ESV argues that the amount of corporate environmental protection in itself neither spurs nor reduces shareholder value (or similarly other measures of economic performance) but links environmental performance and shareholder value in a more differentiated way by means of the theoretically derived value drivers of the original shareholder value concept (Rappaport 1986). Strategies are empirically derived based on the previously mentioned item battery of drivers of shareholder value in their relationship to environmental management, using Principal Component Analysis (PCA) and cluster analysis to categorize firms.

As well as CES identification, measurement of environmental competitiveness (defined as that part of the overall competitiveness of a firm which can actually be influenced by environmental management activities) has been used as a measure of economic performance in the second empirical analysis reported here. Little quantitative data is available on the environmental competitiveness of individual companies, and the most suitable approach seemed therefore to be the use of self-assessment by firms, based on a number of items (an approach which was also used by Sharma (2001) in a similar context). Environmental competitiveness was thus measured by means of an item battery which asked about the perceived effect of environmental management activities on different items such as competitive advantage and corporate image improvements. PCA was carried out on the environmental competitiveness items used in the survey to define four independent dimensions of environmental competitiveness. Environmental performance is measured in terms of an index which assesses the reduction in firms' environmental impacts in a number of categories (such as energy or water use, or the use of toxic inputs), each measured by a separate item variable. For each of the items, the survey asked about the degree to which environmental management activities over the years 1998-2000 reduced the company's environmental impact for this variable over the period 1998-2000. Respondents were asked to provide answers on a 5-point Likert scale ranging from "no reduction" and "little reduction" via "average reduction" to "strong reduction" and "very strong reduction", with the highest score corresponding to the largest reduction.

Prior to the statistical analysis for which results are reported in the next section, it was established that the sample comprising the 301 valid responses to the EBEB survey in the UK (135) and in Germany (166) was representative in both countries as far as firm size and the sectoral distribution of firms is concerned. Since 25 independent variables are used in the regression analysis, data for the UK and for Germany is pooled. Given that this second empirical analysis concerns cross-sectional data, OLS is an efficient estimation method, and the multiple linear regression equation which was estimated via OLS is defined as follows (with Table 8-2 below concisely summarising all variables used in the second analysis):

> *Environmental competitiveness component i = linear additive function (firm size, square of firm size, sector and country dummies, market growth, firm age, legal form, overall profit, dummies for EMS implementation, environmental impact index, square of environmental impact index) + residual value*

Table 8-2. Summary of variable definitions for all variables used in the second empirical analysis.

Concept	Variable	Description	Type
Economic performance	Environmental profit indices 1-4	Indices calculated based on factor analysis of items measuring environmental competitiveness	Cont.
Environ-mental per-formance	Environmental impact reduction index	Averaged index score, standardized for industry sector and country location based on variables for different areas of environmental performance	Cont.
Firm size	No. employees	Number of employees (in thousands)	Cont.
EMS imple-mentation status	"No"	Firm has not implemented EMS (reference group)	Dum.
	"Considering"	Firm is considering EMS implementation	Dum.
	"In process"	Firm is in progress of implementing an EMS	Dum.
	"Implemented"	Firm has implemented an EMS	Dum.
Country	United Kingdom	Firm located in the United Kingdom	Dum.
	Germany	Firm located in Germany (reference group)	Dum.
Sector control variables	Food / tobacco	Firm in food and tobacco sector	Dum.
	Textiles	Firm in textile products sector	Dum.
	Pulp and paper	Firm in pulp and paper products sector	Dum.
	Printing	Firm in printing and publishing sector	Dum.
	Energy, oil etc.	Firm in energy, oil and nuclear fuels sector	Dum.
	Chemicals	Firm in chemicals and fibres sector	Dum.
	Rubber & plastic	Firm in rubber and plastic products sector	Dum.
	Non-ferrous	Firm in non-ferrous mineral products sector	Dum.
	Machinery	Firm in machines and equipment sector	Dum.
	Electrical optical	Firm in electrical and optical products sector	Dum.
	Transport products	Firm in transport products sector	Dum.
	Metals products	Firm in metals products sector (reference group)	Dum.
	Other manufac-turing products	Firm in sector producing other manufacturing products	Dum.
Other control variables	Firm age	Logarithm of firm age in years	Cont.
	Market develop-ment	Measured in the survey on a 5-point scale to assess whether firm has decreasing or increasing sales	Ordi-nal (Ord.)
	Firm legal status	Variable taking 1 if firm is in sole proprietorship	Dum.
	Firm overall profitability	Measure in the survey on a 5-point scale to as-sess whether firm is profit-making or loss-making	Ord.

The regression equation means that, for each of the right hand side variables, coefficients are estimated and a test is carried out to ascertain whether these individually are significantly different from zero. The dummy variables take the value of unity if the characteristic in question is true for the firm in question, and zero otherwise. The dummy variables are therefore binary variables, for which coefficients can also be estimated and tested for significance. The residual value in the equation refers to that part of the left hand side (dependent) variable (i.e. the respective environmental competitiveness index) which cannot be explained by the full set of right hand side variables.

3. RESULTS

3.1 Results of the 1st Empirical Analysis

In the first empirical analysis, for the outputs-oriented environmental performance index, the panel regression framework described earlier was used. The estimation procedure also incorporated the squares of firm size and of the outputs-oriented environmental performance index in order to account for non-linearity in the relationship. The results were analysed separately for the three measures of economic performance which were used: return on capital employed (ROCE), return on sales (ROS) and return on equity (ROE). The Breusch-Pagan Lagrangian Multiplier and the Wu-Hausman specification tests were applied to decide on the most appropriate model. As can be seen from Table 8-3, for ROCE as the dependent variable used to measure economic performance, the model with fixed effects (FE) is the best specification since the Wu-Hausman test is significant. The FE model is also overall significant, and the hypothesis that no fixed effects exist for any firm was rejected. In the model, the linear term of the environmental index is significant (at the 1% level) and has a positive effect on ROCE. In addition, the squared term of the environmental index with a level of 10.4% is also almost significant (at the 10% level) and has a negative effect on ROCE. The result is also economically relevant, since a 10% increase in environmental performance increases ROCE by 33.02 units, all else being equal (the high increase is due to the environmental index taking values only between zero and one). The squared term is also economically relevant.

The level of environmental performance which maximises ROCE in the FE model is equal to an index value of 0.12. With the index taking values between zero and one, this corresponds to a relatively low level of environmental performance.

Table 8-3. Results for ROCE as the dependent variable (outputs-based index) in the first empirical analysis.

Model type	Pooled Model		RE Model		FE Model	
Independent variable	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
Environmental index	0.9413	1.8787	2.6506	2.5800	***33.0213***	8.4538
Square of env. index	–0.9618	1.8805	–2.6762	2.5923	–135.906	81.1471
Firm size	0.1486	0.1130	0.1513	0.1475	0.3435	0.2946
Square of firm size	–0.0273	0.0266	–0.0257	0.3508	–0.0443	0.0682
Leverage	0.0200	0.0174	0.0005	0.0221	–0.0523	0.0336
Asset turnover ratio	–0.0276	0.0311	–0.0306	0.0347	–0.0188	0.0406
Other sub-sector	**0.3380**	0.1429	*0.3398*	0.1863	-	-
Industrial sub-sector	–0.0250	0.0772	0.0002	0.1030	-	-
Mixed sub-sector	0.0035	0.0638	0.0202	0.0868	-	-
United Kingdom	**0.1901**	0.0753	*0.1829*	0.1014	-	-
Italy	0.1570	0.1235	0.1379	0.1611	-	-
Netherlands	0.0885	0.0833	0.0520	0.1162	-	-
Constant	–0.0996	0.1144	–0.0695	0.1491	13.6172	10.7321
Number of observations	63		63		63	
R-squared	0.1857		0.1494		0.4310	
F statistic	0.95				***4.04***	
Wald χ^2			7.03			
F statistic (all $u_i = 0$)					**2.23**	
Breusch-Pagan test (χ^2)			0.42			
Hausman test (χ2)					*24.94*	

[a] Bold figures and italicised figures indicate significance at the 5% and 10% levels respectively. Figures that are both bold and italicised indicate significance at the 1% level.

Concerning ROS as a measure of firms' economic performance, it was found that the fixed effects specification is most appropriate (since the Wu-Hausman test is significant). The results show that the linear term of the environmental performance index has a positive but insignificant effect on ROS, whilst the squared term of the index has a significant and negative effect, which is also relevant in economic terms: a 10% increase of environmental performance reduces ROS by 7.2%, all else being equal. The level of environmental performance which maximises ROS in the fixed effects model corresponds to an index value of 0.0188. As for ROCE, this again corresponds to a fairly low level of environmental performance, which is consistent with the observation that a significant negative effect of environmental on economic performance exists only for ROS. For the estimations with

ROE as the dependent variable, there were similar findings as for ROS. Here again, fixed effects were found to be the most appropriate model.

As for ROS, the linear term of the index had a positive, yet insignificant, effect on ROE. In contrast to this, the squared term had a significant negative effect on ROE, with the ROE-maximising level of environmental performance corresponding to an index value of 0.0353. This effect is also relevant in economic terms, since a 10% increase in environmental performance reduces ROE by 22.6%, all else being equal.

For the inputs-related index of environmental performance (which is driven by strategies based on integrated pollution prevention) and ROCE as the dependent variable measuring economic performance, the model with random effects (RE) was found to be the best specification, as indicated by an insignificant Hausman test (i.e. the fixed effects model is no better than the random effects model, in that the estimated coefficients are not significantly different between the two models). Even though the Breusch-Pagan test is insignificant, the random effects model is still preferred over the pooled model, since the former is overall significant, but the latter is not. In the RE model, the linear term of the environmental index as well as its squared term are however insignificant. Concerning ROS, the results indicate that the pooled model is the most appropriate, since the Breusch-Pagan test is insignificant and only the pooled model is overall significant. In the pooled model however, the linear and the squared term for the environmental performance index are insignificant.

Finally, concerning ROE as the dependent variable, none of the models estimated are overall significant, nor are the Hausman and Breusch-Pagan tests. In both (the pooled and the random effects models) both the linear and squared terms of the environmental performance index and of firm size were found to be insignificant. Therefore, to sum up, the first empirical analysis testing the research question addressed by this contribution found for an outputs-based index a predominantly negative relationship, whereas for an inputs-based index no significant link is found. From these results it is concluded that for firms with pollution prevention-oriented environmental strategies, the relationship between environmental and economic performance is less negative (i.e. better) than for those with an end-of-pipe focus.

3.2 Results of the 2nd Empirical Analysis

Through factor analysis, eight items of the battery of drivers of shareholder value which were included in the EBEB survey questionnaire could be condensed into two underlying factors which are summarized in Table 8-4. The KMO measure for the factor analysis was 0.835, which is sufficiently high. Individual KMO measures based on anti-image correlations on the main diagonal of the anti-image correlation matrix were all above 0.6. The correlation matrix of the data set is therefore considered suitable for carrying out a factor analysis on the data set (see Backhaus et al. 2000, Bühl and Zöfel 2000 for details).

Table 8-4. Rotated component matrix for ESV factor analysis*.

Item Variable	Component/Factor	
	Value creation	Risk reduction
Through eco-products or eco-marketing we can achieve above-average market prices for our current products	0.629	0.381
Environmental management helps us to have lower costs for our processes	0.673	–0.434
Eco-products or eco-marketing help us to sell more of our current products	0.694	0.377
Environmental management in our company leads to lower capital investments for our current processes	0.744	0.048
Environmental management in our company helps us to make better use of existing equipment	0.754	–0.021
Environmental management in our company helps us to create a competitive advantage that is difficult to imitate	0.729	0.174
Through environmental management the proportion of variable costs in our company is higher	0.086	0.840
Environmental management helps our company to predict its future investments better	0.699	0.049

* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 3 iterations. Shaded fields are considered for interpretation of factors.

The first factor can be interpreted as the (perceived) “expected return” (based on firms’ self-assessment) resulting from a firm’s environmental management activities and mainly refers to cost reductions, as well as to margin and sales increases, better control of capital-intensive investments, and the extension of product and process lifetimes. It is characterized by high agreement by respondents (and thus high factor loadings) to items such as the following:

- Through eco-products or eco-marketing we can achieve above-average market prices for our current products
- Eco-products or eco-marketing help us to sell more of our current products

On the second factor, mainly the item referring to (perceived) variable costs had a high positive loading. This factor has therefore been termed “expected risk", and refers to reduced variability of profitability, as it is perceived by the firms surveyed. This is because higher variable costs through environmental management (implying, all else being equal, lower fixed costs) mean lower exposure of a company to variations in its profitability, and a high score on the "variable costs" factor therefore equates to a lower (financial) risk exposure of the firm (i.e. lower variability in a firm's returns).

Based on a cluster analysis of these two ESV-based factors, corporate environmental strategies which were oriented strongly towards shareholder value could be identified and separated from strategies which were not strongly oriented towards shareholder value, i.e. two groups of firms could be distinguished. Figure 8-2 shows a co-ordinate system with the axes defined by the two factors described and the two clusters of firms.

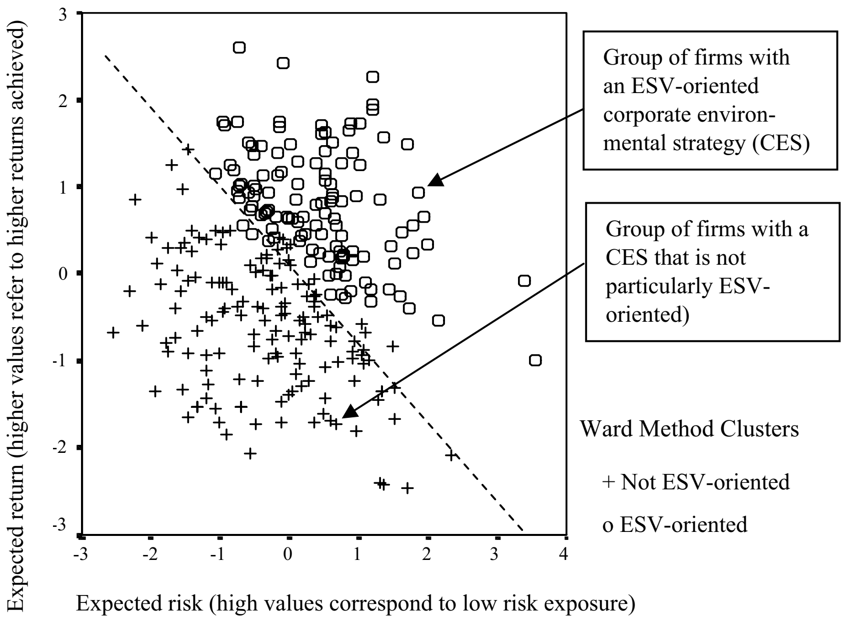

Figure 8-2. Solution of the cluster analysis for ESV factors (n = 276).

PCA carried out on the environmental competitiveness items allowed three different components (factors) of environmental competitiveness to be identified. The first factor refers to competitive advantage, product image, sales, market share and new market opportunities. It was therefore labelled "market-oriented environmental competitiveness" since it predominantly relates to the market- and product-related benefits of a company's environmental activities. The relevant items for the second factor are corporate image, owner/shareholder satisfaction, management satisfaction, worker satisfaction and recruitment, and staff retention. This factor was therefore labelled "internally-/image-oriented environmental competitiveness" since it refers mainly to internally-oriented satisfaction and company image benefits from a company's environmental activities, based on a specific corporate environmental strategy. For the third factor which was identified, the items of short-term and long-term profits, cost savings, and productivity, are particularly relevant. These refer predominantly to a company's profitability and the factor was therefore labelled "efficiency-/profitability-oriented environmental competitiveness". The two remaining items, "improved insurance conditions" and "better access to bank loans", could not be assigned to any one of the above factors, but on examination it became clear that they potentially represent a fourth factor, since both are linked to the financial exposure of a company due to its level of environmental risk, so it was therefore decided to interpret these two items as a fourth factor labelled "financial risk-related environmental competitiveness". For further analysis, indices were calculated, based on the factors identified, which relate to four (independent) dimensions of environmental competitiveness along which firms can position themselves. These again relate to market benefits, satisfaction and reputational benefits, profitability, and risk reduction, respectively.

In the second empirical analysis, testing the influence of ESV-oriented corporate environmental strategies on the link between environmental performance and environmental competitiveness in manufacturing industry in Germany and the UK, regressions were carried out separately for the two sets of firms with and without a shareholder value-oriented corporate environmental strategy respectively, based on the regression equation introduced earlier. Regressions were also carried out separately for the four different environmental competitiveness factors. For the environmental competitiveness index referring to market- and product-related benefits through environmental management, the OLS model is overall significant for the set of firms with an ESV-oriented CES, but insignificant for the set of firms without a strong ESV position. A significant positive effect of the linear term of the environmental performance index was found for the set of firms with an ESV-oriented CES, but not for the set of firms without a specifically ESV-oriented CES.

Table 8-5 summarises the results for the internally-/image-related index of environmental competitiveness as the independent variable. For easier reading, insignificant results for industry sector dummy variables are suppressed. For this environmental competitiveness dimension referring to internal satisfaction- and company internal-/image-related benefits through environmental management, the model was found to be overall significant for both subsets of firms (i.e. based on the model's F statistic, the hypothesis that all coefficients are jointly zero was rejected). Most importantly, in the subset of firms with an ESV-oriented CES, the environmental impact reduction index was found to have a significant positive effect (at the 5% level) and the square of the index was found to have a significant negative effect (at the 1% level). No significant influence of the index was found for the subset of firms without a specific focus on shareholder value in their CES, indicating a more positive link for an ESV-oriented strategy.

Table 8-5. Results for image-related environmental competitiveness in the second empirical analysis*.

Subset of firms with:	ESV-oriented CES		No ESV-oriented CES	
Equation variables:	*Coef.*	*Std. Dev.*	*Coef.*	*Std. Dev.*
Intercept	***2.278***	0.327	***2.696***	0.308
Country	0.026	0.101	–0.065	0.099
Firm size	–0.004	0.010	*0.249*	0.133
Square of firm size	0.000002	0.00007	–0.040	0.028
Non-ferrous	–0.192	0.192	*–0.401*	0.230
Machinery	**–0.409**	0.186	–0.046	0.204
Firm legal status	0.026	0.100	0.055	0.102
Firm age	–0.016	0.047	0.048	0.048
Overall business performance	0.051	0.042	0.008	0.042
Market development	**0.130**	0.053	–0.003	0.043
Considering EMS implementation	0.206	0.175	0.259	0.186
EMS implementation in progress	0.061	0.145	0.229	0.138
EMS implemented	**0.307**	0.120	**0.266**	0.124
Environmental impact index	**0.832**	0.234	0.292	0.192
Squared environmental impact index	***–0.176***	0.065	–0.073	0.052
Number of observations	94		112	
R-squared	0.498		0.287	
F statistic	*3.061*		*1.474*	

* Bold figures and italicised figures indicate significance at the 5% and 10% levels respectively. Figures that are both bold <u>and</u> italicised indicate significance at the 1% level.

For the third dimension of environmental competitiveness, relating to efficiency-/profitability, only the model estimated for the subset of firms with an ESV-oriented CES was overall significant (1% level). For this model, the environmental index was found to be positive and significant (at the 10% level, with its negative square almost significant), but insignificant for the other set of firms. Finally, for the fourth dimension of environmental competitiveness relating to the influence of environmental risk on financial conditions (and summarised in Table 8-6), both models which were estimated, for the subset of firms with an ESV-oriented CES as well as for the subset of firms without a strong ESV position, were overall significant (at the 5% and 10% levels, respectively). For the subset of ESV-oriented firms, the environmental impact reduction index (being of particular relevance to the research question analysed in this contribution) was found to have again a significant positive influence at the 10% level. For the subset of firms with no strong ESV position, neither the linear nor the squared term of environmental impact reduction had any significant influence on the financial risk-related dimension of environmental competitiveness.

Table 8-6. Results for risk-related environmental competitiveness in the second empirical analysis*.

Subset of firms with:	ESV-oriented CES		No ESV-oriented CES	
Equation variables:	*Coef.*	*Std. Dev.*	*Coef.*	*Std. Dev.*
Intercept	***2.196***	0.340	***2.629***	0.259
Country	0.050	0.105	–0.004	0.083
Firm size	*–0.020*	0.010	–0.019	0.112
Square of firm size	**0.0002**	0.00007	0.016	0.024
Pulp and paper products	–0.346	0.457	**–0.565**	0.245
Non-ferrous mineral products	0.042	0.199	*–0.336*	0.195
Firm legal status	–0.057	0.104	–0.118	0.086
Firm age	–0.017	0.049	0.063	0.041
Overall business performance	0.071	0.044	0.040	0.035
Market development	**0.144**	0.055	0.020	0.036
Considering EMS implement	0.291	0.182	–0.124	0.156
EMS implementation in progress	0.086	0.152	0.180	0.116
EMS implemented	0.062	0.125	0.085	0.108
Environmental impact index	*0.471*	0.242	0.026	0.167
Squared environmental impact index	–0.088	0.067	0.002	0.047
Number of observations	94		112	
R-squared	0.390		0.304	
F statistic	**1.945**		*1.582*	

* Bold figures and italicised figures indicate significance at the 5% and 10% levels respectively. Figures that are both bold and italicised indicate significance at the 1% level.

To sum up, the overall result of the second empirical analysis reported in this contribution is that for all four regressions carried out on the subset of firms with an ESV-oriented CES, the environmental impact reduction index was found to have a significant and positive influence on the different dimensions of environmental competitiveness (market-, internally-, profitability- and risk-related environmental competitiveness). In addition, for firms not pursuing a shareholder value-oriented corporate environmental strategy, after controlling for other relevant influences environmental performance has no significant relationship with any of the four dimensions of environmental competitiveness which were identified, indicating that strategy (as revealed by the stated effects of a firm's activities on important economic parameters, such as sales or costs) does make a difference. Firms that have a shareholder value-oriented CES seem more likely to achieve a positive relationship between environmental and economic performance whereas companies that do not have such a strategy seem less likely to bring about such a positive relationship.

As indicated earlier (and to be detailed in the next two sections, on conclusions and recommendations), a pollution prevention-oriented strategy can be seen as a special case of an ESV-oriented CES, which lends further support to the consistency of the results and points to the weaknesses of an end-of-pipe focus. Nevertheless, it should be noted that the results of course do not preclude a company from pursuing a corporate environmental strategy which is not focussed primarily on shareholder value. The reported results imply however that, in this case, a positive link between environmental and economic performance would be less likely.

4. CONCLUSIONS

4.1 Conclusions from the 1st Empirical Analysis

The results of the first empirical analysis to apply panel regression models to the European paper industry confirm the inversely U-shaped relationship between environmental and economic performance for an outputs-oriented environmental performance index in the fixed effects models for which an argument was made at the start of the paper. The positive part of the relationship was however found to be relatively weak. For the inputs-oriented environmental performance index, where the pooled models are most appropriate, no significant relationship could be detected. From these results it is concluded that for firms with pollution prevention-oriented environmental strategies, the relationship between environmental and economic performance is more positive (less negative).

In order to clarify the link between the first and second empirical analyses, and between ESV and a pollution prevention orientation, a cluster analysis was also carried out on the ESV items which were used in the EBEB questionnaire for the set of paper firms in the first empirical analysis.

Unfortunately, these firms were surveyed on their ESV orientation only after the initial data collection, so that not all firms provided this additional information. Table 8-7 below summarises the responses:

Table 8-7. Descriptive statistics of ESV responses from firms in the first analysis (not all firms are included).

	N	Min	Max	Mean	Std. Dev.
Through eco-products or eco-marketing we can achieve above-average market prices for our current products.	14	1.00	3.00	1.714	0.726
Environmental management helps us to have lower costs for our processes.	14	3.00	5.00	3.857	0.770
Eco-products or eco-marketing help us to sell more of our current products.	14	1.00	4.00	2.071	0.730
Environmental management in our company leads to lower capital investments for our current processes.	14	1.00	4.00	2.071	0.829
Environmental management in our company helps us to make better use of existing equipment.	14	2.00	5.00	3.000	1.038
Environmental management in our company helps us to create a competitive advantage that is difficult to imitate.	14	2.00	5.00	3.214	0.802
Through environmental management the proportion of variable costs in our company is higher.	14	2.00	4.00	2.786	0.699
Environmental management helps our company to predict its future investments better.	14	2.00	5.00	3.214	1.122

Given the low number of firms, PCA was not necessary, and the cluster analysis was carried out using the above items directly. This however makes a presentation as in Figure 8-2 difficult, since it would have to be in a space of more than two dimensions. As for the EBEB set of firms, the 2-cluster solution distinguishes two sets of firms which have significantly different ESV orientation. For the basic indicators used to construct the inputs- and outputs-oriented indices of the first analysis above, tests were carried out for significant differences in the mean values of the indicators between the two sets of firms, the results being summarized in Table 8-8.

As can be seen from Table 8-8, only the difference for water use is significantly in favour of the ESV-oriented firms. This means that firms which pursue an ESV-oriented strategy are not significantly penalized in terms of their economic performance, but show generally equal or better environmental performance than firms without an ESV orientation.

Table 8-8. Testing for differences in basic indicators of first empirical analysis based on ESV orientation.

	Cluster	Mean	Std. Dev.	Mean Rank
Average energy use 1995-97 per tonne of paper produced	No ESV-oriented CES	9967.717	7860.705	4.80
	ESV-oriented CES	10289.068	6088.408	5.25
Average water use 1995-97 per tonne of paper produced	No ESV-oriented CES	52302.912	20273.346	6.00
	ESV-oriented CES	17844.999	4106.845	3.00
Average sulphur dioxide emissions 1995-97 per tonne of paper produced	No ESV-oriented CES	0.009	0.019	8.64
	ESV-oriented CES	0.001	0.001	6.36
Average nitrogenous oxide emissions 1995-97 per tonne of paper produced	No ESV-oriented CES	0.001	0.001	8.00
	ESV-oriented CES	0.001	0.001	7.00
Average COD 95-97 per tonne of paper produced	No ESV-oriented CES	0.004	0.002	7.00
	ESV-oriented CES	0.008	0.009	7.00
Average ROCE 95-97	No ESV-oriented CES	11.287	7.046	6.20
	ESV-oriented CES	10.823	4.154	4.80
Average ROE 95-97	No ESV-oriented CES	16.021	14.237	5.80
	ESV-oriented CES	16.035	10.107	5.20
Average ROS 95-97	No ESV-oriented CES	5.909	5.305	5.40
	ESV-oriented CES	3.872	3.442	4.50

4.2 Conclusions from the 2nd Empirical Analysis

Expanding on the first empirical analysis, the second empirical analysis which was carried out to address the topic discussed here used a set of novel measures for environmental competitiveness to address the criticism raised by Lankoski (2000) and is based on two groups of firms not significantly differing in industry membership, country location and firm size. Lankoski (2000) raises the issue that any causal effect of environmental performance on overall economic performance is likely to be small and thus difficult to detect with common measures of overall economic performance. This certainly holds true for the large majority of firms, as they employ a wide range of activities which all have a major influence, to varying degrees, on overall economic performance and competitiveness, and thus has direct relevance for the broad sample of firms from the manufacturing sector which was used in the second empirical analysis. This is why the second empirical analysis focused on environmental competitiveness, i.e. that part of overall corporate competitiveness and economic performance of the company which is created and influenced by environmental management.

For the second empirical analysis the main result was that, for all four regressions which were carried out on the subset of firms with an ESV-oriented CES, the environmental impact reduction index was found to have a significant and positive influence on the different dimensions of environmental competitiveness (i.e. on market-, internally-, profitability- and risk-related environmental competitiveness). In contrast to this, for all four regressions carried out on the subset of firms with no strong ESV position in their corporate environmental strategy, no significant influence of the environmental impact reduction index on any of the four environmental competitiveness dimensions analysed was found. Therefore for firms which do not pursue a value-oriented corporate environmental strategy, after controlling for other relevant influences environmental performance has no significant relationship with any of the four dimensions of environmental competitiveness which were identified, indicating that (revealed) strategy makes a difference, or to put this in other words: firms that have a shareholder value-oriented CES either because of conscious choice or as an emergent strategy (Mintzberg and Quinn 1999) seem the most likely to achieve a positive relationship between environmental and economic performance. In contrast to this, firms which do not have such a strategy seem less likely to bring about such a positive relationship.

4.3 Overall Conclusions

The ESV concept (Schaltegger and Figge 2000) provides theoretical justification for the above conclusions. In short, ESV stipulates that for a defined level of environmental performance, economic performance can be improved more, the more strongly that a company's environmental management activities are linked to the key drivers of its shareholder value (Rappaport 1986). The ESV concept derives from this that efficiency improvements which are brought about by means of an integrated pollution prevention strategy usually require only limited additional investments, compared against the add-on equipment which would be required for an end-of-pipe strategy, and may also result in reduced operating costs and therefore higher profit margins. All these aspects have a favourable effect on the drivers of shareholder value and should thus lead to a more positive relationship between environmental and economic performance. This explains theoretically why a pollution prevention orientation empirically results in a more positive relationship between environmental and economic performance. Table 8-9 briefly summarises the overall conclusions.

Overall, the research therefore shows that, depending on the specific conditions, it is possible to find a predominantly positive, a mainly neutral (i.e. insignificant), or a predominantly negative relationship between environmental and economic performance (or alternatively, environmental competitiveness). This also implies, that both the theoretically derived conceptions of the relationship which are described by the differing views introduced in Figure 8-1 (represented by the "Type 1" and "Type 2" curves) have their merits, but under different conditions.

Table 8-9. Overall conclusions from both empirical analyses.

Research aspect	Finding
Functional relationship	No significant relationship for inputs-based index; largely negative relationship for outputs-based index (except ROS: inversely U-shaped relationship); 2nd empirical analysis: mostly an inversely U-shaped to positive relationship is found for firms with an ESV-oriented strategy, no significant link otherwise
Strategy influence	Weakly confirmed in the 1st empirical analysis: no significant effect of environmental on economic performance for inputs-based index; largely negative effect for outputs-based index; also confirmation for basic indicators. 2nd empirical analysis: ESV-oriented strategy improves the relationship between environmental performance and environment-related competitiveness
Firm size effects	Largely no firm size effects on economic performance in both analyses
Economic factors	Negative effect of leverage (stronger for outputs-based index) in 1st analysis; in 2nd analysis, influences of market development and EMS status
Sub-sector effects	"Mixed" sub-sector has negative effect on economic performance; in 2nd analysis, effects of different industry sectors, varying with dependent variable
Country influence	Positive effects of UK location on economic performance in both analyses

5. RECOMMENDATIONS

The key question in this paper was about the relationship between environmental and economic performance, and whether the focus of an (ESV-oriented) corporate environmental strategy (as revealed by the perceived effects of a firm's activities) has a significant effect on this. The analysis shows that in environmentally intensive industries such as paper manufacturing, it may be difficult to bring about a positive relationship but that this is made easier through a focus on integrated pollution prevention (which can be seen as a special case of an ESV-oriented CES, as will be detailed below). It also shows that for firms with a strategy based on the ESV concept (Schaltegger and Figge 2000), the relationship between environmental performance and the different dimensions of competitiveness is more positive than for firms without such a strategy.

This means that, contrary to the commonly held view that the simple amount of environmental protection (or more precisely, the level of environmental performance related to this amount) is either negatively or positively related to the economic performance (or, more specifically, the environmental competitiveness) of firms, the theoretical argument of ESV that such a relationship depends strongly on factors which are internal to the firm is confirmed empirically. Particularly relevant amongst the internal factors are the corporate environmental strategies and resulting environmental management activities pursued by a company, which emerge as major factors moderating the relationship between environmental and economic performance. For a defined level of environmental performance, according to ESV, economic performance can be improved more, the more strongly the environmental management activities of a company are linked to the key drivers of its shareholder value.

Only if a company's environmental management activities (resulting from its CES, which ideally would be ESV-oriented) have a positive effect (or a minimized detrimental effect) on the drivers of shareholder value, can high environmental competitiveness can be achieved simultaneously with high levels of environmental performance. According to Rappaport (1986) and Schaltegger and Figge (2000), important value drivers are investments in current and fixed assets, profit margin, cost of capital, and value growth duration (i.e. the time period during which a competitive advantage can be sustained). For example, end-of-pipe activities (such as flue gas desulphurisation) often require large investments in fixed assets (possibly also increasing the cost of capital), and thus have a detrimental effect on this value driver for shareholder value.

Accordingly, one would expect an end-of-pipe strategy (leading to environmental improvements mainly through reductions in the undesired outputs of production processes, such as emissions to air and water) to show limited positive, or even negative, effects of environmental performance on economic performance, as was found in the first empirical analysis. A corporate environmental strategy which is based on end-of-pipe activities therefore cannot be considered to be an ESV-oriented strategy. In contrast to this, efficiency improvements which are brought about through integrated pollution prevention often do not require additional investments and may additionally result in reduced operating costs and therefore increasing profit margins.

This concerns improvements such as in a company's energy efficiency or water efficiency as well as increased resource efficiency, i.e. reduced amounts of production inputs per unit of product output (Schaltegger and Figge 2000).

Corporate environmental strategies which focus on environmental management activities leading to such efficiency improvements, which include integrated pollution prevention-based strategies, thus have a strong ESV orientation. This is particularly so because from a materials flow perspective, efficiency gains can also result in indirect cost reductions which are revealed by methods such as activity-based costing. In summary, it is therefore recommended that companies should first cross-check their corporate environmental strategy against the principles of the ESV concept.

With the relevance of the concept now empirically validated, this will provide valuable top-down guidance for strategy development. Secondly, a company can screen its environmental management activities based on its drivers of shareholder value to establish a bottom-up perspective of the degree to which its activities create economic value and improve competitiveness. In particular, the significant differences between end-of-pipe and integrated pollution prevention activities should be a focus of this screening which can guide corporate environmental strategy development.

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Chapter 9

THE IMPACT OF CARBON CONSTRAINTS ON COMPETITIVENESS AND VALUE CREATION IN THE AUTOMOTIVE INDUSTRY

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Abstract: The purpose of this article is to quantify the financial risks and opportunities faced by the automotive industry from “carbon constraints”—policy measures designed to mitigate climate change by limiting emissions of carbon dioxide (CO_2) and other greenhouse gases. This article is derived from Austin D, Rosinski N, Sauer A and Le Duc C (2003) *Changing Drivers*, a report which explores how carbon constraints in global automotive markets may affect value creation in 10 leading automotive companies between now and 2015. The full report and other relevant materials can be downloaded free of charge from Internet URL <:http://www.sam-group.com/changingdrivers/> or <:http://capitalmarkets.wri.org.> The Original Equipment Manufacturers (OEMs) assessed are BMW, DaimlerChrysler (DC), Ford, GM, Honda, Nissan, PSA, Renault, Toyota and Volkswagen (VW)—the world’s largest independent automotive companies. The geographical scope of the assessment is the United States, European Union and Japanese markets, which together account for nearly 70 percent of current global sales.

Changing Drivers is the result of collaboration between SAM Sustainable Asset Management (SAM)—a Zurich-based independent asset management company specialising in sustainability-driven investments—and the World Resources Institute (WRI)—an environmental research and policy organisation based in Washington D.C. Drawing on the respective strengths and expertise of the two organisations, the report analyses both the risks and opportunities of carbon constraints, and then estimates the combined implications for the OEMs’ future earnings. The analysis is explicitly forward-looking, focusing on the main factors affecting the OEMs’ exposure to carbon constraints, and drawing on the latest publicly available information about the 10 assessed OEMs.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 207-229.

1. INTRODUCTION

Climate change is a relatively new issue for the automotive industry, and one that may have significant financial impacts for the sector. Climate change policies (or "carbon constraints") are already in place in several major automotive markets and appear likely to spread, forcing automotive Original Equipment Manufacturers (OEMs) to lower the carbon emissions profile of new vehicles. At the same time, new technology options in various states of development offer the potential to meet new carbon constraints while increasing profitability. Carbon constraints thus create a combination of risk and opportunity for OEMs.

In view of the growing carbon constraints on automotive markets, a key challenge for sector investors and OEM managers is to quantify the impact of carbon constraints on competitiveness. In this article we analyse how carbon constraints could affect the shareholder value creation of 10 leading OEMs: BMW, DC, Ford, GM, Honda, Nissan, PSA, Renault, Toyota and VW. The geographical focus is the US, EU and Japanese markets, which account for nearly 70 percent of current global sales. The time period analysed is from 2003 to 2015.

Carbon constraints create both risks and opportunities for OEMs. Risks principally take the form of possible increases in costs to meet new standards and/or loss of market share to more fuel-efficient producers. Opportunities lie in the potential to develop successful strategies to reduce carbon emissions that translate into technological leadership, enhanced market share and greater profits.

To assess risks and opportunities, we performed two complementary analyses:

- A *Value Exposure Assessment* identifies the risks of carbon constraints in terms of the estimated costs for each OEM to meet new CO_2 emissions standards by 2015.
- A *Management Quality Assessment* identifies the opportunities for OEMs to capitalise on carbon constraints and enhance their competitiveness, by virtue of their superior management quality and focus on lower-carbon technologies.

A key challenge for analysts is to determine the implications of these findings for shareholder value creation. Consequently, we translate the results of both the Value Exposure and Management Quality assessments into changes in forecasted EBIT (Earnings before Interest and Taxes) for the period 2003 through 2015. EBIT is a foundation for valuation estimates in this sector and so changes in an OEM's EBIT offer useful insight into possible changes for overall Return on Invested Capital (ROIC) and thus shareholder value.

2. VALUE EXPOSURE ASSESSMENT

In all three main automotive markets covered in this report—the United States, European Union and Japan—governments have committed to higher fuel economy or CO_2 emission standards in the coming years. These standards will require OEMs to make potentially costly changes to vehicle specifications and sales mix. The costs incurred by each OEM will vary depending on its product portfolio and the current sales-weighted average fuel economy of its fleet, and on the costs of achieving CO_2 reductions for different vehicle types. The Value Exposure Assessment aims to quantify the range of costs that carbon constraints may impose on OEMs over the next 12 years.

The Value Exposure Assessment seeks to answer the following question:

What costs do OEMs face in meeting higher fuel economy standards in 2015, given their initial sales levels and vehicle mix?

2.1 Methodology

We developed a methodology to estimate the cost that each OEM will incur to meet different possible carbon constraints between now and 2015. In our analytical model, each OEM is characterised by its 2002 sales and fuel economy levels and has access to three main categories of lower-carbon technologies—incremental technologies, diesel, and hybrid technology. While fuel cell technology forms part of the management quality assessment thanks to its potential impact on competitiveness, it is ignored for the cost calculation. This is mainly due to the expected low penetration rate through 2015 and hence minimal contribution to actual CO_2 reductions within this time frame.

The model calculates the lowest-cost combination of technologies that an OEM must add to its existing vehicle fleet to ensure that it meets the specified new standards. Separate analyses are completed for the US, EU and Japanese markets and then aggregated to produce an overall cost estimate for each OEM. For more details on the model, please refer to Internet URL <:http://pdf.wri.org/changing_drivers_appendix.pdf>.

Because of uncertainties about the future regulatory environment, we assess sensitivity to different levels of carbon constraint that may emerge by 2015. In addition, we explore different market penetration rates for diesel and hybrid technologies, because of uncertainties regarding their technological development and acceptance by regulators and consumers.

Though the main analysis does not take into account inevitable changes in sales and vehicle mix over the next decade, it provides some quantitative insight into the magnitude of costs that each OEM might face in order to improve the carbon intensity of its vehicles.

2.1.1 Scenarios

While significant carbon constraints are in place in Europe and Japan, the outlook for the United States is more uncertain. To reflect uncertainty about future carbon constraints, we analysed two different levels of emissions standards ("high" and "low") for each market for 2015 (see Figure 9-1a-c.).

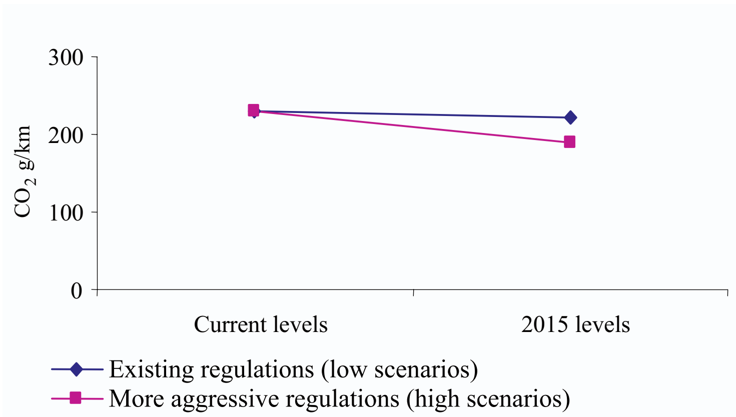


Figure 9-1a. Current and future carbon constraints in the United States.

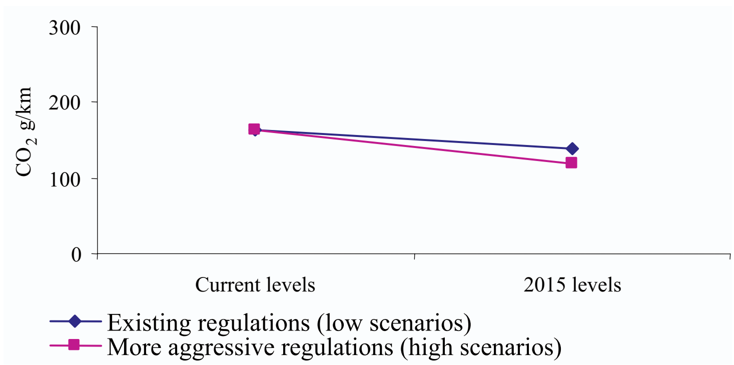


Figure 9-1b. Current and future carbon constraints in the European Union.

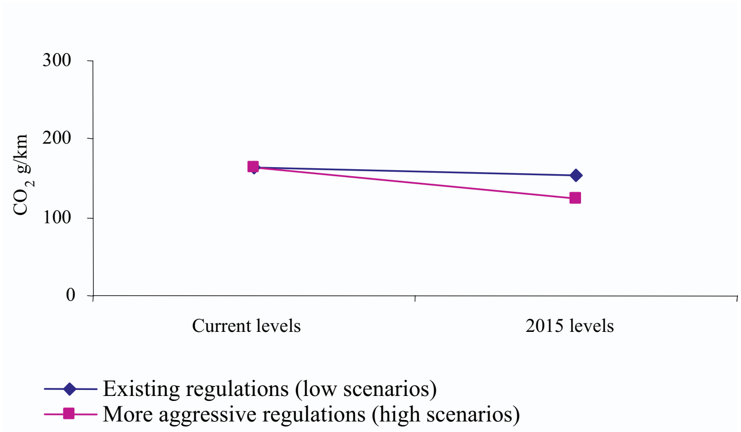


Figure 9-1c. Current and future carbon constraints in Japan.

For the European Union, future standards have already been signposted through voluntary agreements and regulations. Hence, high and low scenarios in this market are based on existing commitments. For the United States, scenarios reflect much greater uncertainty. The United States recently tightened its CAFE (Corporate Average Fuel Economy) standards for light trucks to 22.2 mpg (249 g CO_2/km) from 20.7 mpg (267g CO_2/km). However, fuel economy standards for passenger cars may not change before 2015. Bills proposing tighter standards for passenger cars have repeatedly been rejected by the US Congress, while both the Administration and Congress have shown little willingness to introduce policies to address climate change. On the other hand, some recent developments argue for the possibility of significantly tighter carbon constraints for passenger cars by 2015. California has passed a law that will regulate CO_2 emissions from vehicles by 2009, and other states have shown interest in emulating this approach. In addition, continued energy security concerns may advance CAFE standards by 2015.

The details of the scenarios used for each region are described under the “Market Specific Results” section. Predicting which of these, or other, scenarios is likely to occur is inherently difficult, given the many factors that may influence the setting of carbon constraints between now and 2015. Consequently, we weigh high and low scenarios equally, which effectively brackets the possibilities.

2.1.2 Characterisation of OEMs

OEMs may be limited in their capacity to adjust segment mixes in response to carbon constraints. Each OEM is characterised in terms of vehicle sales in seven separate segments for each of the three main markets. OEMs have different initial levels of carbon intensity for each segment in each market. One limitation of the analysis is that vehicle sales by company and by segment are kept constant at 2002 levels. This assumes that consumers will continue to buy the same types of vehicles from the same OEMs. In practice, of course, an obvious response to carbon constraints is for OEMs to adjust segment mix to produce relatively more low-emissions vehicles.

2.1.3 Technology Costs

Costs of lower-carbon technology will vary across segments and OEMs. Between now and 2015, OEMs will have access to three core types of CO_2-reducing technologies: incremental technologies (engine, transmission and vehicle technologies applied to a traditional internal combustion engine to improve fuel economy), diesel and hybrid technology. These technologies will have different costs in terms of dollars required to generate a given reduction in CO_2. In addition, the costs of a given technology will vary across different vehicle segments (e.g., hybridisation may be more expensive in pickups than smaller cars) and in some cases by OEM (e.g., Toyota and Honda should be able to add hybrid technology at lower cost than other OEMs).

Cost information on incremental technologies forms the basis of our estimates. We used cost data from a recent National Academy of Sciences (NAS) study addressing both *existing* and *emerging* technologies that should be readily available by 2015 (National Research Council 2002). The underlying cost data reflect both capital and operating costs required to improve fuel economy. For such technologies, capital expenditures are expected to account for approximately one third of total costs. For incremental technologies, costs are assumed to be equal across all OEMs, given the well-understood and relatively well-developed nature of those technologies. In practice, though, some OEMs may have small near-term advantages in this area because of existing expertise in conventional ICE technology (internal combustion engine).

These cost curves are modified in certain sub-scenarios by introducing diesel and hybrid powertrains as additional CO_2-reducing technologies. For most OEMs, costs are lower in scenarios where diesel and hybrid technology is available. Availability of diesel and hybrid technologies differs by market. For example, diesel, which is already established in Europe, appears in all sub-scenarios for the European Union but is ignored in Japan. Also, while it is assumed that incremental technologies can be applied to all vehicles, ceilings are placed on the adoption rate of diesel and hybrid technologies, reflecting likely production and market constraints on their penetration over a 12-year period (see Table 9-1).

Table 9-1. Maximum assumed Diesel and Hybrid penetration rates in 2015, by market.

Market	Diesel penetration rate (%)	Hybrid penetration rate (%)
US	20	15
EU	65	15
Japan	n.a.	30

Moreover, for hybrid and diesel technology, we assume that manufacturing costs vary among OEMs according to level of expertise with these technologies. Using results from the Management Quality Assessment, which evaluates the OEMs' relative quality regarding the management of a portfolio of lower carbon technologies, we ranked OEMs in terms of their expertise with diesel and hybrid technologies (excluding fuel cell technology due to its expected low penetration rate and hence minimal contribution to CO_2 reduction through 2015). Leaders in each group were assumed to be able to implement the new technology at a 5 percent cost reduction, while laggards were assumed to incur a 5 percent cost penalty (see Table 9-2).

Table 9-2. Ranking of OEMs by technological leadership (source: Management Quality Assessment).

Technology	Leader (5% cost reduction)	Neutral	Laggard (5% cost penalty)
Diesel	PSA, VW	BMW, DC, Renault (Nissan), Toyota	Ford, GM, Honda
Hybrid	Honda, Nissan (Renault), Toyota	DC, Ford, GM	BMW, PSA, VW

2.2 Market-Specific Results

Costs for each OEM were determined for the United States, European Union and Japan. Results from each market are described below.

2.2.1 United States

For the United States, we evaluated two scenarios of equal weight. The low scenario was based on the conservative assumption that no further changes are made to CAFE standards over the next 12 years beyond the recent tightening for light trucks. This raises standards by 1.5 mpg for light trucks by 2007 to 22.2 mpg (249 g CO_2/km).

In the high scenario, fuel economy standards rose to 33 mpg and 25 mpg (167 g CO_2/km and 221 g CO_2/km), respectively, for cars and light trucks. These represent standards that the NAS finds will maximise net economic and social benefits and can be achieved using available or nearly available technologies (National Research Council 2002). Though a significant increase over today's standards, they still fall well below *current* standards in the European Union and Japan. Furthermore, these standards are in line with the levels that would be achieved in 2015 if the current CAFE increase of 1.5 mpg over 3 years for light trucks were extended at the same rate for all vehicles over this time frame.

Though there has been debate about the future structure of the CAFE program, we assumed that the distinction between imported and domestic vehicles disappears by 2015 for both scenarios. In addition, we assumed that the distinction between cars and light trucks would persist, but that the light truck category would expand upwards to include several large models of SUVs and pickups that currently are exempt from CAFE standards.

The costs of meeting a stricter CAFE standard vary widely among companies, because of the different vehicle mix and initial levels of average fuel economy (see Figure 9-2). Costs also vary significantly between the high and low scenarios. Ford, GM, BMW and DC incur the greatest additional costs per vehicle. Honda is virtually unaffected in either scenario.

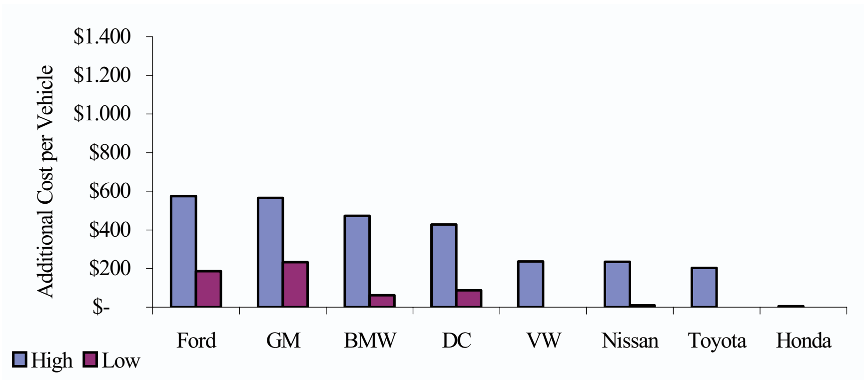


Figure 9-2. Cost *per* vehicle of meeting higher CAFE standards in the United States.

OEMs not shown do not have sales in the United States. Figures represent the costs of altering today's vehicles to meet the standards assumed for 2015.

2.2.2 European Union

For Europe, we evaluated a low scenario reflecting the first step of the ACEA (European Association of OEMs) agreement (140 g CO_2/km) and a high scenario in which CO_2 emissions standards are tightened to the 120 g CO_2/km rate that is the eventual goal of the agreement.

To date, the industry has not disclosed the working structure of its voluntary commitment, creating marked uncertainty for investors about its financial implications. For this analysis, we assumed in both scenarios that the target would eventually be binding on each OEM's fleet. A binding target reflects the strong interest of EU regulators in seeing the agreement succeed and their likely willingness to step in if it does not. If so, it is plausible to imagine a system that places equal responsibilities on individual OEMs, whether it requires each to meet the standard through emissions reductions in its own fleet or whether the standard can be met through some form of trading among OEMs of CO_2 reduction credits. However, until the structure of the agreement is fully disclosed, investors will remain uncertain about the financial consequences for OEMs: while a CAFE-like structure of a single target for each OEM would reward companies currently producing vehicles that are the least carbon-intensive, a structure based on proportionate reductions from current starting points would have the opposite effect.

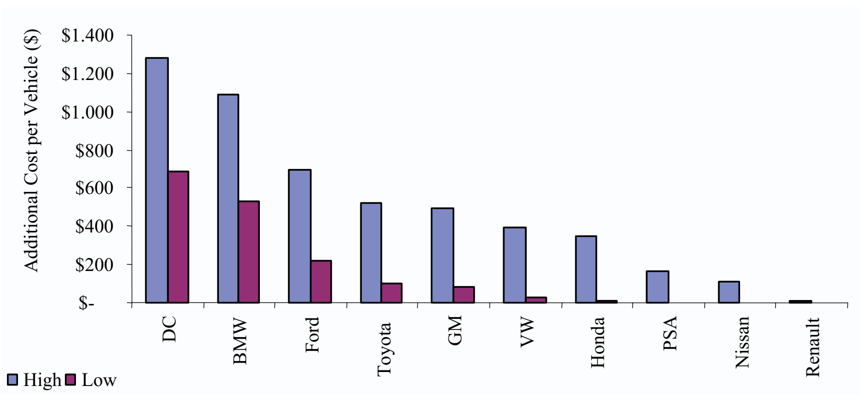


Figure 9-3. Cost per vehicle of meeting lower CO_2 emissions standards in the European Union.

Again, costs vary significantly by OEM (see Figure 9-3). DC and BMW have the highest additional costs per vehicle in both scenarios. Renault, Nissan and PSA stand out as having little or no new additional costs in either scenario. Note that the high figures represent manufacturing costs only. If OEMs rely on diesel technology to lower carbon intensity—as is expected—it is likely that they could recoup all or most of these costs given the price premium that currently exists for diesel technology.

Figures represent the costs of altering today's vehicles to meet the standards assumed for 2015.

2.2.3 Japan

For Japan, we evaluated a low scenario based on the 2010 standards, which a majority of vehicles are already in compliance with. In the high scenario, the recent rate of mandated fuel economy improvements was extended to 2015. This implies a 46 percent increase in fuel economy by 2015 relative to 1995 levels. Although this standard seems quite stringent, the implied trajectory of improvement is consistent with that required to achieve the government's goal of reducing transport emissions from the baseline by 17 percent to meet Kyoto targets. Moreover, given the number of vehicles that exceed the 2010 standard already, such a target seems feasible.

The Japanese government has established a clear preference for hybrid over diesel technology. Thus, we assume that only incremental and hybrid technologies will be adopted by 2015. Again, costs fall on OEMs to different degrees (see Figure 9-4). Ford and Nissan would incur the greatest additional costs if more stringent CO_2 emissions standards were enacted in Japan. There are virtually no costs incurred in the low scenario.

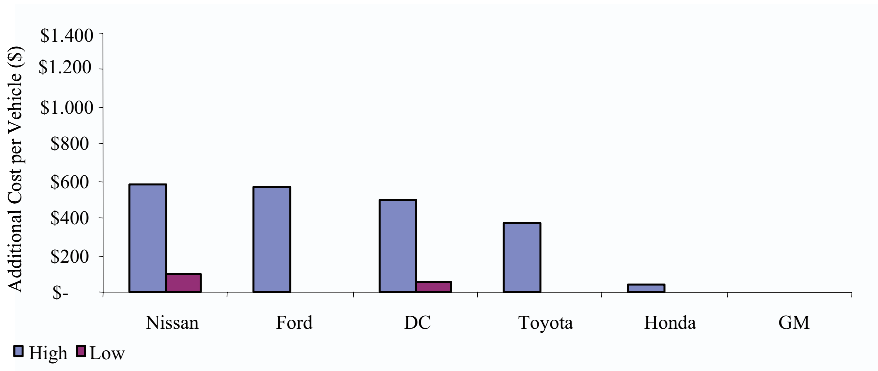


Figure 9-4. Cost per vehicle of meeting lower CO_2 emissions standards in Japan.

OEMs not shown do not have sales in Japan. Figures represent the costs of altering today's vehicles to meet the standards assumed for 2015.

2.3 Aggregate Results and Further Implications

Total costs to meet carbon standards in the major global automotive markets differ substantially among OEMs. The financial impacts for the separate markets were aggregated to identify the overall cost for each OEM to meet new standards in the markets in which it competes (see Figure 9-5 and Tables 9-3 and 9-4). Because OEMs have different product mixes with different carbon-intensity levels, the costs incurred in meeting new standards will vary across the industry. Our analysis shows that costs of compliance per vehicle will range from nearly $650 for BMW to less than $25 for Honda.

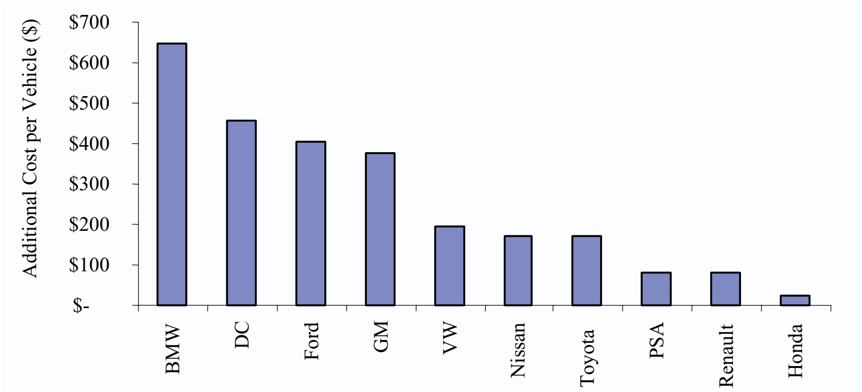


Figure 9-5. Estimated costs per vehicle to meet CO_2 emissions standards by 2015.

Table 9-3. Estimated costs per vehicle to meet CO_2 emissions standards by 2015, by market.

	BMW	DC	Ford	GM	Honda	Nissan	PSA	Renault	Toyota	VW
US	$267	$257	$380	$399	$2	$122	-	$122	$102	$119
EU	$807	$984	$455	$289	$175	$54	$82	$3	$314	$210
JP	-	$279	$287	-	$23	$340	-	$340	$190	-
Total	$649	$459	$403	$377	$24	$172	$82	$79	$170	$195

Average costs per vehicle reflect sales-weighted averages of costs in individual markets.

Table 9-4. Estimated total costs to meet CO_2 emissions standards by 2015, by market ($ millions).

	BMW	DC	Ford	GM	Honda	Nissan	PSA	Renault	Toyota	VW
US	$69	$642	$1,333	$1,869	$3	$50	-	$40	$177	$59
EU	$502	$957	$757	$336	$32	$19	$170	$3	$202	$554
JP	-	$10	$18	-	$18	$123	-	$98	$254	-
Total	$571	$1,609	$2,107	$2,205	$53	$192	$170	$141	$634	$613

Renault is attributed sales in US and Japan because of its 44 percent stake in Nissan.

Although mid- to long-term competitiveness in the industry will rest heavily on the successful development and commercialisation of diesel, hybrid and fuel cell technologies, our analysis indicates that the majority of the near-term carbon reductions are achieved by less-heralded incremental technologies that are already available.

3. MANAGEMENT QUALITY ASSESSMENT

Offsetting the risks, emerging carbon constraints create opportunities for OEMs to enhance their competitiveness by developing vehicles that produce fewer carbon emissions. The degree to which OEMs succeed in this depends on the quality of management decisions made with regard to lower-carbon technologies. One challenge for managers is to establish leadership in one or more lower-carbon technologies that may be vital for future profits. In addition, given that most OEMs compete in more than one of the three major automotive markets, each of which has its own technology preferences, another challenge is to ensure that the strategy for reducing carbon emissions is robust, or balanced, across the multiple technology pathways.

The Management Quality Assessment seeks to answer the following question:

Which OEMs have the strongest potential to capitalise on their investments in lower-carbon technologies and so benefit from carbon constraints?

We identified diesel, hybrid and fuel cell technology as key sources for future competitive advantage. The actual development of these technologies is only part of the challenge facing OEMs. OEMs also have to commercialise market and mass produce these technologies if they are to reap the full rewards. Consequently, an OEM's ability to capitalise on carbon constraints depends on a wide range of management attributes regarding lower-carbon technologies, beyond just technological development capabilities.

3.1 Methodology

The analytical framework we used to assess lower carbon management quality is based on a management competence model developed by SAM. For the purpose of this report, SAM Research's standard competence model was adapted to focus on OEMs' ability to derive competitiveness through strategies to achieve lower carbon intensities (or "lower-carbon strategies"). The quality of such strategies is driven by a core set of management competencies, including strategic, financial, governance, customer and product, human, and process (see Table 9-5).

The Management Quality Assessment focuses on the three technologies - diesel, hybrid and fuel cell technology - that are most likely to form the basis for long-term competitive advantage. We believe that there is less scope for an OEM to establish a competitive edge through lower-carbon technologies based on advanced gasoline engines and incremental technologies, given the mature stage of development of these technologies and widespread understanding of these technologies.

Table 9-5. Management competencies relevant for assessing lower carbon strategies.

Competence	Business Case	Core Indicators
Strategic	Alignment of lower carbon strategy to business strategy enhances strategic co-ordination and is essential to derive competitiveness from lower carbon technologies	Level of strategic commitment Level of strategic co-ordination Targets Milestones
Financial	Ability to fund development and commercialisation of lower carbon technologies is a key driver for turning lower carbon strategy into a competitive advantage	Cash position Level of R&D Expenditure Capital structure Access to capital Investor relations
Governance	Setting de facto standards in lower carbon technologies allow OEMs to capitalise on first mover advantages, such as enhanced pricing power	Ability to set de facto standards Market share License to operate
Customer & Product	Introducing a lower carbon technology ahead of competition holds strong potential for competitiveness, including brand equity.	Ability to derive brand equity Margins Market share Cross-selling Customer feedback
Human	Access to technology and ability to capitalise on intellectual capital through partnerships is essential for deriving competitiveness from lower carbon technologies	Number of patents R&D headcount Partnerships
Process	The ability to generate economies of scale allows to compensate development costs ahead of peers	Economies of scale Process efficiency Production flexibility Industrial ecology

The full set of competencies was assessed and evaluated for each of the three lower-carbon technologies. The six competencies were scored for each technology using a simple scoring system of 0 (Low), 1 (Medium), and 2 (High). The scores for the individual competencies were then aggregated (equally weighted) into a management quality score for each lower-carbon technology. In turn, the technology-specific scores for diesel, hybrid and fuel cell technology were aggregated (equally weighted) into an overall management score to provide an indication of overall management strength (see Figure 9-6).

Finally, though Nissan and Renault are treated as separate OEMs for the Value Exposure Assessment, they received the same management quality scores. This reflects their close alliance and the expected increasing level of integration and strategic coordination between the two OEMs over the next decade.

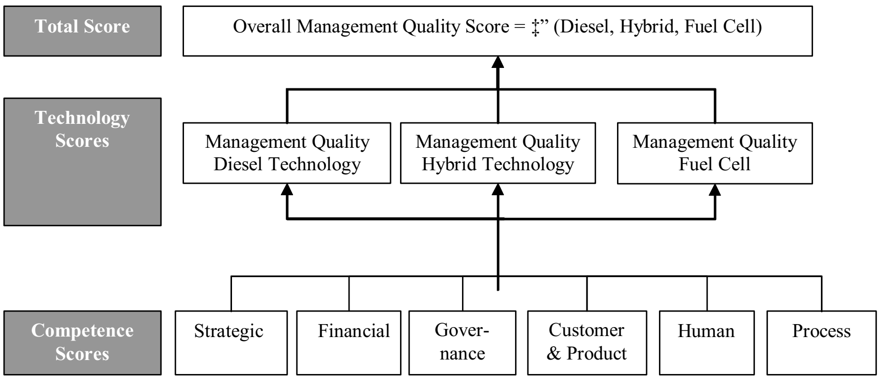


Figure 9-6. Structure of management quality assessment.

3.2 Technology-Specific Results

3.2.1 Diesel

Process competence and customer competence will be crucial for capitalising on diesel technology. Diesel is a relatively cheap and well-established lower-carbon technology. As a result, financial and technology development competencies are of increasingly less competitive relevance. Rather, the management challenge will be to maintain margins in the face of increasing competition through strong reputation, economies of scale, and flexibility of production. Consequently, management quality is reflected in a strong diesel sales base, high diesel margins, and cost leadership.

European OEMs are more competitive in diesel. VW's and PSA's market leadership in diesel is clearly reflected in their high management quality scores (see Figure 9-7). Among the non-European OEMs, Toyota and Ford appear to be the most interesting. Toyota has recently stepped up its efforts in diesel due to a more aggressive push into Europe, where diesel is key for growth, and in preparation for meeting new Tier 2 air quality standards in the United States from 2007 onwards. By cooperating with PSA, Ford may have an opportunity to improve its diesel capabilities quickly by leveraging economies of scale. As a result, Ford's process competence regarding economies of scale is a key driver for its management quality score.

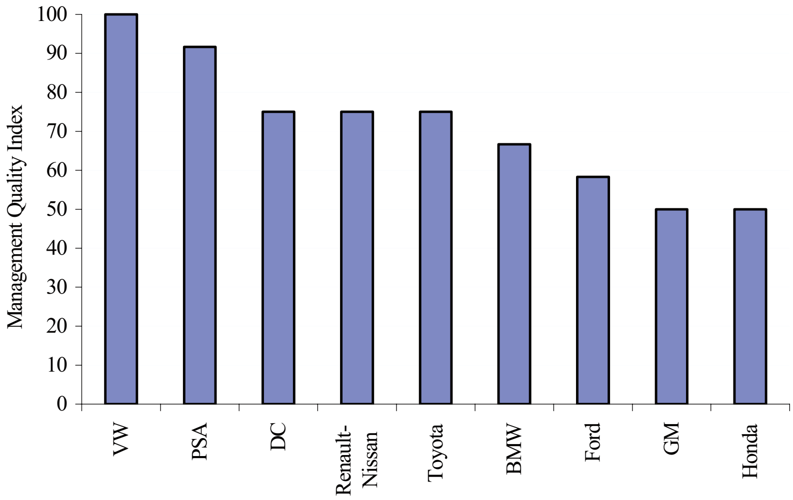


Figure 9-7. Management quality assessment: Diesel technology.

3.2.2 Hybrid

Financial, governance, and customer competencies will be important for capitalising on hybrid technology. Given the nature of HEVs as a relatively immature, emerging lower-carbon technology, the main challenges centre around high development costs and lack of customer acceptance. As a result, the strategic management challenge is quickly to recoup development costs and to grow a strong customer base. Accordingly, key characteristics of management quality are the ability to forge strategic partnerships as well as moving faster up the learning curve. These factors increase the potential to set de facto standards.

Japanese OEMs have a strong strategic position in hybrid technology. In contrast to Europe, the Japanese government has long expressed a preference for hybrid technology over diesel. This has allowed Japanese OEMs to establish early-mover advantages that are reflected in their management quality scores (see Figure 9-8). In addition, because of uncertainty regarding future technology pathways in the United States, US-based OEMs have recently stepped up their hybrid development. This is reflected in the slightly above average level of management quality. However, their ability to derive competitiveness from hybrid technology is still limited compared to their Japanese counterparts, who are the dominant players in this technology.

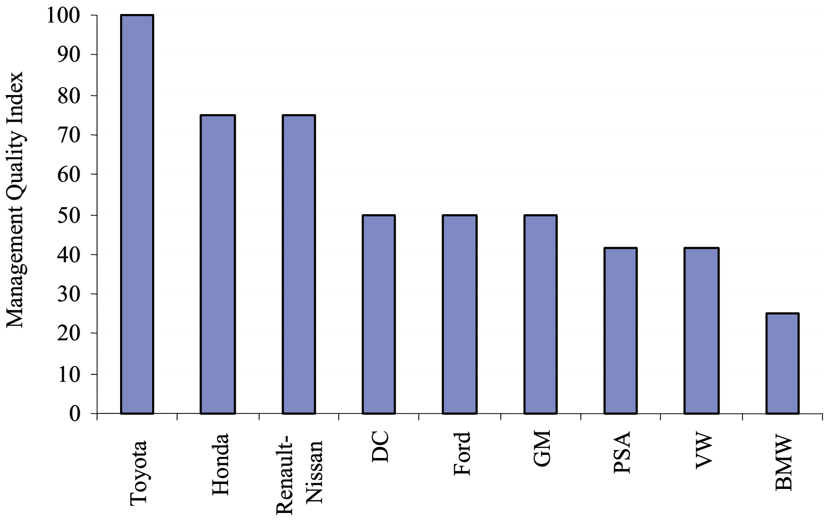


Figure 9-8. Management quality assessment: Hybrid technology.

3.2.3 Fuel Cells

Financial, governance and human competencies will be key for capitalising on fuel cell technology. Because it is still early days for fuel cells, a range of technology issues remain to be resolved. This will require continued financial and R&D commitment. Importantly, the challenge is to bring the technology to the market ahead of rivals in order to recoup development costs and benefit from first-mover advantages. The key aspects of management quality on fuel cells are strong institutional and human R&D capacity, resource allocation and the ability to work through strategic partnerships.

Two key partnerships are advancing fuel cell technology. As a result of these challenges, relative strategic positioning with respect to fuel cells is determined primarily by two main partnerships that have developed: DC-Ford and Toyota-GM. These tie-ups are designed to provide partners with a head start as the market for FCVs emerges (see Figure 9-9). Their strategies differ slightly. While DC and Ford are outsourcing development and future production of fuel cells to Ballard Power Systems, Toyota is working on a proprietary technology. If successful, this could be the source of valuable licensing revenue as other OEMs utilise the technology.

Based on the competence evaluation, the two dominant OEMs in this area are Toyota and DC. Given that BMW is not visibly pursuing fuel cell technology as a powertrain option, we have considered their efforts to commercialise a hydrogen-powered internal combustion engine. In an environment of uncertainty around the emergence of fuel/technology pathways, a hydrogen-powered ICE could prove a viable alternative to fuel cells. This explains the relatively high score of BMW in Figure 9-9.

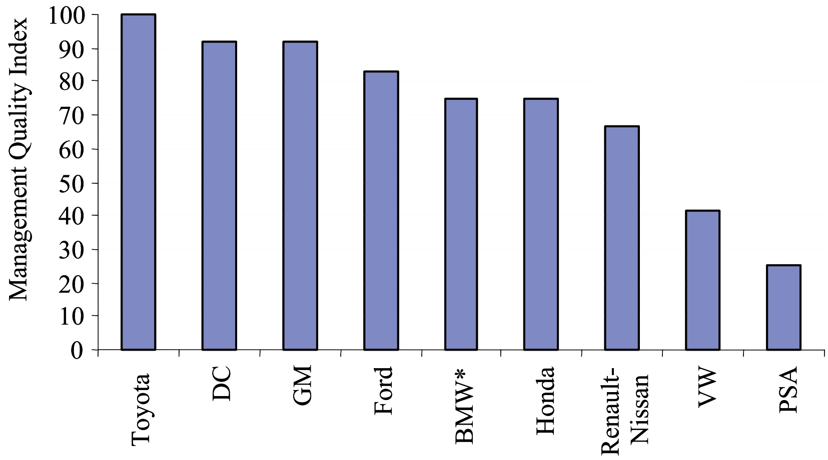


Figure 9-9. Management quality assessment: Fuel cell technology.

Management quality score for BMW reflects its development of a hydrogen-powered internal combustion engine.

3.3 Main Results

OEMs differ in the overall strength of their lower-carbon strategies. By combining scores across technologies, we derive an overall score for lower-carbon strategy for each OEM (see Figure 9-10). Toyota, DC and Renault-Nissan appear to have the strongest current management quality with regard to lower-carbon technologies. At the other end of the scale, PSA and BMW display the weakest management positioning regarding lower-carbon technologies.

Managementt quality score for BMW reflects its activities regarding the hydrogen-powered internal combustion engine.

Besides overall strength, an OEM's current strategy with regard to carbon constraints may be more or less robust (or balanced) across alternative technology pathways. Based partly on prevailing regulatory regimes in their most important markets, OEMs have developed different preferences for lower-carbon technologies. Figure 9-11 reflects the strategic choices made by OEMs. While most European OEMs display a strategic bias toward diesel, US-based OEMs focus on fuel cell technology. Toyota and Honda show most bias toward hybrid technology. Renault-Nissan stands out among

OEMs as having one of the more balanced lower-carbon strategies, reflecting the alliance's strategic fit and competitive potential.

Management quality score for BMW reflects its activities regarding the hydrogen-powered internal combustion engine.

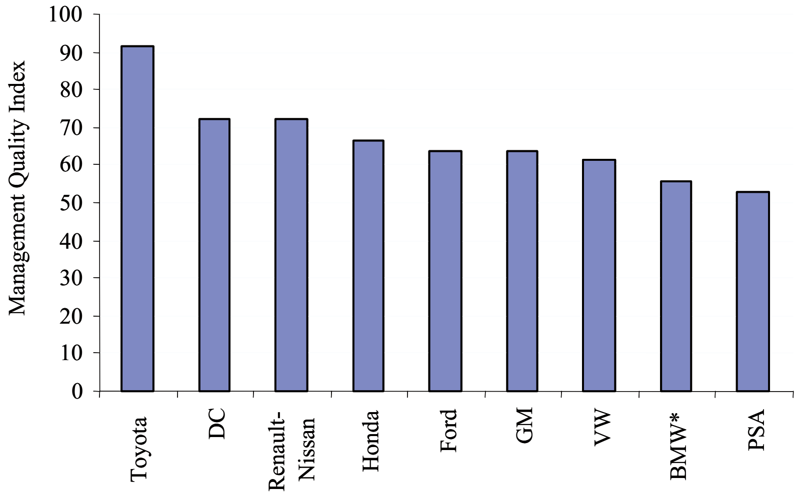


Figure 9-10. Management quality assessment: All lower-carbon technologies.

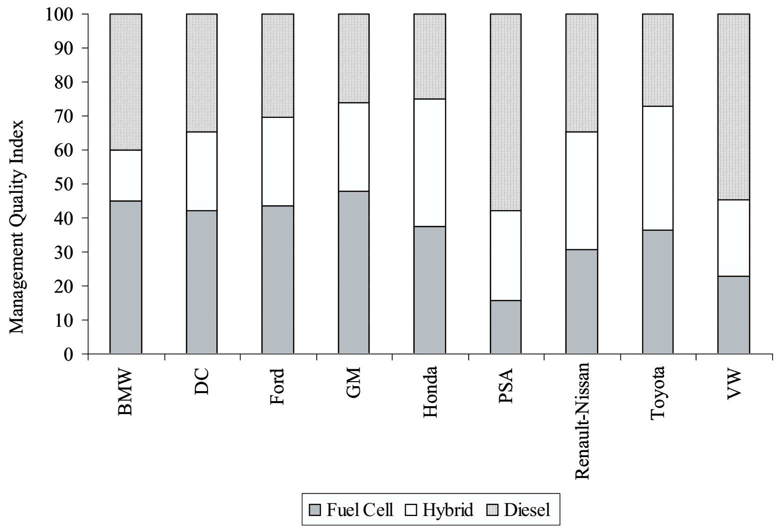
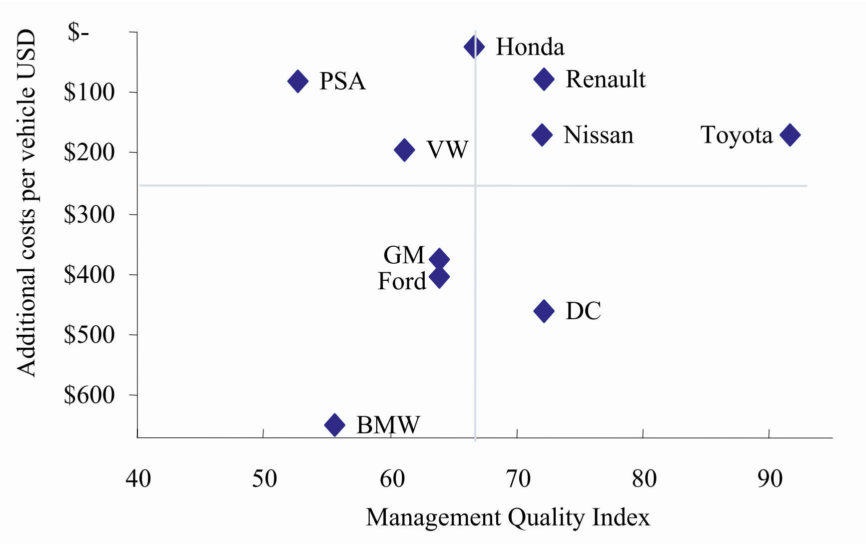


Figure 9-11. Relative robustness of management quality across lower-carbon technologies.

4. AGGREGATE RESULTS

The Value Exposure Assessment estimates the costs in dollars that carbon constraints could impose on OEMs. The Management Quality Assessment ranks OEMs on their potential to capitalise on carbon constraints. Combining the two results provides a two-dimensional matrix upon which OEMs can be mapped (see Figure 9-12). Risk reflected by the Value Exposure Assessment is measured on the vertical axis, while opportunity captured by the Management Quality Assessment is measured on the horizontal axis. The top right quadrant (low value exposure – high management quality) represents above average performance on both criteria.



The lines indicate industry averages in each category.

Figure 9-12. Quantification of the risks (value exposure) and opportunities (management quality) of carbon constraints.

OEMs vary considerably with respect to both value exposure and management quality around carbon constraints. This indicates that carbon constraints have the ability to influence competitive balance within the industry.

Honda, Nissan, Renault and Toyota appear to be the OEMs most strongly placed to meet the challenge of carbon constraints, with above average management quality scores and lower than average expected costs. In particular, Honda faces least immediate risk from carbon constraints as the current high fuel efficiency of its vehicles implies only minimal costs to meet anticipated carbon constraints. In addition, Toyota emerges as the clear leader on carbon-related management quality with a strong position in all three technologies that will be key for long-term competitiveness.

BMW stands out as having the greatest value exposure, though this may be somewhat misleading. BMW is the smallest of the 10 OEMs reviewed and produces exclusively premium (and high cost) vehicles. Consequently, BMW has a greater ability to pass on those costs to consumers than do other OEMs. PSA has the weakest management strategy regarding carbon constraints, which may limit its ability to exploit opportunities even though it faces low expected costs.

Ford and GM both have above average value exposure and below average management quality regarding climate risks. Their value exposure is driven principally by the relatively low fuel efficiency of their current vehicle mix. While much of this is due to their leadership in the carbon-intensive segments of the US market, which may not face immediate constraints, their current bias towards heavy vehicles coupled with below average positioning on hybrid and diesel technology may limit their near-term competitiveness in non-US markets.

5. IMPLICATIONS FOR VALUE CREATION

A key challenge for analysts is to determine the implications of these findings for earnings, return on invested capital (ROIC) and thus shareholder value creation. In this section, we tentatively translate the results of the Value Exposure and Management Quality assessments into changes in forecasted EBIT (earnings before interest and taxes) for the period 2003 to 2015. EBIT is a foundation for valuation estimates in this sector and so changes in an OEM's EBIT offer useful insights into possible changes for overall shareholder value.

Converting our cost estimates and management quality scores into EBIT figures sets our results in the context of existing and projected business performance. Though this adds confounding factors to our initial results, it nonetheless represents the basic challenge facing investors: to understand the additive effect that carbon constraints may have on each OEM's financial position.

Value Exposure translates into reductions in EBIT. As the results of our Value Exposure Assessment are denominated in dollars, it is relatively easy to integrate these into existing financial valuation models. Carbon-related costs will increase the costs of goods sold (CoGS) and so reduce EBIT.

Management Quality could affect multiple financial metrics. As an indication of how analysts might use these results, we translate scores from the Management Quality assessment into changes in EBIT margins in order to integrate them with the results of the Value Exposure assessment. We assumed, for simulation purposes only, that the OEM with the strongest management quality (i.e., Toyota) would see its projected EBIT margin increase by 20 percent, while the OEM with the weakest management quality (i.e., PSA) would see no change in its projected EBIT margin. For the remaining OEMs, changes in EBIT margin lay in between these two extremes based on their relative management quality scores. Integrating this strategy premium into the EBIT forecast reveals a significant upside effect, reflecting the potential to establish a competitive advantage through lower-carbon strategies.

We developed a simple model based on the SAM Sustainability DCF (Discounted Cash Flow) model to forecast the impacts of value exposure and management quality for each company's discounted EBIT from the period 2003 to 2015 (see Table 9-6). Information on recent years' cost and EBIT margins was combined with SAM and Deutsche Bank forecasts for sales growth and changes in EBIT margins to derive a baseline EBIT forecast. This baseline reflects important differences in OEMs' fundamental business performance. For example, some OEMs, like GM and Ford, are expected to see slower than average sales growth in the coming years as others compete for their profitable SUV segment. Additionally, some OEMs, such as BMW and Toyota, are expected to retain higher EBIT premiums because of such factors as quality and reliability.

Table 9-6. Influence of carbon constraints on discounted EBIT, 2003-2015 (percentage change).

	Impact of Value Exposure Assessment (risk)	Impact of Management Quality Assessment (opportunity)	Combined Impact
BMW	–4	1	–3
DC	–6	7	1
Ford	–14	4	–10
GM	–11	3	–7
Honda	0	3	3
Nissan	–1	4	3
PSA	–2	0	–2
Renault	–2	6	4
Toyota	–1	10	9
VW	–3	2	–1

These combined results are presented in Figure 9-13 to show the range of possible effects on EBIT, in terms of percentage changes from business-as-usual EBIT projections. The upper limits reflect the results from the

Management Quality Assessment alone, while the lower limits are results from the Value Exposure Assessment alone. The points indicate our estimate of the combined impact of both assessments on EBIT.

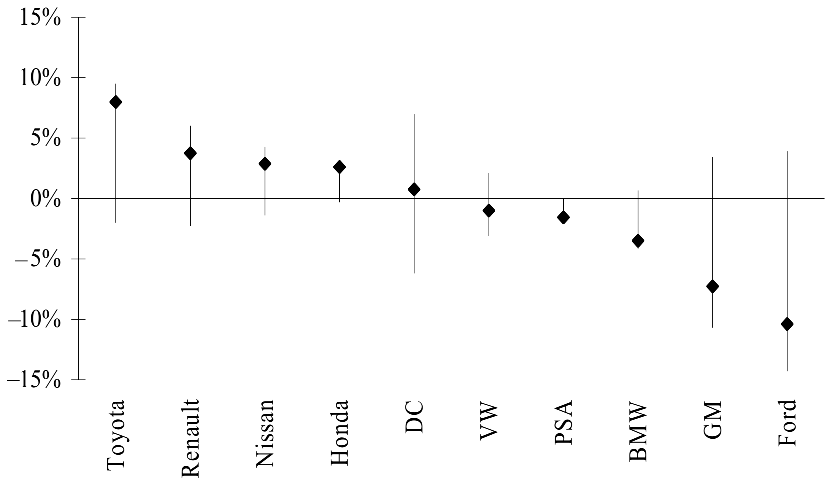


Figure 9-13. Potential impact of carbon constraints for EBIT (2003–2015) based on value exposure and management quality assessments.

Combining value exposure and carbon strategy scores into a single EBIT measure demonstrates once again that carbon constraints could significantly affect the competitive balance within the industry. Changes in EBIT forecasts range from a 9 percent increase to a 12 percent decrease. Toyota's position as leader is reaffirmed, while Ford has the weakest result.

6. MAIN CONCLUSIONS

Though the shape of future carbon constraints and the stringency with which they will be enforced are uncertain, there is every indication that they could have a profound effect on the competitive balance in the industry.

In the short term, carbon constraints could present the industry with new cost burdens that vary among OEMs. In particular, we find that BMW (with estimated costs of \$649 per vehicle) may have to spend twenty-five times more per vehicle to meet carbon constraints than Honda (\$24 per vehicle). Some of these costs could be recouped by price premiums for diesels and hybrids, both of which offer additional attributes that drivers may value. Even more of these costs could be recouped if more consumers were to account properly for fuel cost savings, though this varies from market to market.

In the mid- to long-term, carbon constraints will also raise the competitive significance of vehicle and engine technologies that offer improved fuel efficiency. This is an area in which OEMs are very differently positioned. Toyota stands out as best-positioned on these issues overall. In contrast, BMW and PSA are in the weakest positions. Certain OEMs show additional strengths and weaknesses with respect to particular lower-carbon technologies.

While the findings refer primarily to carbon constraints, they also shed light on how OEMs may perform in response to other pressures that would lead consumers or regulators to value fuel economy more highly (e.g., energy price rises or renewed energy security concerns). Indeed, consumer and policy responses to energy market shocks may play out considerably more rapidly than the steady progress in carbon regulations envisaged in this report, potentially making manufacturing adjustments more awkward. If so, the impacts on OEMs—whether positive or negative—may be more extreme than reported here.

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Chapter 10

TRADITIONAL ACCOUNTING RETURN RATIOS AND BUSINESS SUSTAINABILITY

An Incompatible Relationship in the Context of Greek Strategic Business Units

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Abstract: The pursuit of sustainability in business practices has necessitated the *integrated assessment* of corporate economic, environmental and social performances. Continuous technological, political and legal evolutions enforce the implementation of Sustainable Development (SD) principles in major sectors of Greek corporate reality. However, the ultimate criteria for the evaluation of a company's performance remain its profitability and market value. Interesting parties emphasise and base their credit and investment decisions on various accounting ratios of return produced on data disclosed in the financial statements of companies. This paper analyses how the traditional accounting ratios, discourage the implementation of investment plans that aim to improve the environmental performance of companies and therefore can prove inadequate and misleading for SD applications. With few exceptions, most international studies have recorded a positive relationship between the environmental performances of proactive firms and their financial positions and market values in the long run. This fact has consistently been disregarded in the computation of the return ratios, widely used in the Greek context to set up the basis for management rewards and bonuses. The divergence of the real market value of a corporation from the book value on which ratios are based indicates the urgent need for adjustment to the return ratios so that they can record the positive economic impact of sustainable actions and encourage decision makers in this direction. This article offers recommendations about how such an adjustment can be achieved while the company works within traditional accounting principles.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 231-250.

1. INTRODUCTION

Companies are being encouraged to move towards greater sustainability in their operations. The drivers of attitudinal change may be internal or external, local, national or international, general or sectoral, statutory or voluntary. For Greek companies such drivers include:

- The EU Recommendation (Commission of the European Union 2001: 33ff.) for disclosure of the environmental impact of corporate activities in their annual reports
- The implementation of the White and Green Books (respectively on Environmental and Social Liabilities of companies), adopted by the European Commission (Commission of the European Union 2002)
- The Integrated Pollution Prevention and Control Directive (Commission of the European Communities 1996) on the competitiveness of European Industry, with its implementation deadline in 2007
- The increasing number of certified Environmental Management Systems (EMS) such as ISO 14001 and EMAS, required by companies interested in expanding their operations internationally
- The recent Greek Law 3016 (Greek Parliament 2002) on Corporate Governance
- A number of international general and sectoral initiatives, such as the TOI (Tour Operators Initiative) in the field of tourism and the GMI (Global Mining Initiative by the World Business Council for Sustainable Development WBCSD and the International Institute for Environment and Development (IIED)), two sectors on which the Greek economy is heavily dependent
- The GRI (Global Reporting Initiative), a joint effort by UNEP (the United Nations Environmental Programme), EU (the European Union) and WBCSD presented at the World Summit on Sustainable Development conference (WSSD, Johannesburg, August/September 2002). The initiative's mission involves the development and dissemination of globally applicable sustainability reporting guidelines, to help those companies interested in pursuing sustainability. A limited number of Greek companies have already expressed an interest in applying GRI guidelines in the disclosure of their environmental and social performance
- The fact that major Greek Banks, such as the Commercial Bank of Greece and Alpha Bank have recently joined the UNEP-FI (United Nations Environmental Programme-Finance Initiative), with the stated purpose of improving their own corporate ecological efficiency, evaluating environmental risks as part of their normal risk assessment process and encouraging voluntary agreements with their stakeholders aimed at

strengthening environmental awareness and preventing environmental degradation (UNEP-Finance Initiative 2004).

One impact that these drivers have in common, is the requirement they place on Greek companies to proceed with investment in new processes, purchase of new technology and the hiring or training of personnel to operate and support these processes, i.e. expenses. Investment activities in the context of this paper refer to a company's acquisition and maintenance of tangible or intangible non-current assets, for the purpose of conducting its business operations. Expenses refer to all non-capitalised expenditures made in the proper course of operations, to allow the company to generate revenue (Wild et al. 2001). Companies can proceed with proactive investments to achieve process optimisation and increase their economic and environmental efficiency. They can also operate reactively, investing in capital intensive end-of-pipe technologies, which incur high operating costs and usually do not generate any revenue (Schaltegger and Figge 1998).

The modern definition of environmental costs shifts emphasis from the traditional "monetary measure of the resources consumed by a product, service, function or activity" (Ansari 1997:20) to the extended "physical measure of the material and energy flow that can be systematically assigned to inputs, processes and products" (Letmathe and Doost 2000:426). Any attempt to define a cost as environmental is rather problematic since in many instances it is difficult to distinguish between the purely environmental and partly (or non-) environmental components. Nevertheless, because of the increasing importance of environmental factors, it is not sufficient merely to disregard the problem. Strong environmental performance will become a significant determinant of the future survival and success of the business and accountants must redefine their positions, taking a proactive and extrovert role in their organisations (Karatzoglou 2002). In its transition to a more sustainable approach, company management will have to balance the company's environmental aspirations with the capital base and the financial strength (Crosbie and Knight 1995). Different companies will adopt different environmental and financial strategies. At the lowest level such strategies will be compliance driven, reactive and struggling to meet the minimum requirements of the law. At the highest level, companies will shift the emphasis towards measures that lead to the reduction in both environmental risk and resource use. These companies will be the only ones to embark on a proactive journey towards sustainability. The distinction between the different strategies is related to the classification of the costs involved. The more reactive a company, the more it treats environment-related outlays as expenses. The more proactive a company, the more it treats the same costs as investments. Corporate choice of environmental strategy is an internal decision which soon has an impact on the market value of the whole company. This leads to the question: what happens when different divisions of the same company with one uniform publicly proclaimed environmental strategy adopt different environmental practices in order to manipulate divisional financial performance measures? The following paragraphs provide an answer to this question as well as policy recommendations on how to alleviate the problem raised.

2. A COSTING APPROACH TO SUSTAINABILITY

The effective implementation of organisational strategy requires that all company divisions share the same corporate goals and are held responsible for the accomplishment of those goals. The company's accounting system measures the contribution of each division to the corporate economic value-added. When these divisions are organised using a strategic dimension, such as customer type, product type or technology applied, they are called strategic business units (SBUs). 'Divisionalisation' has clearly added to the flexibility, autonomy and accountability of management in each SBU but can also lead to friction between different divisional managers in the same company, as they act in their own division's best interest and disregard the interests and strategy of their corporate organisation (Brandon and Drtina 1997).

An large number of major Greek companies from sectors critical to the Greek economy such as the food and beverage sector, the textile and apparel sectors, the banking sector, the construction and the hospitality industries, operate with divisions scattered all over the country. From the 5,603 Greek manufacturing companies 1,267 (22.6%) operate decentralised units within Greece (ICAP data base, <:http://www.icap.gr/financial/guide/1_gif.asp?lang = 1>). All banks and other financial institutions maintain branches on a country-wide basis and the same observation applies for a considerable number of merchandise companies and for over fifty hotel chains. In responsibility accounting terms, SBUs are treated either as profit centres or as investment centres. Though the managers of both these types of centres have autonomy in deciding what types and amounts of costs to incur in order to generate revenue and thus profit, only the investment centre managers are responsible for controlling the amount of investment their profit centres require. The most common measure of profit centre performance is Return on Sales (RoS, or the net profit ratio) while for an investment centre the most typical performance measure is Return on Investment (ROI). The company-wide accounting system has the crucial role of charging each SBU with the expenses incurred by their operations, as well as with an allocated part of general and other corporate expenses. Most decisions related to such charging processes have an impact on the RoS and ROI measures of the SBUs.

Depending on their causal links to outcomes, costs can be recognised as engineered, committed or discretionary. *Engineered* costs are variable costs, largely determined by levels of expected activity and make up a minor percentage of sustainability related costs. *Committed* costs are binding for the SBU managers who cannot negotiate or reduce them and therefore cannot be held accountable for them. (Brandon and Drtina 1997, Garrison and Noreen 2000). Compliance or regulatory costs offer a typical example of committed costs and constitute the biggest proportion of environment related expenses for a reactive company. For a proactive company, the major part of such expenses falls in the *discretionary* cost category with no clear relationship established between cost input and product output. Such voluntary costs mostly stem from societal, cultural or business causes, are incurred by an organisation on its own initiative, and aim to meet customer expectations or create goodwill (Ansari et al. 1997). Being non-compulsory, such costs are prime candidates for cutting when budgets become tighter. Scaling back or eliminating these costs will benefit short-term economic divisional goals but will also pose a hazard to long-term corporate strategy. The characteristics of discretionary costs include a dominating fixed nature; difficulty to measure value-added; and an input-output relationship that cannot be standardised. So, when the performance of a division is measured and evaluated with accounting data, management will continually evaluate the trade-off between the incurrence of further discretionary costs and the expected benefits. This presents a rather unfortunate evaluation for the sustainability cause, since costs will be immediate, certain and measurable while benefits will be postponed, probable and non-quantifiable.

3. A PERFORMANCE MEASUREMENT APPROACH TO SUSTAINABILITY

A performance measurement system provides management and other interested parties with feedback about how well corporate objectives have been attained. The theme underlying the use of measures is that people will act in accordance with the way their actions are being measured. Comparing the actual with the targeted performance for a SBU, provides an indicator of its management's *effectiveness*. The ratio of the input required (resources consumed) to achieve actual output is a measure of *efficiency* (Brandon and Drtina 1997). Recent developments, including the interest in quality and continuous improvement as well as regulatory, societal and other external stakeholder requirements, encourage businesses to focus attention on the simultaneous consideration of financial and non-financial performance measures (Bartolomeo et al. 1999). Various schemes, such as the Balanced Scorecard (Kaplan and Norton 1996), the Baldridge Quality Award (1987) and the European Quality Award (1991), provide templates and organised procedures for their application. Since these schemes offer approaches addressing how to link strategy with operational and non-financial corporate activities, they were soon modified and proposed as being strategic management tools, integrating the three pillars of sustainability into a single overarching measurement system (Figge et al. 2002, 2003).

The *first step* for setting up a performance measurement system is to derive the key variables for every SBU. Key variables gauge high-risk activities that can disrupt the accomplishment of corporate strategies. The previously mentioned list of drivers of sustainability in the Greek context (Section 1) convincingly indicates the emerging necessity for Greek companies to include sustainability related activities among the key variables being monitored by the firm. On the other hand, Greek corporations suffer from very low levels of competitiveness and Greek industrialists have expressed serious reservations as to whether the Greek and the European economy can proceed unilaterally to pursue sustainability without further aggravating their world market share and competitiveness (S.E.B. 2004). This means that maximising shareholder value remains the top-priority, but productivity, quality and environment are gradually becoming equally important concerns. The loosely used term "*shareholder value*" in this context is defined as the present value of a company's future cash flows, discounted at an appropriate rate (Bartolomeo et al. 1999, Wild et al. 2001). Since the environment can potentially affect all the parameters in this equation, i.e. the investment level, the cost of capital, future expenses and revenues, it is an important element to be considered in the relevant calculations (Schaltegger and Figge 2000). This is especially true in countries with organised and extended capital markets, which have a strong impact on the economy as a whole. However, the Greek capital market does not exactly match this description. Its shallowness and immaturity produce excessive reactions (volatility) and result in extreme fluctuations in the market value of the companies, making it particularly important that companies properly and accurately estimate the impact of their strategic decisions in advance.

The *second step* for setting up a performance measurement system is to associate specific measures with each key variable and assign ideal values to each measure. Literature indicates that the measures and values chosen should be controllable, attainable, error-free, timely, understandable, homogenous among divisions, and cost-effective (Brandon and Drtina 1997, Simons 2000). The last two qualities are debatable for at least two reasons.

First, although the legal framework is uniform throughout Greece, its enforcement is poorer in certain regions, either because of incompetent authorities and inadequate controls, or as a way of attracting direct investment, circumstances that in both cases result in lower environmental standards. Second, divisions of the same company, operating in different regions, may have varying environmental performance levels because of differences in size, manufacturing or production processes, or in local characteristics. The headquarters' requirement that all divisions conform to the same higher standards may result in value enhancement at the corporate level but definitely will not be equally cost-effective for, and will have a different impact on, the financial performance of the SBUs. The opposite will be true if all divisions are allowed to adopt lower, locally acceptable environmental standards. Such practice will result in cost-effective divisions but also in declining corporate reputation and shareholder value.

3.1 The Traditional Return Measures

In accounting terms, business success is measured by the firm's ability to generate profits. Profits allow a company to acquire resources to invest in future opportunities, pay higher dividends to investors and enjoy higher stock prices. Ratio analysis is among the most popular and widely used tools of financial analysis (Wild et al. 2001). Ratios provide meaningful economically important relationships between financial statement elements. Ratios are easy to calculate but difficult to interpret. Limitations and inherent weaknesses in accounting measurements, adjustment requirements and unreliable monitoring mechanisms have a further impact on the credibility of ratios. This is particularly true in the case of sustainability when accounting data that relate to the past are used to evaluate and manage a concept which by definition refers to the future. The International and the UK Accounting Standards Boards (IASB and UKASB) have already acknowledged that the "bottom-line" is not a particularly useful number because it aggregates a whole range of components of financial performance and because of the ambiguity inherent in the definition of "operating earnings". Both Boards are currently working toward the development of a single statement of comprehensive income (IASB 2002). Yet, this "bottom-line" figure provides the basis for practically all the return ratios used by Greek companies in their annual reports for illustrating corporate performance and, at an intra-company level, for evaluating the performance of their SBUs. The first claim is easily supported by the fact that all major Greek financial data banks, such as ICAP (<:http://www.icap.gr>), STAT Bank (<:http://www.statbank.gr>) and Naftemporiki, classify companies based on these ratios. The same ratios are used by commercial banks and Development Laws as the primary evaluation criteria to assess company prospects. Greek companies are particularly reluctant to disclose information about the way they perform intra-company (SBU) comparisons and evaluations. Thus, the second claim can only be validated by the author's personal experience and research (Kakarelis and Karatzoglou 2003).

The most important measure for investors is Return on Investment (or ROI). ROI is a ratio measure of the profit output of the business expressed as a percentage of financial investment inputs:

$$\text{ROI} = \text{Net Income/Investment in Business} \qquad (1)$$

Because of the accounting equation, according to which assets always equal liabilities, ROI equals ROA (Return on Assets) and operates as an indicator of the efficiency with which the assets of the company have been used. Contrary to the notion prevailing in relevant international studies, managers too often consider environmental investments as counter-productive and as forcing companies to commit resources and manpower to non-productive uses, thus resulting in a lower ROA (Haveman and Christiansen (1981) cited by Dowell et al. 2000). From the management perspective the most appropriate internal measure for Return should be Return on Equity (or ROE), a ratio of the income made by a company or division expressed as a percentage of the shareholders' equity portion of the balance sheet:

$$\text{ROE} = \text{Net Income/Shareholders' Equity} \qquad (2)$$

Both ratios derive their numerator from the Income statement and their denominator from the Balance Sheet. A newer measure of value creation that goes one step further than ROI and ROE is the Residual Income, a measure of how much additional profit remains in the firm after subtracting the normal cost of capital used:

Residual Income = Accounting Profit *less* Charge for Capital Used to Generate Profit (Value of Assets Used * Expected Rate of Return on Those Assets) (3)

Finally, SBU managers are often held accountable for a variant of ROE known as Return on Capital Employed (or ROCE):

$$\text{ROCE} = \text{Net Income/Capital Employed} \qquad (4)$$

where capital employed refers to the assets within a manager's direct span of control. Involvement of a SBU manager in the adoption of more sustainable operations will result in a decrease in the Net Income (profit) component found in all the above ratios and therefore to a deterioration of the perceived performance of his/her division and of his/her personal reputation. The decline of the Net Income will result from the 'internalisation' of externalities, i.e. those costs which originate from the operations of the division but have been traditionally imposed on entities external to the corporation, such as the society and the environment (Epstein 1996). Such costs may take the form of increased operating expenses (employee training, health and security measures, social concerns, better design of products and processes) or of capitalised expenses (investment in tangible and intangible assets to protect, benefit or remediate the environment) that will flow in the Income statement through the depreciation or amortisation process. In the case of capitalised assets, the denominator of ROI and ROCE will increase, further aggravating recorded performance. Therefore investments in environmental improvements will result in a decline of the perceived profitability of the division and potentially of the whole corporation. This statement does not disregard the fact that certain environmental improvements may have a beneficial effect on a company's economic performance. Yet, most of these improvements would have been undertaken by managers, with environmental gains as side-effects of a purely economic decision, if management had access to relevant information and funds. The fact is that an indefinite number of pollution prevention activities cannot continuously increase the economic performance of any company and net marginal benefits will soon decrease since all rational managers will start by investing money on the activities that provide the highest return (Schaltegger and Synnestvedt 2002)

3.2 Accounting Value vs. Market Value

While by definition traditional accounting based performance measures produce a negative linkage between environmental management and economic firm performance, a number of empirical studies (Arlow and Cannon 1982, Capon et al. 1990) have found either no correlation, or an unclear correlation between corporate social responsibility and financial performance. Yet, most recent academic and empirical research concedes that financial performance, and by inference the market valuation of a firm, is positively affected by strong environmental performance (Hart and Ahuja 1996, King and Lenox 2001, Klassen and McLaughlin 1996, Porter and van der Linde 1995, Welford 1993). The observed relationship between environmental performance and market valuation takes place through both revenue and cost pathways. On the revenue side, customer preferences for the products of environmentally orientated companies allow such companies to enjoy market differentiation, competitor advantage and price premiums. On the cost side, benefits mostly result from increased efficiency (Schaltegger and Burritt

2000, Schmidheiny 1992), avoidance of potential liabilities, better positioning to meet or exceed standards and creation of entry-barriers to potential competitors. McGuire et al. (1988) found that this positive correlation relates to historical, rather than future, economic performance but raised the issue of causality between high profits and social concerns. Hart and Ahuja (1996) found that increasing pollution precedes poor financial performance by one or more years while King and Lenox (2001) provided statistical evidence that environmental performance is associated with financial performance rather than being the outcome of some other underlying firm attribute. Stage of technological development, long-term or short-term orientation to the environment, size of the firm, regulatory regime and industry in which the firm operates, as well as the frequency of events and stakeholder pressure, all have an impact on the intensity of the economic-environmental relationship. The fact that all these are dynamic, constantly changing factors shifts the question from "does it pay to be green?" to "when does it pay to be green?" (Reinhardt 1999), and to "which is the optimal combination of environmental protection activities that a company should undertake to maximise its market valuation in the most economically efficient manner possible?" (Schaltegger and Synnestvedt 2002, Schaltegger and Figge 2000).

The market valuation, or corporate value, concept in this paper is based on *present value theory* which states that the value of debt or equity securities (and thus of the assets they represent) is equal to the sum of all the expected future payoffs, discounted to the present at an appropriate discount rate (Wild et al. 2001). The market value is determined as the discounted net current value of a company's future free cash flow (FCF), i.e. the cash flow from the company's activities that is left to pay the providers of both equity and borrowed capital:

$$\sum_{n=1}^{n=\infty} FCF \frac{1}{(1+i)^n} \text{ (Schaltegger and Figge 2000)} \qquad (5)$$

Evaluation of business prospects combines elements of past-related financial (accounting-based) analysis as well as of future orientated business environment and strategy analysis. Market actors continuously scrutinise companies within the environment in which they operate to assess how successfully they have established a competitive advantage. Accordingly, accounting data provide only part of the basis upon which market actors evaluate a firm, while investor expectations, growth prospects and perceived risk provide additional considerations that have an impact on the expected annual free cash flows and the discount rate elements of the free cash flow formula. The more investors base their evaluation on future prospects, the more irrelevant traditional return ratios become for measurement and appraisal reasons. Assuming that the semi-strong form of the Efficient Market Hypothesis holds (Fama 1970), the market continually values and assesses all public information related to the firm's environmental performance and its expectations are reflected in the equity value of the firm. Thus, the publicly traded share price includes information about the current and the expected financial performance of the firm in an overall 'intrinsic' valuation. The unanticipated portion, i.e. the actual return less the amount expected according to some fundamental investment analysis, is the *surprise* element and follows the random walk hypothesis and therefore is not correlated with any publicly available information (van Horne 1992). Unlike positive events, such as investment in new environmental technologies or a sustainability award received by the firm, environmental crises tend to generate follow-up publicity that can result in a far more significant, negative change in the market valuation of the firm. Even if the damages are covered by insurance, loss of public trust and customer goodwill have ramifications for future corporate profitability (Klassen and McLaughlin 1996:1209). Observation of the equity beta (an indicator of systematic risk) of sustainable firms shows that change in market valuation is not accompanied by an increase in risk. Environmental management is linked to both corporate and functional strategies and, through market gains and cost savings, affects corporate financial performance. When made public, it alters investors' valuation of the firm's stock price. And stock price is a proxy for financial performance, representing actual financial benefits for the environmentally conscious firm (Klassen and McLaughlin:1212).

3.3 Management Reservations about Sustainability

Since environmentally proactive companies benefit in terms of market value, why do some managers not pursue relevant opportunities? "When managers see that their execution of socially responsible policies and programs is evaluated in promotion and compensation decisions, along with meeting familiar profit, cost and productivity goals, they will be motivated to address all of these factors. For obvious reasons, middle managers "…appraise responsibility in terms of two familiar criteria. The first is what is measured and the second is what is rewarded" (Ashen (1980) cited by Gray 1993:160). Not many companies worldwide, and specifically in Greece, have organised their appraisal and reward systems in the way described above. Even those that do so, face serious problems when financial and environmental criteria conflict, and most of the time the traditional financial measures dominate the environmental ones (Gray 1993). A possible explanation lies in the fact that research into the links between environmental improvements and financial gains has not been convincing. Although the findings of both academic and empirical research referred to in Section 2 suggest that investments in environmental management lead to a substantial reduction in the perceived risk of a firm with an accompanying increase in its stock price, businesses still doubt whether pollution reduction enhances financial performance, or whether higher financial performance allows involvement in pollution reduction (King and Lenox 2001). Statistical proof on this issue has been very difficult to obtain, especially in countries like Greece, that do not maintain long-term analytical environmental data records such as those supplied by the USA Toxic Release Inventory (<:http://www.epa.gov/tri/>). Other corporate environmental measures widely used involve: capital expenditures on pollution control technology; spills and plant accidents; energy and water consumption patterns; and lawsuits concerning improper disposal of hazardous waste. Event studies have been used to correlate environmental performance with market capitalisation (Wagner et al. 2002), but all cases studied were *only partially* environmental in nature, with other elements present and other firm attributes affecting the final result thereby allowing for alternative interpretations. In many studies it seems that only firms with certain attributes can profitably improve their environmental performance and also that the means used and the timing of sustainability initiatives can play a crucial role in the intensity of this correlation.

The direction and strength of correlation between environmental and financial performance, though not critical for researchers, is extremely critical from the perspective of corporate managers (Schaltegger and Synnestvedt 2002). Contrary to any ‘green literature’, managers will never proceed to implement environmental investments that may aggravate accounting measures, unless they are convinced that financial gains, sooner or later, will be credited to them (Gray et al. 1993). Therefore, all attempts to make sustainability a part of the managerial agenda should involve eliminating the negative impact of relevant impacts on the accounting ratios and/or considering the positive impact of initiatives on the market value of the company. Currently, the performance of all profit and investment centre managers in Greece seems to be evaluated on a purely accounting basis. Although, at this point, no relevant empirical studies are readily available to support this claim, one should consider the fact that accounting data, despite the vagueness of their content, are still objective, measurable and allow for comparisons. Also the fiscal and legal frameworks in which Greek companies operate require that they only need to supply accounting based ratios for loan applications, state subsidies, other financing activities, or in their annual reports; these frameworks are not standardised and do not demand other physical or qualitative measures or ratios to evaluate financing or investing decisions, making it unnecessary for managers to produce or rely on such other measures.

4. SUGGESTED MODIFICATIONS OF THE PERFORMANCE MEASURES USED

To encourage the adoption of sustainability initiatives by their Strategic Business Units, Chief Executive Officers and central corporate administrators might do one of the following:

a) Allow capitalisation of sustainability related *operating* expenses (such as training employees in operating an EMS) and their amortisation over the estimated life during which the company will benefit from their use. Such practice will result in an increase in income for the investment year as well as an increase in and a more accurate representation of the value of the asset and capital bases of the company. The Greek State has legislatively approved (2002) the measure of allowing Greek companies to capitalise and amortise the massive losses they have suffered from their investments in traded securities quoted on the Athens Stock Exchange (ASE), after the sharp decline of the ASE general composite index from over 6,000 points (September 1999) to below 3,000 points (March 2001). The same practice would be far more relevant in the case of capitalising SD related expenses, since the balance sheet would represent an actual asset rather than aggregate losses of the company. The suggestion, if applied at an intra-corporate level, will not have an impact on the published financial statements but will result in reclassification of company divisions according to their profitability. Further, it can be applied at a corporate level, since it does not seem to operate against any Stock Exchange Committee (SEC) ordinances, such as SFAS 5, FIN 14 and SAB 92, which set disclosure requirements to ensure that companies provide a meaningful analysis of how the amounts charged in each period were determined and recorded in the Management Analysis and Discussion section of their annual reports (SEC 2004).
b) Allow subtraction of operating environmental and social expenses as well as of the amortised part of capitalised expenses from the total expenses of the SBU. Sustainability expenses should be debited to the general administrative expenses of the corporation to the extent that such investments illustrate the *corporate commitment to sustainability*. Of course, investments determined by the SBU management to be in excess of the corporate commitments should still be debited to the SBU expense ledger. The tax impact of the subtraction should be considered (deducted amount = total amount * (1-tax rate)) so as to avoid a misallocation of the income among the divisions of the company, or among the divisions and Headquarters (HQs). The Economic Value Added (EVA) concept, a newer indicator of returns that attempts to transform accrual accounting income into a figure that more closely approximates cash economic

income, allows for these relevant adjustments (Wild et al. 2001). To maintain objectivity and preclude cross-subsidisation, HQs should apply standard costing principles in advance. Costing here refers to a broader view of environmental costs, expanded to involve energy and resources consumed (Schaltegger and Burritt. 2000). Standard costing refers to the attainable (not ideal) level of resource consumption and pollution production that can be tolerated by each specific division, considering its size, manufacturing process occupied, obsolescence and other relevant variables and which indicates the acceptable level of environmental expenses for this division.

c) The breakdown of ROCE can take the following form:

$$\text{ROCE} = (\text{Net Income/Sales}) * (\text{Sales/Capital Employed}) \qquad (6)$$

Capital employed may be designed so as *not to include* the SBU tangible and intangible sustainability related investments. One way or another, the definition of 'capital employed' differs from company to company and normally refers to the capital used by each SBU (profit centre) *to generate revenue and profits*, not to capital that has been scheduled to defend the corporate reputation and values. ROCE can be further decomposed into a systematic view of the efficient use of specific parts of the company's operations and can help in the computation of emission ratios (total emissions of a firm over total revenues), compliance ratios (total penalties over total revenues) and environmental policy efficiency ratios (total emissions over environmental capital expenses).

d) A similar decomposition and correction can be applied to the Return on Assets (ROA) ratio and the Residual Value assessment. In both these cases the value of assets used can be reduced by the amount of those assets acquired by the division to comply with the corporate goal of sustainability. To the extent that the structure of the firm and the type of its operations require extensive investment on such assets the impact of such a modification will be positive.

e) Deduction of up to 100 per cent of interest on any loan taken by a corporate division from any private sector lending institution for restructuring the facilities or refurbishing the division's operations to upgrade its environmental performance. In case the materials and the equipment required have to be imported, import should take place free of custom duties. Items imported duty-free or funded by an interest-free loan will have to be used by the division for a minimum time period. Both interest expense and duties expense should be debited to the corporate HQs ledger. After all, it is the HQs that administer and allocate funding for the divisions' involvement in environmental investments when this funding comes from national or European programs. Such programs in Greece, like development Law 2601/98, can subsidise heavily relevant initiatives by up to 40 or 50 per cent of the total investment cost. It is also the HQs that benefit from refunded duties, accelerated depreciation and credit interest aimed by the state at improving divisional environmental performance. Forwarding part of the related costs to the instigator and final beneficiary of sustainable initiatives via such practices has been suggested by PriceWaterHouse Coopers and has successfully become part of the Barbados Tourism Development Act (Barbados Hotel & Tourism Association et al. 2002). The impact on the return ratios results from improvement in the numerators because divisions are relieved of certain expenses.

f) The market value of a firm is the price at which the shares of the company are traded on the open market. The total market value of a company, or total capitalisation, is calculated as the number of shares outstanding times the price per share and is considered the highest, most aggregate measure of value created by the firm. Market value fluctuates with investor perceptions of the level and timing of expected future cash flows of the business. James Tobin developed a market valuation tool called *Tobin's q* (Lindenberg and Ross 1981). Tobin's q has been defined as the ratio of the market value of the company to its net worth, i.e. to the replacement costs of its assets minus the market value of its liabilities (Dowell et al. 2000, Wild et al. 2001). Using replacement values, Tobin's q compensates for inflation and may differ strongly from the traditional 'price to book value' ratio. Various forms of Tobin's q have been widely used by researchers as indicators of the intangible value of the firm (Dowell et al. 2000, Klassen and Mc Laughlin 1996). Tobin's q has been consistently and positively correlated with a firm's choice of environmental standards. This correlation is particularly strong for closely monitored, highly polluting companies. Statistically excluding other factors that may affect Tobin's q, such as firm size, growth trends and product diversification, one can estimate the *added market value* resulting from the application of environmental standards. Since this 'value premium' represents the (discounted present value) perception of the investors about the increased incremental future cash flows related to current environmental investments, the managers that determined and implemented these investments should be credited with the financial results responding to their decisions. A limitation with the application of Tobin's q is that the market value increase refers to expectations extended for an unknown length of time and therefore its allocation over a number of years would be subjective. Yet, distant future expectations are usually not considered in any investment appraisal and, in practice, analysis is restricted to a limited period of five to ten years (Epstein

1995, Schaltegger and Figge 2000). In any case, part of the capitalisation increase must be considered and assigned to those corporate divisions which have created the value added. To avoid an arbitrary allocation process the drivers used in the process, such as environmental investments or hours of employee environmental training, should be predefined and communicated to all divisions. The application of this suggestion does not have an impact on the overall earnings and tax liabilities of the corporation and therefore does not operate against SEC or IAS directions. Rather, it results in a reallocation of earnings among the divisions, encouraging their managers to give serious attention to the environmental impact of their decisions.

Suggestions (a), (b), (e) and (f) refer to an increase in the return ratio numerators while suggestions (c) and (d) will result in a lower and more relevant denominator. Since all suggestions result in an improvement of the return ratios through different routes, they *should not* be applied simultaneously. By the time a company proceeds with the proposed changes it should decide on the ideal mix of actions and choice of measures that will optimise its balanced performance measurement. The suggestions made do not, and should not, have an impact on the externally orientated, market based measures of the company, such as earnings per share, price to earnings, earnings yield and dividend yield ratios; they act on the reevaluation and reapportionment of the financial benefits among the company SBUs according to the management accounting definition as "the process of identifying, measuring, analysing and interpreting information that assists executives in fulfilling *organizational* objectives" (Horngren and Sundem 1990). Yet, if the choices made may somehow influence the figures in the annual report, the impact should be properly disclosed and the same ratio definitions should be consistently applied. The modified ratios will alleviate the negative impact of the sustainability choices on divisional accounting figures and will encourage management to adopt and implement relevant measures.

Greek companies are not expected to embrace the idea of restructuring their performance measures to enhance the sustainability cause. Although the accounting departments of most major corporations utilise ERP (enterprise resource planning) computer software that can support such proposals, these systems have been developed with the emphasis on external reporting. So, conventional Greek accounting departments lack not only the incentives but also the experience and the human resources to implement such proposals. Indicatively, when the Greek State mandated that companies operating under the 4th and 7th EU directives apply plain cost accounting (1991), companies and professional chambers exercised pressure thereby postponing implementation of the decision for two years, by invoking technical and personnel inability to comply with the Law. A small number of Greek companies utilise composite performance measurement systems such as the balanced scorecard. Further, increased resistance to change should be expected from the SBU managers against any measurement system that increases the informational load required and that might 'subjectify' their evaluation, shifting the emphasis from monetary, anticipated and manageable accounting ratios to physical, vague and incomprehensible SD ratios. Yet, the need for the attitudinal change, mentioned in the introduction, will be reinforced in the following years. Availability of technical means and trained individuals will deprive Greek companies of all potential excuses to ignore current trends. The Federation of the Greek Industrialists, S.E.B., at its 2003 annual convention (May 2003) established SD as a cornerstone on which member companies should plan their development (S.E.B. 2003:9). Certain corporations, such as Eurobank, Grecotel and S&B Industrial Minerals S.A., are pioneering the field by gradually introducing specific environmental and social measures. It is anticipated that these will be the first entities to elaborate on the suggestions made here.

5. CONCLUSION

This paper posits that, in a company's search for sustainability, most divisional management attempts to internalise external environmental costs lead to deterioration in traditional accounting-based return ratios (ROE, ROI, ROCE). They do so by either decreasing the ratio numerators, i.e. the perceived earnings of the division, or by increasing the denominators, i.e. the means that the division has used to achieve these earnings. When such ratios constitute the critical basis for evaluation of divisional managerial performance, they remove any incentive for managers to undertake relevant initiatives. Yet, the adoption of high environmental standards by the company's operating departments has been shown, both academically and empirically, to be associated with increased corporate market valuation.

The need for an improved sustainable performance is gradually being recognised by Greek corporations. Three major Greek banks have recently joined the UNEP Financial Initiative and TITAN Cement S.A. has become the first Greek company to publish a sustainability report based on the Global Sustainability Reporting (GRI) Guidelines. Yet, the ultimate criterion for the evaluation of Greek companies remains their profitability measured using a number of traditional return ratios. Company divisions are closely monitored for their contribution to satisfaction of the quest for overall corporate profitability, and those divisions that fail to contribute adequately are the prime candidates for closure of their operations.

The simultaneous consideration of these needs leads to the conclusion that, in Greece, any corporate expression of interest in sustainability should be accompanied by a number of return ratio modifications at the intra-company level. Proper modifications, if effectively devised, applied and communicated, will allow a more accurate evaluation of each division's contribution to the pursuit of company profits and will encourage sustainability thinking and actions by decision makers, without harming corporate compliance with conventional accounting principles and standards. The paper concludes by suggesting possible ways of implementing such modifications and by underlining possible obstacles to the implementation of these suggestions in the context of Greek SBUs.

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Chapter 11

IS THERE A MARKET PAYOFF FOR BEING GREEN AT THE LIMA STOCK EXCHANGE?

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Abstract: In contrast to research studies on developed markets, there is scarce evidence about the relationship between firms' economic and environmental performance in emerging markets. In this paper, evidence is provided for such a link by showing that publicly traded firms at the Lima Stock Exchange (LSE) offer positive abnormal returns around the announcement date of an ISO 14001 certification. Although there were only 10 firms that fulfilled the sample criteria, positive and statistically significant average cumulative abnormal returns could be found ranging from 0.7% to 1.27% for one day previous to and one day after the announcement date of the company's first ISO 14001 certification, depending on the model that was used to generate abnormal returns. The positive abnormal performance was not produced by only a single firm, and is robust across different model specifications. Although the low magnitude of the abnormal performance indicates that environmental issues still have little importance to investors at the LSE, Peruvian-based firms have an important incentive to become green.

1. INTRODUCTION

Since the publication of the document *ISO 14001 Environmental Management Systems – Specification with guidance for use* by the International Organization for Standardization (ISO), on September 1st 1996, many firms around the world have adopted the standard as a way to conform with their environmental policy. An environmental policy shows the firm's intentions and commitment to the environment, and usually requires firms to prevent pollution and comply with relevant environmental legislation as well as continually improve their environmental performance. Furthermore, within

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the framework of ISO 14001, a firm's environmental policy must also be made public.

An Environmental Management System (EMS) is a management tool that provides a framework for practices, procedures and processes to manage *systematically* an organization's environmental agenda. In particular, an EMS is made up of five steps: setting the environmental policy, planning the way to achieve the objectives, implementing and executing the plan (which includes training, awareness, communication, and so on), monitoring and taking corrective action, and reviewing. These five steps define how to continually improve the environmental performance of a firm. An EMS belongs to the organization's structure and has to achieve, improve and sustain the firm's environmental policy.

ISO 14001 is the only normative standard in the ISO 14000 series of standards. This means that firms can achieve international recognition for their environmental performance by obtaining an ISO 14001 certification, while the other standards in the ISO 14000 series are not subject to third part certification. In other words, investors and other stakeholders may regard achievement of ISO 14001 certification as a firm's commitment to an ongoing improvement of its environmental performance.

In this research, the hypothesis is that there is a positive relationship between the achievement of ISO 14001 certification and the firm's stock returns. ISO 14001 certification signals a commitment to continually improve the firm's environmental performance in the future which will put the firm in a better competitive position to take advantage of future investment opportunities. Positive expectations of future investment opportunities are discounted back into the firm's stock price, so that positive abnormal returns should be observable around the announcement date of ISO 14001 certification. In fact, there is evidence that EMS help firms to improve their economic and environmental performance although the EMS benefits are not systematically explored by companies (Hamschmidt and Dyllick 2001).

The relationship between the firm's economic and environmental performance is not easy to establish because there are contradictory empirical results. Some studies speak of a positive link between both while others suggest that there is no relationship at all. The inconsistency among empirical results in the literature has been explained by Schaltegger and Synnestvedt (2002) who say that the empirical results are compatible because a good environmental management can produce a positive link, whereas bad environmental management can generate no relationship or even a negative one. Consequently, the way in which environmental management is conducted determines the relationship between environmental and economic performance.

Schaltegger and Synnestvedt (2002) have proposed two research strategies in order to discover the kind of environmental management that results in improvements in both environmental and economic performance: to conduct in-depth case studies, or to study the economic impact of good environmental management. In both cases, the authors are referring to *ex post* studies into the relationship between a firm's economic and environmental performance. In this research the approach is *ex ante*, which means that the main issue here is not how environmental management is being conducted and what economic impact it has had, but the impact of the firm's signal to improve its environmental performance in the future (achievement of ISO 14001 certification) on its stock return (economic performance).

No study could be found to date that focuses specifically on the connection between ISO 14001 certification and a firm's stock returns in emerging markets, though some studies have related ISO 9000 certification to the firm's market value. Furthermore, some event studies have been conducted in developed markets such as the United States into the relationship between the firm's environmental performance and its economic performance.

Table 11-1 summarizes the most important findings of six event studies. The first two discuss the relationship between a firm's environmental performance and its economic achievements, and the others are oriented to study the relationship between a firm's quality performance (signalled by the achievement of ISO 9000 certification) and its economic performance. Wagner (2001, 2003a) reviews more event studies about the relationship between the firm's environmental and economic performance. However, all the results are in line with those reviewed in Table 11-1. The studies reported in Table 11-1 have been chosen for review because they seek to determine whether the certification of any ISO standard or the adoption of a strong EMS generates positive abnormal returns around the announcement date.

From Table 11-1 significant and positive abnormal returns, ranging between 0.6% and 1%, were obtained around the announcement date of an event which indicated a strong EMS. In the case of White's study (1996), the event was the firm's adoption of the Coalition for Environmental Responsible Economies' (CERES) principles, which is a formal code for corporate environmental responsibility.

In the case of Klassen and McLaughlin (1996), the event was the winning of an environmental award given by an independent third party. These authors also found a significant negative cumulative average abnormal return for weak environmental management as indicated by an environmental crisis (e.g. product recalls, announcement of oil spills, etc.).

The other four studies focused on the relationship between the firm's quality performance and its economic performance. All studies, with the exception of Lima et al. (2000), found a statistically significant and positive relationship between the two. Hendricks and Singhal (1996) studied the effect of winning a quality award on the firm's stock return, while the studies of Nicolau and Sellers (2002) and Corbett et al. (2002) used the achievement of the quality standard ISO 9000 to measure quality performance.

Table 11-1. Results of relevant event studies.

Study	Major findings
White (1996)	U.S. firms obtain significant positive mean abnormal return of 1.05% the day after they have signed the CERES principles.
Klassen and McLaughlin (1996)	U.S. firms gain a significant positive cumulative average abnormal return for strong environmental management (0.63%) and significant negative abnormal returns for weak environmental management (–0.82%).
Hendricks and Singhal (1996)	U.S. firms reap significant positive mean abnormal returns, from 0.59% to 0.67%, on the date of the announcement of a quality award.
Lima et al. (2000)	There is no relation between quality certification, as indicated by ISO 9001 and ISO 9002, and the economic performance of Brazilian firms.
Nicolau and Sellers (2002)	The Spanish stock market reacts positively to the achievement of quality certification ISO 9000
Corbett et al. (2002)	U.S. firms, after deciding to seek their first ISO 9000 certification, gain significant abnormal economic improvements, depending on the industry sector.

In Nicolau and Sellers' (2002) study, a firm's stock return is taken as a measure of economic performance, while Corbett et al. (2002) use four different measures: return on assets (ROA), Tobin's Q, one internal measure of performance (cost of goods sold/sales), and one external measure of performance (sales/total assets). For all measures, Corbett et al. (2002) found a positive effect for quality certification, with the exception of the internal performance measure for which there is a negative effect.

Overall, there is a positive link, though of low magnitude, between a firm's environmental and economic performance. There is also a positive relationship between the firm's achievement of an ISO 9000 (quality performance) and its economic performance. Given these results, the question arises of whether there is a connection between a firm's environmental commitment, embodied in the ISO 14001 achievement, and its economic performance. In other words, does the firm's achievement of ISO 14001 certification yield positive abnormal returns? If there are positive abnormal returns, what are their magnitudes? Do they appear long before the announcement date of an ISO 14001 certification, and how long do they last? These empirical questions will be addressed in the fourth section.

The remaining part of the paper has been structured in four sections. Important issues related to the proper execution of event studies are reviewed in the next section. The third section discusses the sample criteria and describes the data. The methodology and results are explained in the fourth section, and the final section concludes the work.

2. ISSUES IN EVENT STUDIES

In conducting event studies, there are several issues that need to be accounted for. This section reviews the main stages of the process, emphasizing the problems that may be encountered and how best to deal with them. Five important issues are discussed: event definition, selection criteria, estimation of abnormal returns, estimation of model parameters, and tests for detecting abnormal returns. These issues will be discussed separately in the following subsections.

2.1 Event Definition

It is crucial to identify the event subject to scrutiny (e.g. the announcement date of a merger, an acquisition, an earnings announcement, a change in the debt rating, the achievement of an ISO standard, etc). Then, one must obtain the exact date of the event to determine the estimation and event windows (see Figure 11-1).

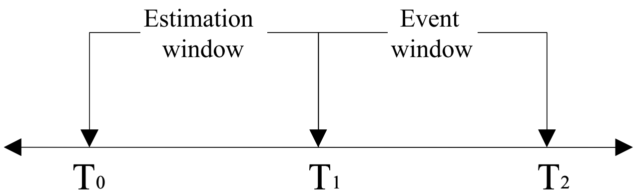

Figure 11-1. Event study windows.

The event date, when the announcement occurs, lies somewhere within the interval [T1 + 1, T2], which is the event window with length L2 = T2-T1-1, while the interval [T0 + 1, T1] is the estimation window with length L1 = T1-T0-1. During the estimation window one calibrates different models for abnormal returns. These models are then used during the event window in order to estimate realized abnormal returns around the announcement date. When the study is being conducted with daily data, the estimation window usually ranges between 100 and 300 trading days (Peterson 1989). The length of the event window usually depends on the ability to fix precisely the announcement date. If one is able to date it with precision, the event window will be short and the tests to detect abnormal returns will be more powerful. The length of the event window normally ranges between 21 and 121 days (Peterson 1989).

2.2 Selection Criteria

This step is very important since it is easy to introduce accidentally an undesired selection bias in defining the sample of firms to be studied. In emerging markets, one of the main tradeoffs is between having quantitatively more firms in the sample, but with several firms subject to thin trading; or having less firms in the sample, but actively traded. In the former case, a procedure is needed to test for abnormal returns in the presence of thin trading, while in the latter case it is important to avoid as far as possible any selection bias in the sample. This trade-off has to be made because of the low number of actively traded or liquid stocks in emerging markets.

Table 11-2. Liquid firms as a percentage of total traded stocks; period: 1995-2003 (source: Mongrut 2004).

Year	Argentina	Brazil	Chile	Peru	Colombia	Venezuela
1995	51	25	38	30	19	34
1996	53	27	37	29	12	52
1997	58	30	32	24	16	58
1998	49	22	21	22	15	40
1999	45	31	27	18	11	29
2000	36	30	23	13	4	27
2001	26	27	22	8	8	21
2002	35	27	19	10	21	n.a.
2003	55	30	23	15	32	18
Average	44	28	26	17	13	32

n.a. not available

As Table 11-2 shows, the percentage of actively traded stocks (with a market presence of at least 75%), as a fraction of the total number of traded stocks per year, ranged between 8% and 30% at the LSE during the period 1995-2003. The situation for other South American emerging markets is similar.

Thin or non-synchronous trading means that market shocks will not be incorporated immediately into the price of the stock simply because it is not being traded. If the effect of thin trading is not considered, there will be a serious bias in the moments and co-moments of asset returns; for example, the beta parameters of thinly traded stocks will be lower than the beta parameters of actively traded stocks. This bias arises because time series of stock prices are recorded at time intervals of one length when in fact they are incurred at other irregular time intervals (Campbell et al. 1997).

Different ways to deal with the problem of thin trading have been suggested by Scholes and Williams (1977), Dimson (1979), and Cohen et al. (1983) in the context of market risk estimation. Each tried to estimate the market risk parameter (beta) in the presence of thin trading. However, as reported by Brown and Warner (1985), there is little to gain by using the procedures of Scholes and Williams (1977), and Dimson (1979) in testing abnormal returns.

What happens if the option is taken of including in the sample only a few actively traded firms? A small number of firms will not represent a problem, because parametric test statistics used to detect abnormal returns quickly converge to their asymptotic values (Brown and Warner 1985). Besides, even in the presence of abnormal returns that do not obey a normal distribution, one can still use parametric tests invoking the Central Limit Theorem. The real problem is the potential for a selection bias.

2.3 Estimation of Abnormal Returns

In this section, three models to estimate abnormal returns are introduced: the constant-mean return model, the market model, and the market adjusted model. According to Brown and Weinstein (1985) there is little value to gain in using a multifactor model (such as the Arbitrage Pricing Theory-APT) rather than the market model, because the latter seems to be the more suitable to detect abnormal performance (Dyckman et al. 1984).

2.3.1 The Constant-Mean Return Model

Use of this model implies an assumption that the stock's mean return of the estimation window will remain constant during the event window. For each stock "i" in period "t", the abnormal return is estimated as the difference between the realized return "$R_{i,t}$" and the mean return:

$$AR_{i,t} = R_{i,t} - \overline{R}_i \tag{1}$$

Where the mean return is given by:

$$\overline{R}_i = \frac{1}{L_1} \sum_{t=T_0+1}^{T_1} R_{i,t} \tag{2}$$

In this model, as well as in the following ones, continuously compounded returns are defined in the following way (where "$P_{i,t}$" is the price of stock "i" in period "t"):

$$R_{i,t} = Ln(P_{i,t}) - Ln(P_{i,t-1}) \tag{3}$$

Equations (1) and (2) therefore consider the mean return as an arithmetic rather than a geometric average. Furthermore, in the presence of thin trading one must apply the following simple rule: if one daily quote is missing, this and the quote for the subsequent day must be excluded from the estimation of returns.

As shown by Brown and Warner (1985), the constant-mean return model yields similar results to those obtained by using the market model. According to Campbell et al. (1997), the lack of sensitivity to the model choice is due to the fact that the constant-mean return model does not reduce in a meaningful way the variance of abnormal returns.

2.3.2 The Market Model

The market model is the most common choice for modelling abnormal returns. This states that the stock "i" abnormal return in period "t" is equal to:

$$AR_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{m,t}\right) \tag{4}$$

As can be observed, the market model adjusts for the stock's systematic risk in estimating the stock abnormal return. In this way, the variance of the abnormal return will be reduced because one is removing the portion of the return that is related to the market index "$R_{m,t}$" (MacKinlay 1997). Popular choices for the market index are the equally weighted local market index and the value weighted local market index. However, the former is more likely to detect abnormal returns because it has been shown that it has more correlation with market returns (Peterson 1989).

The model parameters (alpha and beta) are usually estimated during the estimation window using Ordinary Least Squares (OLS). The OLS estimation of Equation (4) relies on two crucial assumptions concerning the error term or abnormal return: that the variance of the abnormal return is constant through time, and that there is no time series correlation among the abnormal returns. In other words, that the model implies no heteroskedasticity and no autocorrelation. Nevertheless, thin trading could generate times-series dependence or serial correlation. Furthermore, a variance increase due to the event announcement generates the problem of heteroskedasticity. If one uses the variance of the estimation window instead of the variance of the event window, the test statistics will yield too many rejections of the null hypothesis so that the cumulative average abnormal return is equal to zero.

One way to correct for serial correlation and heteroskedasticity in abnormal returns is to estimate the model parameters using the Generalized Autoregressive Conditionally Heteroskedastic Model (GARCH). The GARCH (1,1) is expressed in the following way:

$$\begin{aligned} AR_{i,t} &= R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{m,t} \right) \\ AR_{i,t} &= \rho_i AR_{i,t-1} + \varepsilon_{i,t} \\ h_{i,t} &= \omega_{i,0} + \omega_{i,1} \varepsilon^2_{i,t-1} + \omega_{i,2} h_{i,t-1} \end{aligned} \quad (5)$$

Where:

$\varepsilon_{i,t} \sim N(0, h_{i,t})$ and

$AR_{i,t}$: Abnormal return of stock "i" in period "t"

$R_{m,t}$: Return of the local market index in period "t"

ρ_i: First-order correlation coefficient of stock "i"

The OLS estimation of the model parameters also relies on the assumption that abnormal returns are normally distributed. There is considerable evidence that daily stock returns (raw returns), and their respective abnormal returns, are right skewed and leptokurtic (fat tails) (Fama 1976). In emerging markets, the returns are considerably more skewed and leptokurtic than in developed markets (Mongrut 2004 and Bekaert et al. 1998).

Although the parametric test statistics converge rather quickly to a normal distribution, it is advisable to estimate the model parameters using a procedure that allows for non-normality in the cross-section of abnormal returns, such as the Theil (1950) procedure proposed by Dombrow et al. (2000), or to use a non-parametric test to test for abnormal returns such as the generalized sign test analyzed by Cowan (1992) or the rank test proposed by Corrado (1989). In this research both alternatives are used.

Dombrow et al. (2000) suggested the use of the Theil (1950) non-parametric regression technique in order to correct for non-normality in the estimation of the market model parameters. In fact, they report that a combination of Theil's technique and a non-parametric test statistic improves power in the detection of abnormal returns. Furthermore, Theil's estimators perform better than OLS estimators when abnormal returns are non-normal (Talwar 1993).

Theil's approximate method follows five steps for the "j" pair of observations that belong to the estimation window:

1. Sort the pairs of returns $R_{i,t}$, $R_{m,t}$ into ascending order based on the values of $R_{m,t}$
2. Separate the data pairs into two groups based upon the median (do not consider the median pair if it is odd)
3. Calculate the following slope parameter for each of the N/2 data pairs in each group with the following expression:

$$\beta_{\left(ij+\frac{N}{2}\right)} = \frac{R_{\left(j+\frac{N}{2}\right)} - R_j}{Rm_{\left(j+\frac{N}{2}\right)} - Rm_j} \qquad \text{For: j = 1 to } \frac{N}{2} \tag{6}$$

Where N is the number of data items.

4. Sort the calculated slope parameters into ascending order. The stock beta ($\hat{\beta}_i$) will equal the median slope
5. Using the slope (beta) parameters derived in the previous step, calculate the values of alpha for all data pairs. The stock alpha ($\hat{\alpha}_i$) is equal to the median value of these alphas.

As indicated by Dombrow et al. (2000), focusing on the median estimates eliminates the possibility that outlier observations will affect the estimation of the model parameters. In this sense, more robust estimators are obtained for the parameters.

One of the features of non-normality is that stock returns in emerging markets are right-skewed. In this sense, many authors have argued that investors in emerging markets care more about downside (systematic) risk than about traditional systematic risk (Estrada 2000). Estrada (2002) has proposed an equilibrium model named the D-CAPM that accounts for downside risk, which states that what matters to expected returns in emerging markets is the downside (systematic) risk or downside beta, as opposed to the traditional beta from the CAPM. Following this argument, the *ex post* version of the D-CAPM can be used to estimate abnormal returns in emerging markets:

$$AR_{i,t} = Min\left[\left(R_{i,t} - \overline{R}_i\right),0\right] - \left(\hat{\alpha}_i +\right)\hat{\beta}_i^D Min\left[\left(R_{m,t} - \overline{R}_m\right),0\right] \tag{7}$$

Where:

$\overline{R}_m$: Mean return of the market index

$AR_{i,t}$: Abnormal return of stock "i" in period "t".

β_i^D : Downside beta of stock "i"

2.3.3 The Market-Adjusted Model

Abnormal returns under the market-adjusted model can be written as follows:

$$AR_{i,t} = R_{i,t} - R_{m,t} \tag{8}$$

Another way to consider this model is to start from the market model (Equation 4) and impose the restrictions that alpha must be equal to zero and beta equal to one. In this sense, the model does not require an estimation window to estimate model parameters. As noted by Campbell et al. (1997), this model is suitable whenever there is no estimation window available. Due to the fact that the above restrictions may not apply in emerging markets, it is recommended to use this model jointly with other models.

2.4 Tests for Abnormal Returns

Once the abnormal returns have been estimated for each stock, using one or more models, a test must be made of whether or not abnormal returns are statistically different from zero. This task can be performed for each day, or for a time interval during the event window. The former aims to test whether individual cumulative abnormal returns are statistically different from zero, while the latter aims to determine whether the cumulative average abnormal returns during a selected time interval for a group of stocks are statistically different from zero.

In this research, three parametric tests (J1, J2 and J4) and one non-parametric test (J3) have been used. Parametric tests rely on a known probability distribution, usually a Normal or T-Student distribution, while non-parametric tests do not. The parametric test J1 aims to determine whether the cumulative average abnormal return differs from zero within the selected time interval [t1, t2] (MacKinlay 1997, Campbell et al. 1997). This is suitable whenever it is considered that cumulative abnormal returns vary across securities. If this is the case, equal weight must be given to the realized cumulative abnormal return of each security.

$$J_1 = \frac{CAAR(t_1, t_2)}{[Var(CAAR(t_1, t_2))]^{\frac{1}{2}}} = \frac{CAAR(t_1, t_2)}{\left[\frac{1}{N^2}\sum_{t=t_1}^{t_2}\sum_{i=1}^{N} S_{i,\varepsilon}^2\right]^{\frac{1}{2}}} \qquad J_1 \sim N(0,1) \quad (9)$$

Where:

$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t$ and $AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$

$CAAR(t_1, t_2)$: Cumulative average abnormal return for the time interval (t_1,t_2)

AAR_t: Average abnormal return for period "t"

Another possibility would be to consider constant abnormal returns across securities. In this case it is more appropriate to use J2 because it gives more weight to the securities with the lower abnormal return variance so that the power of the test will improve.

$$J_2 = \frac{SCAAR(t_1, t_2)}{\left[\left(\frac{1}{N}\right)\frac{L_1 - 2}{L_1 - 4}\right]^{\frac{1}{2}}} \qquad J_2 \sim N(0,1) \qquad (10)$$

Where:

$SCAAR(t_1, t_2) = \frac{1}{N}\sum_{i=1}^{N} SCAR_i(t_1, t_2)$

$SCAR_i(t_1, t_2) = \frac{CAR_i(t_1, t_2)}{\hat{\sigma}_i(t_1, t_2)}$

$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} SAR_{i,t}$ and $SAR_{i,t} = \frac{AR_{i,t}}{S_{i,\varepsilon}}$

$SCAAR(t_1, t_2)$: Average standardized cumulative abnormal return for the event window $[t_1,t_2]$

$SCAR_i(t_1, t_2)$: Standardized cumulative abnormal return for stock "i" for the event window $[t_1,t_2]$

$CAR_i(t_1, t_2)$: Cumulative abnormal return for stock "i" for the event window $[t_1,t_2]$

$SAR_{i,t}$: Standardized abnormal return for stock "i" in period "t"

$S_{i,\varepsilon}$: Standard error of the estimate for stock "i"

If the variance of abnormal returns increases on the event date, the above parametric tests will reject the null hypothesis more often than the nominal significant level (Cowan and Sergeant 1996). In other words, event-induced variance increases cause parametric tests to report a price reaction more often than expected (Cowan 1992). To avoid this problem, one may use the Boehmer et al. (1991) test (better known as the BMP test):

$$J_4 = \frac{\sum_{i=1}^{N} SCAR_i(t_1, t_2)}{\left[Var(SCAR(t_1, t_2))\right]^{\frac{1}{2}}} \tag{11}$$

Where:

$$Var(SCAR(t_1, t_2)) = \left[\frac{N}{N-1}\sum_{i=1}^{N}\left(SCAR_i(t_1, t_2) - \frac{1}{N}\sum_{i=1}^{N} SCAR_i(t_1, t_2)\right)^2\right]$$

Due to the fact that the BMP test works with data from the event window, it can consider any event-induced variance increase and is not affected by the problem of thin trading. Furthermore, the test is essentially unaffected by the presence of event-date clustering (Boehmer et al. 1991).

To address the problem of non-normality in stock returns, a non-parametric test which does not rely on this assumption may be used. Two non-parametric tests are available: the generalized sign test and the rank test. In general, the rank test is more powerful than the generalized sign test in detecting abnormal returns, though in the presence of event-induced variance, different authors favour the generalized sign test. Hence, due to the possibility of an increase in event-induced variance, the generalized sign test has been favoured over the rank test in this research. Besides, in the presence of non-normality both tests are well specified and equally powerful in detecting abnormal performance.

The generalized sign test aims to determine whether the number of securities with positive cumulative abnormal returns in the event window exceeds the expected number in the absence of abnormal security performance (Cowan 1992). The expected number of positive abnormal returns along a 214-day estimation window is given by:

$$\hat{p} = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{214}\sum_{t=1}^{214} D_{i,t}$$

In the above expression, the dummy variable "D" takes the value of 1 whenever there is a positive abnormal return for security "i" on day "t", otherwise it is 0. If "ω" is now defined as the number of securities in the event window with a positive cumulative abnormal return, the generalized sign test statistic (S) may be written:

$$J_3 = \frac{\omega - N\hat{p}}{\left[N\hat{p}(1-\hat{p})\right]^{\frac{1}{2}}} \qquad \text{Where: } J_3 \sim N(0,1) \qquad (12)$$

These four tests (three parametric and one non-parametric) will be used in the empirical part of this research.

3. SAMPLE CRITERIA AND DATA DESCRIPTION

Before going into the details of the selected sample, it is important to know some features of stock returns at the Lima Stock Exchange (LSE). It has already been pointed out that stock returns in emerging markets are characterized by being non-normal. As Table 11-3 shows, this feature applies to the LSE and is shared by the main South American capital markets. In particular, stock returns at the LSE are right-skewed and exhibit excess kurtosis.

Table 11-3. Statistics for stock indexes in South American capital markets (source: Mongrut 2004).

Statistic	Argentina*	Brazil*	Chile*	Peru**	Colombia**	Venezuela**
Mean (Annualized)	13.0%	11.7%	12.3%	9.8%	3.3%	2.4%
Median (Annualized)	13.8%	26.4%	8.9%	15.2%	6.1%	–1.9%
Maximum (Monthly)	67.0%	59.5%	19.5%	30.4%	26.5%	48.0%
Minimum (Monthly)	–48.6%	–110.7%	–34.4%	–41.0%	–27.6%	–63.8%
Variance (Annualized)	29.2%	36.6%	6.6%	10.2%	10.4%	27.9%
Skewness	0.640	–1.335	–0.398	–0.593	–0.213	–0.795
Kurtosis	3.632	8.910	2.094	3.245	0.882	3.606

* Period: January 1987 – June 2004
** Period: January 1993 – June 2004

With respect to the selected sample, Mongrut and Tong (2004) reported a total of 42 firms in which an EMS has been implemented in Peru. Of these, 30 firms achieved ISO 14001 certification during the years 1995-2003, but only 14 were traded at the LSE. These 14 firms were then filtered on three criteria: they should have a minimum of 245 daily quotations before the announcement date of an ISO 14001 certification, they should have a minimum of 31 daily quotations after the announcement date, and they should not be exposed to a different event during the event window. As Table 11-4 shows, only 10 firms fulfilled these criteria.

This sample criterion helped to remove some thinly traded firms from the sample. However, there were still some missing returns for the estimation window. In this case, the missing quote and the succeeding period quote were removed from the analysis. This method, proposed by Brown and Warner (1985), attains the greatest sample size without affecting the identification of the abnormal performance (Peterson 1989). Finally, confounding effects were avoided due to the third criteria.

Table 11-4. Statistics for stock indexes in South American capital markets (source: Economatica and Centro de Desarrollo Industrial (CDI)).

Firm	Quotations previous to the announcement date	Quotations after the announcement date	Announcement Date
Cervesur	398	384	06/22/1998
Milpo	649	267	04/06/1999
Backus	1255	411	12/11/1999
Alicorp	602	288	07/14/2000
Volcan	790	519	07/27/2001
Goodyear	1039	81	01/30/2002
Malteria Lima	681	31	02/28/2002
Buenaventura	1562	376	04/22/2002
Duke Energy	2309	84	07/17/2003
ELSA	394	31	08/06/2003

The fact that only firms who voluntarily adopted the ISO 14001 certification have been considered can produce a selection bias. If a random selection is made of the sample of certified firms from the total population of firms, there is no reason to suspect that they have some unobserved and observed characteristics that have influenced them to adopt such standard. However, if a random selection process is not followed, it may be that common unobserved and observed characteristics such as size and industry sector influence the decision to seek ISO 14001 certification. In this latter case, one cannot draw inferences for the total population of firms. For instance, one cannot state that because this sample of firms earns abnormal returns on the announcement date of an ISO 14001 certification, other firms are therefore able to earn them too.

A raw attempt to identify a potential selection bias is to compare the selected sample of firms with another sample which does not have an ISO 14001 certification granted. One choice would be to use firms with an EMS, but without such certification granted. Out of the 42 firms with EMS, 12 did have an EMS and were not certified. Unfortunately, these firms were not traded at LSE.

How severe could the potential selection bias be? There is no precise way to assess this, but it is unlikely that this bias is present in the sample of firms. As Figure 11-2 shows, the firms belong to different business sectors. Besides this, the selected firms are of different sizes (not reported).

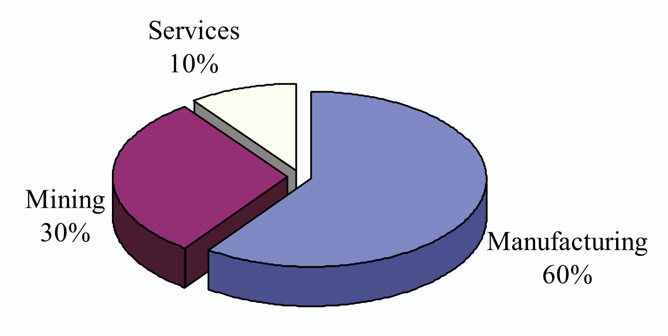

Figure 11-2. Certified firms by sector (source: own elaboration with data collected from Mongrut and Tong 2004).

What about non-observable or soft firm characteristics? Figure 11-3 shows the perceived benefits of implementing an EMS, according to nine firms that belong to the selected sample. As can be seen, preferences are almost equally divided between the various benefits, the most important of which are the reduction of negative environmental impacts and the achievement of higher employee commitment. The former is related to external stakeholders, while the latter is related to internal stakeholders.

Another way to check for unobserved firm characteristics is to determine how many pages of the annual report are dedicated to the issue of sustainable development. As Figure 11-4 shows, nine firms devote differing numbers of pages to sustainable issues. However, this is only a broad indicator because firms can use different ways in which to report about their environmental activities (see Figure 11-5).

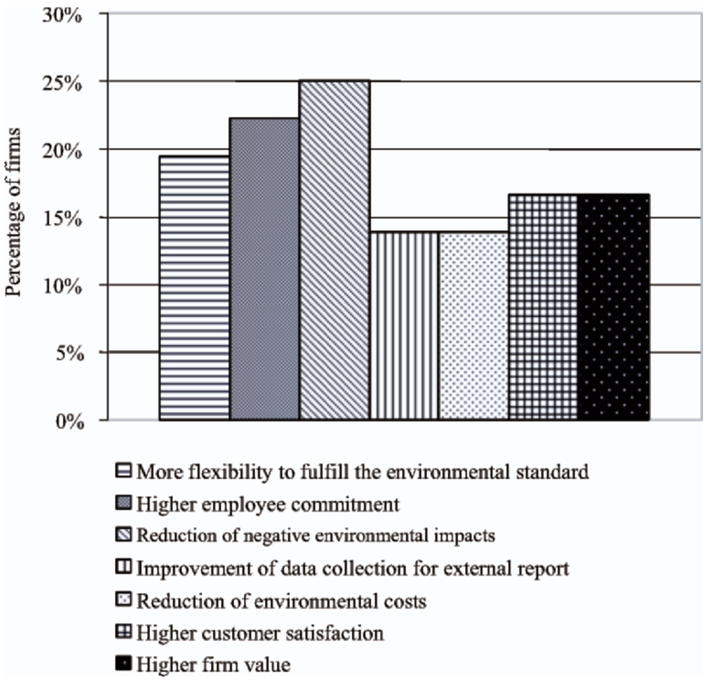

Figure 11-3. Benefits from implementing an Environmental Management System (EMS) (source: own elaboration with data collected from Mongrut and Tong 2004).

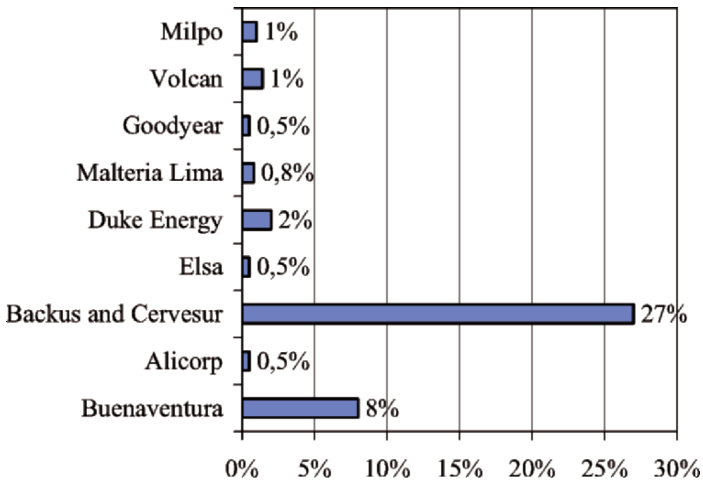

Figure 11-4. Percentage of annual report pages dedicated to sustainable development (source: own elaboration with data collected from Mongrut and Tong 2004).

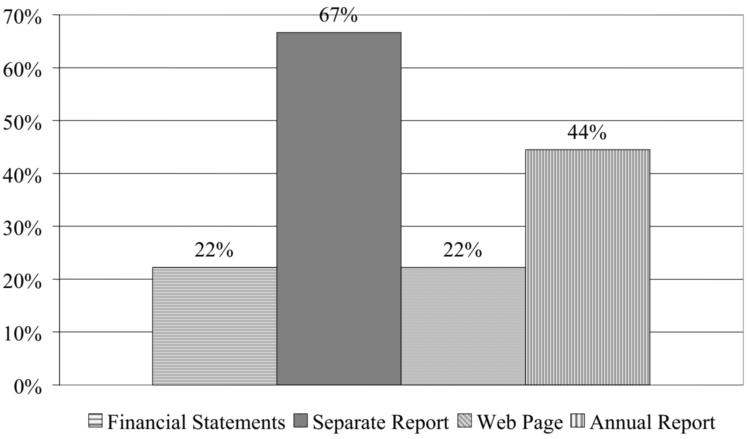

Figure 11-5. Different ways used by firms to disclose environmental activities (source: own elaboration with data collected from Mongrut and Tong 2004).

From the above discussion, it is unlikely that firms in the selected sample share common observable and unobservable features that make them more prone to adopt an ISO 14001 standard.

4. METHODOLOGY AND RESULTS

This section explains briefly the different steps used in this research to determine the daily abnormal performance of the selected sample of firms. The event under study is the announcement of the first ISO 14001 certification as a signal of a firm's commitment to a substantial improvement in its environmental performance. In this sense, one may expect positive abnormal returns on the announcement date of such certification.

An estimation window of 214 days, and an event window of 60 days around the announcement date (30 days previous to and 30 days after the announcement date), have been considered, implying a total of 275 daily stock returns. With this general event window some abnormal performance could be captured, and even more important, the estimation window could be isolated from the event window. This general event window was then restricted by aggregating abnormal returns for different shorter time intervals.

As discussed previously, parametric tests rely on the assumption that abnormal returns are normally distributed so that inferences about the aggregate abnormal performance can be made. For the selected sample, stock returns and estimated abnormal returns are not normally distributed because most are skewed and leptokurtic (not reported). As noted before, whenever abnormal returns are non-normally distributed, one may still rely upon asymptotic results by applying the central limit theorem.

Brown and Warner (1985) have shown that tests converge quickly to their asymptotic values, since parametric test statistics are still well specified even with sample sizes of only five. However, a problem is that the degree of skewness increases in small sample sizes, so stated significance levels should not be taken literally (Brown and Warner 1985). A way to account for this problem is to use a combination of Theil's method for the estimation of the market model's parameters and the application of a non-parametric test such as the generalized sign test. Furthermore, in this research skewness has been accounted for directly by estimating a downside-risk version of the market model.

Another problem that must be dealt with is event clustering. Aggregating abnormal returns requires that the different event windows do not overlap in calendar time. When they do, covariances between abnormal returns will not be zero and parametric tests are not longer valid. Table 11-5 shows the year of the first ISO 14001 certification for each firm in the sample.

A simple inspection of Table 11-5 leads to the conclusion that potential event clustering may arise in 1999, 2002, and 2003. However, after looking at Table 11-4 it can be concluded that the clustering problem can occur only in year 2003 because event windows overlap for 12 days. Nevertheless, the overlapping effect is not likely to induce a serious cross-correlation effect because those firms whose event windows do overlap (Duke Energy and ELSA) belong to different sectors: Duke sells energy, while ELSA sells beverages.

Table 11-5. Years of the first ISO 14001 certification.

FIRM	98	99	00	01	02	03	Total
Cervesur	1						1
Milpo		1					1
Backus		1					1
Alicorp			1				1
Buenaventura					1		1
Goodyear					1		1
ELSA						1	1
Malteria Lima					1		1
Duke Energy						1	1
Volcan				1			1
Total	**1**	**2**	**1**	**1**	**3**	**2**	**10**

The time series of abnormal returns were obtained using the constant-mean return model, the market-adjusted model and the market model. In the case of the market model, the parameters were estimated using the GARCH (1,1) procedure, the downside-risk GARCH (1,1) procedure, and the nonparametric regression procedure of Theil. The first corrects for heteroskedasticity and serial correlation in abnormal returns, the second accounts for much the same with a special focus on skewness, while the third corrects for non-normality in abnormal returns.

As suggested by Zivney and Thompson (1989), a good strategy is to report parametric and non-parametric tests when testing the statistical significance of abnormal returns. In order to assess the statistical significance of aggregated abnormal performance, three parametric tests (J_1, J_2 and J_4) and one non-parametric test (J_3) have been used. The first two tests were selected because they have some ability to detect abnormal performance even with small sample sizes. The third was selected to account for any event-induced increase in variance, and the non-parametric test was added to account for non-normality in the cross-section of abnormal returns.

A major concern in working with a small sample size is the possibility that one firm (an outlier) may distort the results. Figures 11-6 to 11-10 in the Appendix show the cumulative abnormal returns for each firm in the sample, and according to the five specifications for estimating abnormal returns (Figures read from left to right). It cannot be stated that positive abnormal returns are present in only a few firms, since in fact more than 7 firms in the sample report positive cumulative abnormal returns across different model specifications.

Another important issue was to identify any potential for event-induced increase in variance, which seems apparent from Figure 11-11 in the Appendix. Alternatively, one may arrive at this observation by looking at the average cumulative abnormal returns (see Figure 11-12 in the Appendix).

Tables 11-6 to 11-8 in the Appendix show the statistical significance of the average cumulative abnormal returns (CAAR) for the sample of 10 firms across the five specifications for estimating abnormal returns (note that CAAR are in decimals, so they must be multiplied by 100% to obtain percentages). In general the constant-mean return model, the market-adjusted model and the downside-risk GARCH (1,1) models do not have a very good performance because they report negative average cumulative abnormal returns for some time intervals. Nevertheless, they also report positive average cumulative abnormal returns of about 0.8% for one day previous to and one day after the announcement of the first ISO 14001 certification. This positive abnormal return is statistically significant with parametric and non-parametric tests.

The Theil procedure attains a better performance than the former specifications. With the Theil specification it is possible to detect an abnormal performance of 1.27% for one day previous to and one day after the announcement date of the first ISO 14001 certification, which is statistically significant with parametric tests. This specification also reports an abnormal performance of about 0.72% for the announcement date according to the non-parametric test. The market model estimated with GARCH (1,1) yields similar results. It reports a positive abnormal performance of about 0.95% for a time interval of one day previous to and one day after the announcement date and is statistically significant with parametric and non-parametric tests.

It is possible to detect some traces of information leakage using the generalized sign test with the GARCH (1,1) specification and with the Theil procedure for days [–5,–1]. However, it is of very low magnitude. In contrast, traces of market over-reaction are stronger. Using the GARCH (1,1) and the Theil specifications, positive cumulative abnormal returns can be observed up to 1.24% for the time interval [1,5]. This abnormal performance is statistically significant even considering a possible event-induced increase in variance.

5. CONCLUSION

Overall results indicate a positive abnormal performance around the announcement of the first ISO 14001 certification. The payoffs for being green are usually of low magnitude because investors are only just starting to be aware of the importance of environmental issues. A negative influence is also the fact that one needs to account for transaction costs - according to the Emerging Markets Factbook (1998), transaction costs are of about 76 basis points (0.76%) at the LSE, so net abnormal returns could decrease to about 0.51%.

In a recent paper Wagner (2003b) finds no relationship between the certification of an environmental standard (such as the EMAS or the ISO 14001) and the *ex post* economic performance of a sample of firms from the Netherlands, Italy, Germany, and the UK. This result depends on the kind of environmental management (Schaltegger and Synnestvedt 2002). Given the type of event study conducted in this research, the relationship between expected environmental performance (signalling) and economic performance has been established only in the short run. Abnormal stock market performance can be sustained in the long run only through good environmental management that is able to improve the economic performance of the firm.

Although the results show no evidence of information leakage, they show evidence for market over-reaction. The lasting short-term positive abnormal performance is consistent with the literature about stock market efficiency in emerging markets: for instance, Mongrut (2002) has found short-term market over-reaction at the LSE.

As expected, the market model estimated with the GARCH (1,1) procedure and the one estimated with the Theil procedure showed a better ability to detect abnormal returns. The reason for this lies in the fact that both specifications consider some features of stock returns in emerging markets such as serial correlation, heteroskedasticity and non-normality.

Despite these results, several interesting questions remain for future research. Are investors well-informed about the environmental activities of the firms they invest in? What type of environmental management is consistent with shareholder value maximization? What are effective ways in which to inform investors about environmental activities? Do investors penalize firms which have generated an environmental crisis in emerging markets? Does abnormal performance differ across industries or time? In order to answer these questions, one needs to collect information that is not readily available in emerging markets. To obtain such data is a major challenge that researchers into these markets must face.

To sum up, one may expect that as the LSE becomes more integrated with other capital markets, investors will become more aware of the importance of firms' environmental performance; and that net positive abnormal performance will increase in the future, at least in the short-term.

ACKNOWLEDGEMENTS

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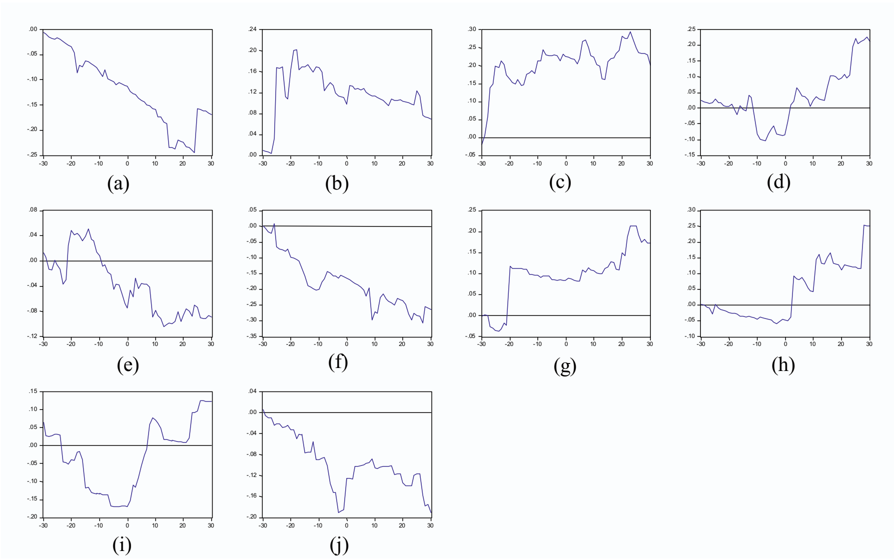
APPENDIX



Axis of abscissae: t; Axis of ordinates: AR

(a) Alicorp (b) Backus (c) Buenaventura (d) Cervesur (e) Duke (f) ELSA (g) Goodyear (h) Malteria Lima (i) Milpo (j) Volcan

Figure 11-6. Cumulative abnormal returns by firm. Constant-mean return model.

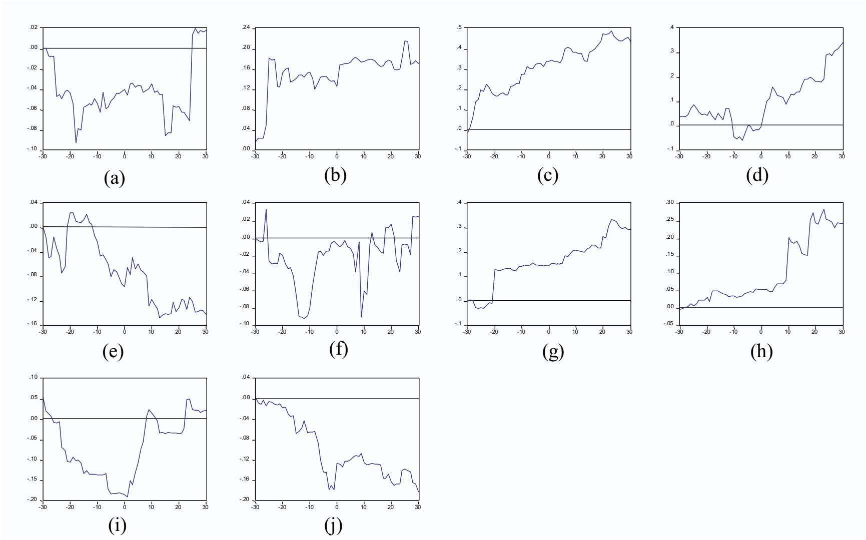


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Figure 11-7. Cumulative abnormal returns by firm. Market-adjusted model.

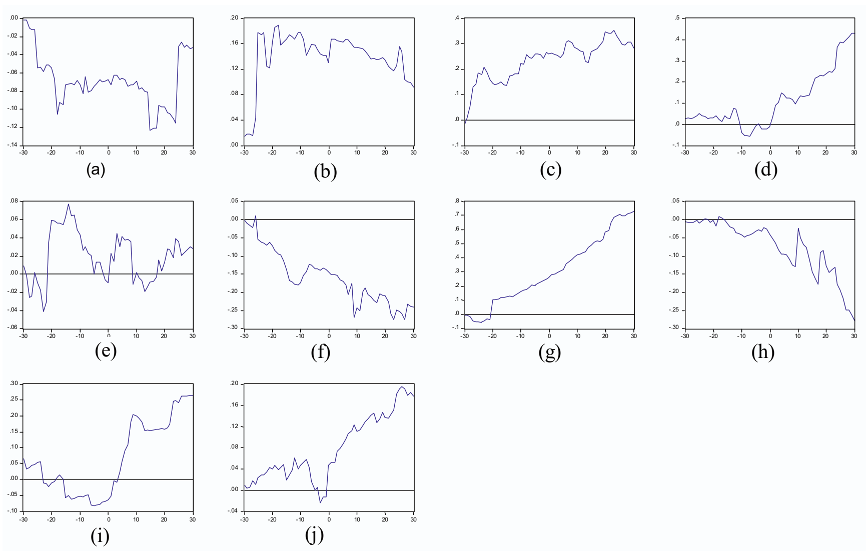

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Figure 11-8. Cumulative abnormal returns by firm. Market Model – GARCH.

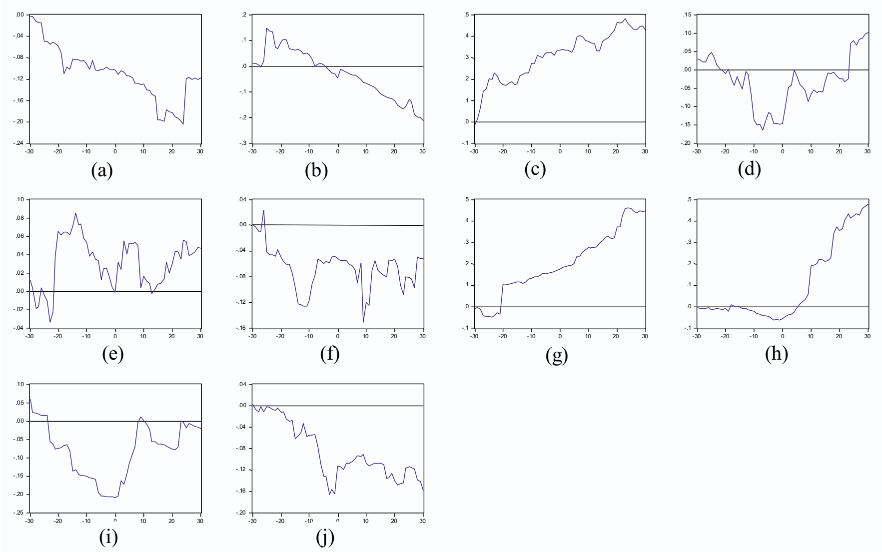

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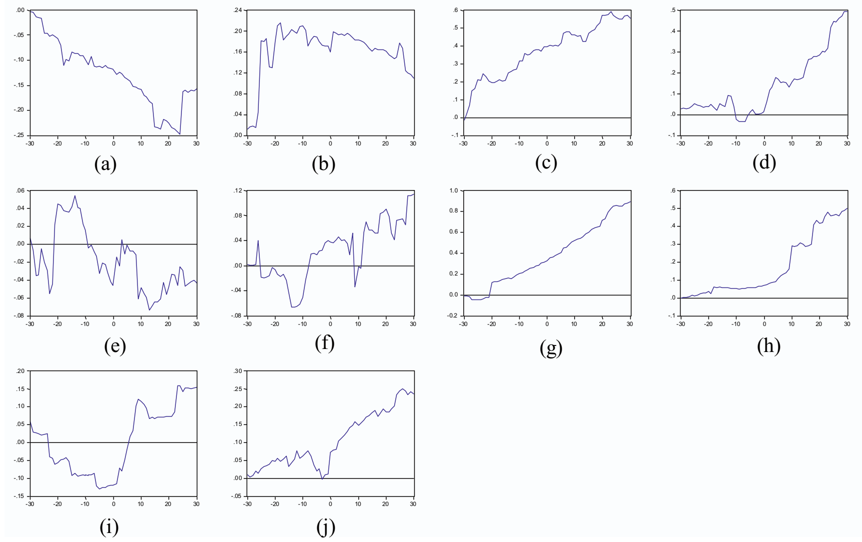
Figure 11-9. Cumulative abnormal returns by firm. Market Model – GARCH – Downside beta.



Axis of abscissae: t; Axis of ordinates: AR
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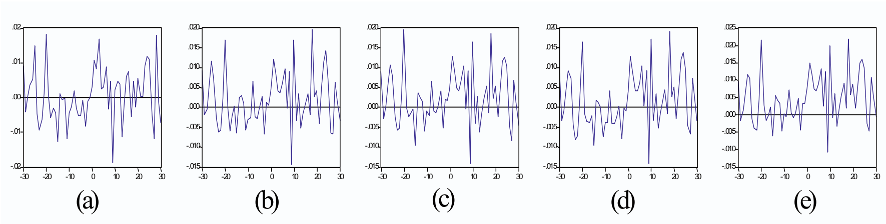
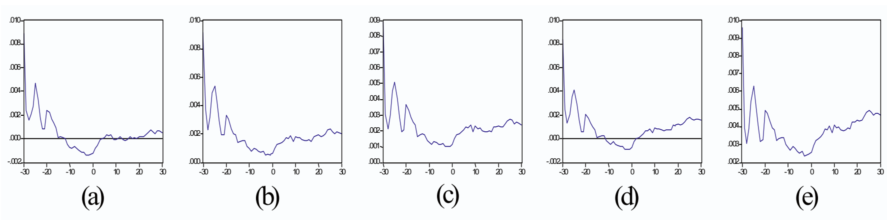
Figure 11-10. Cumulative abnormal returns by firm. Market Model – Theil.



Axis of abscissae: t; Axis of ordinates: AR
(a) Constant-mean return model (b) Market-adjusted model (c) Market Model - GARCH (d) Market Model – GARCH – Downside beta (e) Market Model – Theil

Figure 11-11. Average abnormal returns. Sample of 10 firms.



Axis of abscissae: t; Axis of ordinates: AR

(a) Constant-mean return model (b) Market-adjusted model (c) Market Model - GARCH (d) Market Model – GARCH – Downside beta (e) Market Model – Theil

Figure 11-12. Average cumulative abnormal returns. Sample of 10 firms.

Table 11-6. Statistical significance of average cumulative abnormal returns (CAAR).

	Constant-mean return model					Market-adjusted model				
(t1,t2)	CAAR	J1	J2	J3	J4	CAAR	J1	J2	J3	J4
(–30,30)	0,00052	0,07612	0,00477	0	–0,59131	0,00204	0,31489	0,25001	0	0,84762
(–25,25)	0,00051	0,07418	0,02439	0	–0,82917	0,00213	0,3198	0,27005	–0,79057	0,83928
(–20,20)	–0,00004	–0,0066	–0,12018	–0,6455	–0,8667	0,00194	0,32117	0,24463	–0,79057	0,26359
(–15,15)	–0,00053	–0,0845	–0,27116	–0,6455	–1,03804	0,00136	0,23408	0,2415	–0,79057	0,1089
(–10,10)	0,00037	0,0611	–0,15748	–0,6455	–0,44551	0,00263	0,43177	0,45861	0	0,63461
(–5,5)	0,00276	0,47758	–0,33067	–1.29099*	–0,15752	0,00363	0,81285	0,82175	–0,79057	2.14550**
(0,0)	0,00282	0,02817	0,02803	–2.58199***	–0,97426	0,00417	0,04168	0,04148	–3.16228***	–0,70105
(–1,1)	0,00671	1.45420*	–1,05256	1.29099*	–0,34715	0,00844	1.77601*	–1,00664	–1.58114*	–1,21655
(–30,–1)	–0,00139	–0,21201	–0,42241	1.93649**	–1,1763	0,00055	0,08748	–0,00507	–3.16228***	–0,38354
(–25,–1)	–0,00224	–0,34048	–0,50009	1.93649**	–1.49525*	–0,00036	–0,05659	–0,1546	–3.16228***	–0,57496
(–20,–1)	–0,00256	–0,44379	–0,65537	1.93649**	–1,25438	–0,00018	–0,0334	–0,15456	–2.37171***	0,61312
(–15,–1)	–0,00387	–0,82388	–0,97207	–3.22749***	–0,36908	–0,00089	–0,19669	–0,15642	–2.37171***	0,80397
(–10,–1)	–0,00326	–0,83163	–1,01571	–2.58199***	–1,26562	–0,00079	–0,18335	–0,07641	–2.37171***	–0,88532
(–5,–1)	–0,00394	–1.34898*	–1.64583**	–2.58199***	–1,27836	–0,00058	–0,1883	0,09773	–2.37171***	–0,29566
(1,30)	0,00237	0,33965	0,23571	–1.29099*	–0,72516	0,00352	0,54429	0,46442	0	1,113
(1,25)	0,00318	0,46499	0,45341	–1.29099*	–0,2434	0,00462	0,67858	0,66383	–0,79057	1.40724*
(1,20)	0,00233	0,34825	0,23874	0	–0,71676	0,00405	0,62691	0,57475	–0,79057	–0,40974
(1,15)	0,00252	0,35037	0,20678	–0,6455	–0,58227	0,0035	0,53309	0,5289	–1.58114	–0,53048
(1,10)	0,00378	0,53004	0,09533	0	0,81956	0,00616	0,88822	0,99298	0	0,97692
(1,5)	0,01014	1.53580*	–1,25332	0	2.06576**	0,00863	1.93780**	1.54349*	0,79057	1.78389**

* Significant at 90% level of confidence
** Significant at 95% level of confidence
*** Significant at 99% level of confidence

Table 11-7. Statistical significance of average cumulative abnormal returns (CAAR) - Sample of 10.

	Market Model - GARCH					Market Model - GARCH - Downside beta				
(t1,t2)	CAAR	J1	J2	J3	J4	CAAR	J1	J2	J3	J4
(–30,30)	0,00242	0,37208	0,35985	1.93649**	0,98162	0,00157	0,23963	0,18503	4.21637***	0,80281
(–25,25)	0,00264	0,39622	0,39588	1.93649**	1,13268	0,00163	0,24218	0,20441	4.21637***	0,94243
(–20,20)	0,00243	0,40093	0,35679	1.29099*	0,95335	0,00138	0,22307	0,05379	3.16228***	0,97844
(–15,15)	0,00173	0,29518	0,53287	0,6455	0,52079	0,00069	0,11531	0,09951	4.21637***	0,61049
(–10,10)	0,00337	0,57131	0,84678	1.29099*	0,98764	0,00201	0,32273	0,30559	4.21637***	1,1326
(–5,5)	0,00449	1,00813	1,23167	2.58199***	1,1392	0,00288	0,64438	0,73774	6.32456***	2.03434**
(0,0)	0,00438	0,04382	0,04362	0,6455	–0,62969	0,00413	0,04127	0,04107	3.16228***	–0,70683
(–1,1)	0,00951	2.05229**	1.39028*	1.93649**	0,83928	0,008	1.68254**	1.38825*	7.37865***	–0,58575
(–30,–1)	0,00108	0,16894	0,03298	–0,6455	–0,23742	–0,00091	–0,14419	–0,31512	2.10819**	0,22234
(–25,–1)	0,00036	0,05626	–0,07948	–0,6455	–0,75773	–0,00184	–0,2907	–0,44519	1,05409	–0,55321
(–20,–1)	0,00057	0,10459	–0,07265	–0,6455	–0,24181	–0,00171	–0,31394	–0,50257	1,05409	0,22807
(–15,–1)	–0,00031	–0,06732	0,25769	–0,6455	0,43201	–0,00267	–0,58716	–0,7952	2.10819**	0,58987
(–10,–1)	0,00042	0,10601	0,87953	0	–0,72524	–0,00255	–0,61681	–0,71535	2.10819**	–1,14292
(–5,–1)	0,00072	0,24638	0,86278	1.29099*	–0,19847	–0,00284	–0,94705	–1.82080**	3.16228***	–1,24463
(1,30)	0,00377	0,59225	0,74345	1.93649**	1.52639*	0,00401	0,62129	0,47949	5.27046***	1.89841**
(1,25)	0,00497	0,74177	0,97077	2.58199***	1.90885**	0,00507	0,74576	0,64373	5.27046***	1.90257**
(1,20)	0,00432	0,67311	0,93348	1.93649**	1.69296**	0,0044	0,67708	0,45517	5.27046***	1.48340*
(1,15)	0,0037	0,56717	1,06383	1.93649**	1,16993	0,00385	0,58198	0,49788	6.32456***	2.01595**
(1,10)	0,00658	0,97623	1.49646*	2.58199***	1.94415**	0,00655	0,94035	0,84216	6.32456***	2.12307**
(1,5)	0,00942	2.23065**	1.90792**	1.93649**	1.33957*	0,00901	2.10924**	2.20762**	7.37865***	2.14475**

* Significant at 90% level of confidence
** Significant at 95% level of confidence
*** Significant at 99% level of confidence

Table 11-8. Statistical significance of average cumulative abnormal returns (CAAR) – Sample of 10.

		Market Model - Theil			
(t1,t2)	CAAR	J1	J2	J3	J4
(–30,30)	0,00475	0,73076	0,68066	0	0,79185
(–25,25)	0,005	0,74728	0,71156	0	0,9387
(–20,20)	0,00475	0,77966	0,63528	0	0,9369
(–15,15)	0,00394	0,67612	0,86388	–0,79057	0,88051
(–10,10)	0,00536	0,89329	1,08222	–0,79057	1.42592*
(–5,5)	0,00642	1.46258*	2.27327**	0,79057	2.30930**
(0,0)	0,00723	0,0723	0,07196	–1.58114*	–0,28328
(–1,1)	0,01267	2.77249***	4.55076***	0,79057	0,29018
(–30,-1)	0,00251	0,39685	0,29925	–0,79057	0,63513
(–25,-1)	0,0019	0,30087	0,19375	–3.16228***	0,44766
(–20,-1)	0,0021	0,388	0,2305	–2.37171***	1,15609
(–15,-1)	0,0011	0,24683	0,66119	–3.16228***	1,01344
(–10,-1)	0,00149	0,37313	1.37290*	–3.16228***	–0,54243
(–5,-1)	0,0018	0,62346	1,0956	–1.58114*	0,11355
(1,30)	0,00708	1,10634	1,14294	0	1,17176
(1,25)	0,00821	1,2193	1.34858*	0,79057	1.48516*
(1,20)	0,00752	1,16875	1,25802	0	1.42488*
(1,15)	0,00683	1,04526	1.43673*	0	0,85265
(1,10)	0,00963	1.41205*	1.62031*	–0,79057	2.43328***
(1,5)	0,01244	2.93841***	4.07232***	0,79057	2.20415**

* Significant at 90% level of confidence
** Significant at 95% level of confidence
*** Significant at 99% level of confidence

Chapter 12

INTEGRATING AND REPORTING AN ORGANISATION'S ECONOMIC, SOCIAL AND ENVIRONMENTAL PERFORMANCE

The Expanded Value Added Statement

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Abstract: This chapter presents a social accounting model called the Expanded Value Added Statement (EVAS), which reports on the economic, social and environmental value added by an organisation in an integrated, single statement. The development of the model is guided by the assumption that accounting is a driver of behaviour and can be conceived of as an explicit change agent in order to move organisations towards sustainability. An example of sustainable (green) building is used to demonstrate how the model can focus attention on and report these impacts.

1. INTRODUCTION

The main goal of this chapter is to present an accounting model called the Expanded Value Added Statement (EVAS) developed with the intention of driving organisational behaviour towards sustainability. Many definitions of sustainability have been advanced, but most arise from the 1987 United Nations report *Our Common Future*, also known as the Brundtland Report, which called for "a form of sustainable development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED 1987:8). Drawing on this, sustainability reporting has been defined as "an organisation's public account of its economic, environmental, and social performance in relation to its operations, products, and services" (GRI 2002:1).

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 281-298.

In contrast to accounting statements and conventional analyses currently published by most organisations, the EVAS brings together economic, social and environmental impacts in a single statement. It also expands the boundaries of organisational reporting to consider multiple stakeholders and aims to use accounting as an explicit change agent: 'what gets measured, gets managed.'

The remainder of the chapter is organised in five sections. The first discusses the key assumption behind this model. The second looks at social accounting as a conceptual guide to the model. Next, value added accounting is explained, and then an example is provided of the EVAS as applied to a sustainable building company. The last section provides a general discussion.

2. THE MAIN ASSUMPTION: ACCOUNTING AS A CHANGE AGENT

Accounting, by the very act of counting certain things and excluding others, shapes a particular interpretation of social reality which in turn has policy implications (Hines 1988). Much has been written on how accounting communicates, creates, sustains and changes social reality (Cooper and Neu 1997, Craig and Amernic 2004, Gray 2002, Hines 1988, Llewellyn 1994, Mathews 1997, Morgan 1988, Tinker 1985). This leads to the key assumption that guides the work in this chapter: accounting is a driver of organisational behaviour.

The Danish Green Accounts are one example that supports this assumption. In 1995, the Danish parliament passed the Green Accounts Act, which requires certain organisations to publish their environmental profile. An initial evaluation of 500 organisations that had prepared these accounts found several organisational behavioural changes as a result:

- 40% of all enterprises have achieved environmental improvements. This applies especially within the sector of energy and water consumption, other resources and materials as well as waste. Many have initiated work with cleaner technology and every fifth (20%) with less environmentally hazardous products.
- 50% of the firms have involved employees in the elaboration of the accounts. 60% of these enterprises have experienced a positive effect on employee involvement, and most expect increased involvement. The positive effects include higher involvement, better communication, and more efficient work routines.
- For several firms, work with the green accounts has also contributed to the establishment of new environmental policies, the elaboration of

environmental action plans, or a decision to introduce environmental management (Danish EPA 1999:7f.).

Although there are many studies on the quantity and type of disclosure of social and environmental items, there are far fewer on organisational behaviour as a result of measuring and reporting (Schepers and Sethi 2003, Waring and Lewer 2004). For instance, do environmental standards (and the environmental management systems measuring and reporting them) actually reduce emissions? (For a discussion on this question, see Corbett and Luca 2002, King and Lennox 2000, Russo 2004, Wagner 2003.) Do labour standards improve the lives of workers? What are the unintended consequences of applying these standards? Does reporting generate an intrinsic or extrinsic motivation to act in a certain way?

By focusing attention on measuring the economic, social and environmental value which is created (or destroyed) by an organisation, these questions can begin to be addressed. This is one of the purposes of social accounting.

3. SOCIAL ACCOUNTING

Social accounting provides guidelines and tools to collect, analyse and monitor financial, social and environmental data (and thus guide behaviour). Although accounting as a professional field has a lengthy history dating back to at least the mid-nineteenth century (Tinker 1985), social accounting is more recent and burgeoned during the early 1970s (Mathews 1997).

There are many definitions of social accounting, of which the following is a sample:

- The process of selecting firm-level social performance variables, measures, and measurement procedures; systematically developing information useful for evaluating the firm's social performance; and communicating such information to concerned social groups, both within and outside the firm (Ramanathan 1976:519).
- The measurement and reporting, internal or external, of information concerning the impact of an entity and its activities on society (Estes 1976:3).
- The process of communicating the social and environmental effects of organisations' economic actions to particular interest groups within society and to society at large. As such it involves extending the accountability of organisations (particularly companies) beyond the traditional role of providing a financial account to the owners of capital, in particular, shareholders. Such an extension is predicated upon the assumption that

companies have wider responsibilities than simply to make money for shareholders (Gray et al. 1987:ix).

- At the very least, social accounting means an extension of disclosure into non-traditional areas such as providing information about employees, products, community service, and the prevention or reduction of pollution. However, the term "social accounting" is also used to describe a comprehensive form of accounting which takes into account externalities (Mathews and Perera 1995:364).
- Social and ethical accounting is concerned with learning about the effect that an organisation has on society and about its relationship with an entire range of stakeholders - all those groups who affect and/or are affected by the organisation and its activities (ISEA 2000:1).
- A systematic analysis of the effects of an organisation on its communities of interest or stakeholders, with stakeholder input as part of the data that are analysed for the accounting statement (Quarter et al. 2003:xix).

What these definitions share in common is the feature of expanding the range of criteria that are taken into consideration when measuring performance and looking at the organisation in relation to its surrounding social and natural environment. These definitions can be contrasted with the definition of conventional accounting set forth by the Accounting Principles Board (1970: Section 1023): "Accounting is a service activity. Its function is to provide quantitative information, primarily financial in nature, about economic entities that is intended to be useful in making economic decisions of action." Thus, while conventional accounting focuses only on the reporting of financial items for economic decision-making, social accounting focuses on a wider scope than on financial items alone.

4. THE EXPANDED VALUE ADDED STATEMENT

Building upon earlier social accounting models (for example, Abt 1974, Belkaoui 1984, Estes 1976, Linowes 1972), Mook developed several social accounting models that integrate financial and social information in order to present a fuller picture of an organisation's performance story (Mook 2004, Mook et al. 2002, 2003a, 2003b, 2004, Richmond and Mook 2001, Quarter et al. 2003). One of these models is the Expanded Value Added Statement, or EVAS, which is based on a conventional accounting statement (the Value Added Statement) but modified to include social and environmental items. (See Quarter et al. 2003 for more details on how the EVAS was developed and applied to cooperatives and non-profit organisations.)

Value added is the wealth that an organisation creates by its own and its employees' efforts (ASSC 1975). Whereas sales revenue includes the value of work done by organisations outside the firm, value added includes only the value of work done by the firm (Meek and Gray 1988).

Value added is typically measured by the difference between the market value of the goods or services produced, and the cost of goods and services purchased from other producers (Ruggles and Ruggles 1965). The Value Added Statement shows both the wealth created and how that wealth is used to pay those who created it. In equation form it can be expressed as follows (Riahi-Belkaoui 1992):

$$S - B = W + I + DP + D + T + R$$

Where

S	=	Sales revenue
B	=	Bought-in materials and services
W	=	Wages and benefits
I	=	Interest
DP	=	Depreciation
D	=	Dividends
T	=	Taxes
R	=	Retained earnings

In contrast to profit, which is the wealth created for only one group – the owners or shareholders – value added represents the wealth created for a larger group of stakeholders (Burchell et al. 1985, Riahi-Belkaoui 1999). Thus, the Value Added Statement focuses on the wider implications of an organisation's activities beyond its profits or losses (Meek and Gray 1988). It emphasises that the organisation also employs people, contributes to societal costs through taxes, rewards investors and creditors for risking their funds, and contributes to the community.

One of the limitations of the traditional Value Added Statement is that it focuses only on financial items and pays no attention to intangibles and items that do not pass through the market. Another limitation is that it does not account for the indirect impacts of an organisation's activities. To overcome these limitations, the Expanded Value Added Statement was developed to incorporate the social and environmental wealth which is created or destroyed (directly or indirectly) together with economic wealth.

The EVAS is not intended to replace existing financial statements, but to supplement them. By synthesising traditional financial data with social and environmental data, the EVAS provides additional valuable information for understanding the dynamics of an organisation and shows great potential by focusing attention on value creation and use.

5. SUSTAINABLE BUILDING EXAMPLE

The example of a sustainable building company will help to illustrate the economic, social and environmental value added of an organisation. Sustainable building has been approached as a way "to produce structures that enhance the quality of life and protect the environment, and do so efficiently, profitably and fairly" (WS Atkins Consultants 2001:4). In Canada, sustainable building certification initiatives such as the Leadership in Energy and Design (LEED)-Canada certification program, the Green Globes design for environmental assessment, and the Building Research Establishment Environmental Assessment Method (BREEAM)/Green Leaf Eco-rating program, are available to evaluate new and existing buildings in terms of how well they meet sustainable building practices. For example, the LEED-Canada program, based on the U.S. LEED program but taking into consideration the Canadian climate, construction practices, and regulations, evaluates buildings in six different categories:

1. Sustainable Sites
2. Water Efficiency
3. Energy and Atmosphere
4. Materials and Resources
5. Indoor Environmental Quality
6. Innovation and Design Process (CGBC 2004)

The green building movement has great potential to make a significant impact on sustainability, particularly in relation to three areas. First, commercial and residential buildings consume considerable amounts of water, wood, energy and other resources. Second, the building sector accounts for significant CO_2 emissions (in the U.S. these are estimated to be about 35% of total national CO_2 emissions), which are a major contributor to global warming. Finally, 'sick building syndrome' resulting from inadequate temperature, humidity, lighting, or ventilation, is a common complaint of traditional buildings, affecting the health and productivity of building occupants.

In a pioneering study of green buildings in the U.S., Kats et al. (2003) found that sustainable building practices yield many benefits to customers including lower energy, waste disposal, and water costs, lower environmental and emissions costs, lower operations and maintenance costs, and savings from increased productivity and health. Potential benefits to wider society through reduced waste and reduced emissions were also calculated. The study also found that the upfront investment for these buildings was minimal (about 2% of construction costs), and that the life cycle savings were over ten times the initial investment. Indeed, this study, the first to aggregate fully the costs and benefits of green buildings in the U.S., concluded that "an initial upfront investment of up to $100,000 to incorporate green building features into a $5 million project would result in savings of at least $1 million over the life of the building, assumed conservatively to be 20 years" (Kats et al. 2003:*v*). Based on data collected on 33 green buildings (25 offices and 8 schools), Kats et al. estimated that the financial benefits of green buildings based on a 20-year lifespan amounted to a net present value (NPV) of $15.98/ft^2 (NB: 1 ft = c. 0.31 metres) for environmental benefits, and between $36.89/ft^2 and $55.33/ft^2 for social benefits (Table 12-1). (See Kats et al. 2003 for details of these calculations.)

Table 12-1. Financial benefits of green buildings (per ft^2).

Category	20-year NPV
Energy value	$5.79
Emissions value	$1.18
Water value	$0.51
Waste value (construction only) – 1 year	$0.03
Commissioning* operations & maintenance value	$8.47
Subtotal	*$15.98*
Productivity & health value (LEED Certified and Silver)	$36.89
Productivity & health value (LEED Gold and Platinum)	$55.33
Less green cost premium	*($4.00)*
Total 20-year NPV (LEED Certified and Silver)	$48.87
Total 20-year NPV (LEED Gold and Platinum)	$67.31

* Commissioning is the "process of ensuring that systems are designed, installed, functionally tested and capable of being operated and maintained according to the owner's operational needs" (US DOE 1998:9).

While some of these rates relate directly to potential tangible financial benefits to the purchaser of the building, such as a reduction in expenses due to decreased energy and water consumption, others relate to the impact on property, health and environment. For example, the emissions value in Table 12-1 refers to the value of reducing air pollution and emissions associated with burning fossil fuels, including a value associated with the risk of not reducing CO_2 levels in order to counter global warming.

Relative to traditional buildings, however, green buildings are few and far between. One of the reasons is that there is a general misconception that green buildings are significantly more expensive up-front than traditional buildings (Bartlett and Howard 2001, Berman cited by Kats et al. 2003). Part of the problem is the separation of capital budgets from operating budgets, as this hinders the validation of higher capital costs by future revenue savings. But the effect of sustainable building is not just economic; it is also social and environmental. Since an organisation's conventional accounting statements (i.e., the income statement and the balance sheet) are limited to reporting internally generated financial items, they fall short in reporting (and hence in promoting) the full impact of green building practices. A more inclusive approach such as the EVAS is needed.

To illustrate the possibilities of EVAS with a concrete example, the data gathered by Kats et al. (2003) will be applied. The intention of this exercise is to show how the EVAS can incorporate social and environmental information, thereby presenting a fuller picture of the organisation than conventional accounting statements. Identifying and monetising externalities is a complicated matter which is currently under much discussion. Probably Kats et al. could have used different or more indicators, but this discussion is beyond the scope of this paper. The purpose of this example is to present an alternative accounting model which could reflect externalities however they are determined.

The data for the example are as follows:

1. Building size:	17,500 ft^2 (1625.75 m^2)
2. Traditional building cost per ft^2:	$\$286$
3. Total traditional building cost: $\$286/\text{ft}^2 * 17{,}500\ \text{ft}^2 =$	$\$3{,}600{,}000$
4. The cost of raising the standard of a building up to the LEEDs standard of environmental performance =	$\$5/\text{ft}^2$
5. Sustainable building cost per ft^2: $\$286/\text{ft}^2 + \$5/\text{ft}^2 =$	$\$291$ (item 3 plus item 4)
6. Total sustainable building cost: $\$291/\text{ft}^2 * 17{,}500\ \text{ft}^2 =$	$\$3{,}700{,}000$
7. Total 20-year NPV Environmental Benefits: $\$15.98 * 17{,}500\ \text{ft}^2 =$	$\$279{,}650$ (from Table 12-1)
8. Total 20-year NPV Productivity & Health Benefits $\$36.89 * 17{,}500\ \text{ft}^2 =$	$\$645{,}575$ (from Table 12-1)

5.1 Income Statement

The income statement based on these data is shown first for a traditional building project, and then for the same project built to sustainable building standards. In this example, the assumption is that the increased cost (derived from Kats et al. 2003) of using sustainable building materials and techniques ($100,000 plus profit margin) is passed along to the customer. According to the income statement, the 'bottom line' for the Traditional Building Co. (TBC) is $250,000, and for the Sustainable Building Co. (SBC) is $255,050 (Table 12-2).

Table 12-2. Income statement.

	Traditional Building Co. (TBC)	Sustainable Building Co. (SBC)
Revenues	$ 5,250,000	$ 5,356,050
Expenses		
- Materials/Outside services	$ 3,600,000	$ 3,700,000
- Wages/Benefits	$ 1,250,000	$ 1,250,000
- Depreciation	$ 100,000	$ 100,000
	$ *4,950,000*	$ *5,050,000*
Earnings before taxes	$ 300,000	$ 306,050
- Taxes	$ 50,000	$ 51,000
Earnings after taxes	$ 250,000	$ 255,050

However, this statement does not reflect the social and environmental impact of sustainable building practices. It reflects the additional cost of materials to create a more sustainable building ($100,000), but it does not show social and environmental benefits (a 20-year NPV of $925,225) (Table 12-3).

Table 12-3. Financial benefits of SBC Project A (17,500 ft^2/1625.75 m^2).

Category	20-year NPV/ft^2	20-year NPV
Potential benefits to customers		
Energy value	$ 5.79	$ 101,325
Water value	$ 0.51	$ 8,925
Commissioning operations & maintenance value	$ 8.47	$ 148,225
Productivity & health value (Certified and Silver)	$ 36.89	$ 645,575
		$ 904,050
Potential benefits to larger society/environment		
Waste value (construction only) – 1 year	$ 0.03	$ 525
Emissions value	$ 1.18	$ 20,650
Sub-total		*$ 21,175*
Total	$ 52.87	$ 925,225

As we can see by comparing the last two tables, Table 12-2 indicates that the additional cost of materials to create a more sustainable building is $100,000, yet Table 12-3 informs us that the 20-year net present value of projected social and environmental benefits is $925,225.

5.2 The Expanded Value Added Statement (EVAS)

To prepare an Expanded Value Added Statement for SBC, we need to consider both direct and indirect outputs and the subsequent impacts of its activities. Direct outputs refer to the direct effects of the organisation's activities on clients. For the SBC, the primary output in this example is a building using sustainable building standards. Indirect outputs can be split into two types: those that are the indirect effects of the organisation's activities on its clients or members, and those that are the indirect effects of the organisation's activities on those other than its clients or members. In the example of SBC, the former includes the reduced costs of energy, water operations and the commissioning of operations and maintenance, and levels of improved health and productivity. The latter includes reduced landfill use and reduced emissions.

As noted, there are two parts to an Expanded Value Added Statement: (1) the calculation of value added by an organisation; and (2) its distribution to the stakeholders. Note that the definition of value added is broadened from considering only financial transactions (that are part of the financial statements), to take into account also monetised social and environmental impacts. Table 12-4, which presents the value added by SBC, has six columns that refer to different sources of value added:

1. Financial 1 (F1): information from audited financial statements, but not including expenditures or revenues related to changing social and/or environmental performance
2. Financial 2 (F2): information from audited financial statements related to voluntary/proactive expenditures or revenues related to changing social and/or environmental performance
3. Financial Total (F TTL): adds together F1 and F2
4. Social/Environmental (SOCENV1): information about non-monetised contributions and outputs for which market comparisons are estimated: potential benefits to customers
5. Social/Environmental (SOCENV2): information about non-monetised contributions and outputs for which market comparisons are estimated: potential benefits to larger society
6. Combined TOTAL (C TTL): total of F TTL and SOCENV1 and SOCENV2

5.2.1 Value of Outputs

In order to calculate the amount of value added, the first step is to assess the total outputs of the organisation and assign a comparative value to them. In the first column, F1, the amount indicated as 'direct value' is revenue that would be received for the building had it been constructed under traditional building standards ($5,250,000). In the second column, F2, the amount of additional revenue received as a result of covering the increased costs to construct the building according to sustainable building standards is shown ($106,050). The third column, F TTL, adds these two figures together to total a 'direct' value of $5,356,050. The fourth and fifth columns, SOCENV1 and SOCENV2, include the values that were calculated by Kats et al. for the social and environmental benefits of building to sustainable standards (Table 12-3). SOCENV1 refers to the potential benefits that would go directly to the customers, while SOCENV2 includes an estimate of potential value that would be gained by larger society. The final column (C TTL) adds together the financial, social and environmental values to end up with $6,281,275.

5.2.2 Subtracting External Purchases

Returning to our earlier definition, value added is a measure of wealth that an organisation creates by "adding value" to the raw materials, products, and services through the use of labour and capital. The total outputs (combined) represent the value placed on the organisation's goods and services, but in order to provide those goods, SBC has purchased goods and services from external sources. The cost of these purchases is taken from the organisation's audited financial statements. As shown in Table 12-4, SBC's total expenditures in its audited financial statements are $5,101,000, but in order to arrive at the amount expended externally on goods and services, the costs related to capital and labour have to be subtracted from the total. Therefore, $5,101,000 is reduced by the employee wages and benefits ($1,250,000), the amortisation of capital assets ($100,000), and taxes ($51,000), and the resulting amount is the cost of externally purchased goods and services ($3,700,000). The cost of externally purchased goods and services which would have been spent to construct a traditional building is shown in F1 ($3,600,000), and the additional costs to make the building sustainable are shown in F2 ($100,000).

5.2.3 Value Added

The amount of value added is calculated by subtracting the amount of externally purchased goods and services from the value of the goods and services produced.

Table 12-4. Expanded value added statement – Sustainable Building Co. (SBC).

		1	2	3	4	5	6
SUSTAINABLE BUILDING CO.		Traditional	Sustainable				
Expanded Value Added Statement		F1	F2	F TTL	SOCENV1	SOCENV2	C TTL
For Project ABC					Benefits to customers	Benefits to society	Combined
Direct outputs	Sales	$ 5,250,000	$ 106,050	$ 5,356,050			$ 5,356,050
Indirect outputs	Energy value				$ 101,325		$ 101,325
	Water value				$ 8,925		$ 8,925
	Commissioning value				$ 148,225		$ 148,225
	Productivity & health value				$ 645,575		$ 645,575
	Waste value					$ 525	$ 525
	Emissions value					$ 20,650	$ 20,650
Total outputs					$ 904,050	$ 21,175	$ 6,281,275
External Goods & Services		$ 3,600,000	$ 100,000	$ 3,700,000			$ 3,700,000
Value Added Created		**$ 1,650,000**	**$ 6,050**	**$ 1,656,050**	**$ 904,050**	**$ 21,175**	**$ 2,581,275**
Ratio of VA to Ext G&S		0.46		0.45	0.24	0.01	0.70
Employees	Wages/benefits	$ 1,250,000		$ 1,250,000			$ 1,250,000
Customers					$ 904,050		$ 904,050
Society	Reduction in waste and emissions					$ 21,175	$ 21,175
	Taxes	$ 50,000	$ 1,000	$ 51,000			$ 51,000
Organisation	Depreciation	$ 100,000		$ 100,000			$ 100,000
	Profit	$ 250,000	$ 5,050	$ 255,050			$ 255,050
Value Added Distributed		**$ 1,650,000**	**$ 6,050**	**$ 1,656,050**	**$ 904,050**	**$ 21,175**	**$ 2,581,275**

5.2.4 Ratio of Value Added to Purchases

The ratio of value added to purchases, indicated in Table 12-4 is calculated by dividing the value added by the cost of external goods and services. This ratio indicates that for every dollar expended on goods and services, the organisation generated \$0.70 in value added. As noted, the Expanded Value Added Statement includes an estimated future value of items such as reduced energy use, water use, and emissions levels; decreased operating and maintenance expenses; increased occupant health; and increased worker productivity. If these items had not been included, the ratio of value added to purchases would have been 0.45, indicated in the "financial" column. Therefore, the inclusion of non-monetised items increases this ratio by over 56%.

5.2.5 Distribution of Value Added

The stakeholder-based approach of the Value Added Statement differentiates it from most other forms of financial statements that are oriented toward shareholders. For the statement of distribution, the value added which is created by the organisation is distributed to the stakeholders in its entirety. Stakeholders are selected on the basis of their contribution to the viability of the organisation and its values. For a Value Added Statement, the stakeholders suggested by accounting regulatory bodies are normally employees, government, investors, and the organisation itself. For the purposes of the Expanded Value Added Statement of SBC, one additional stakeholder was identified - customers; and one was modified - the stakeholder 'government' was changed to the stakeholder 'society'.

Table 12-4 presents the distribution of value added for these five stakeholders and also lists the items associated with each stakeholder.

- *Employees*: The value added distributed to the stakeholder employees lists their wages and benefits at \$1,250,000.
- *Customers*: The building owner or lessee received a portion of the value added which was created through financial benefits to be received over the life of the building (\$904,050). These include reduced energy and water costs, reduced operating and maintenance expenses (\$258,475), and increased productivity of employees (\$645,575).
- *Society*: The stakeholder referred to here as 'society' received a portion of the value added which was created through the reduction of emissions into the environment, estimated according to the research done by Kats et al. (2003) to be \$21,175, and also received value added from payments made to the public sector through taxes (\$51,000).

- *Organisation*: Value added which was distributed to the stakeholder 'organisation' was $100,000 for the depreciation of capital assets and $255,050 from an operating surplus.

5.3 Summary of EVAS

In total, the value added which was distributed corresponds to the value added which was created. Where the items were limited to those on audited financial statements, that amount was $1,656,050; where the items were expanded to include non-monetised social and environmental impacts, the amount was $2,581,275. Figure 12-1 shows this in graphic form.

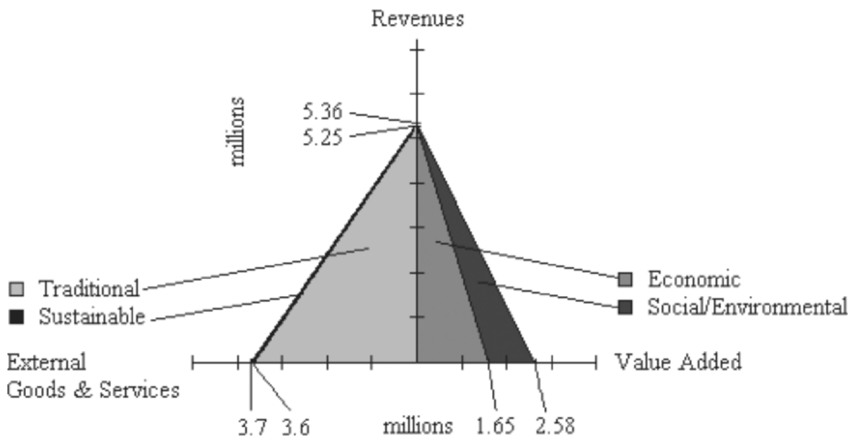

Figure 12-1. Graphic depiction of value added showing traditional and sustainable building methods.

Conventional accounting does not show the impressive additional social and environmental benefits (nearly $1 million) gained from a mere 2% increase in costs ($100,000) in order to make the building sustainable. The EVAS reflects these figures, and hence shows a much broader picture of the organisation's performance.

6. DISCUSSION

The Expanded Value Added Statement shows that financial information alone does not tell the organisation's whole performance story. In the example posed in this chapter, the Expanded Value Added Statement focuses on value creation and creates greater awareness of at least three areas:

- The impact of the organisation on different stakeholders
- The role of the organisation in creating economic, social and environmental value added
- The interconnectedness of the economic, social and environmental dimensions of organisational activities

Some of the limitations of the EVAS are imposed by the selection of items to be included and by the methods available to put a monetary value on them. In this regard, the challenges faced by the Expanded Value Added Statement are shared by other forms of alternative accounting and economics, namely identifying, measuring, quantifying, standardising and placing a value on key social and environmental indicators which could encourage and measure sustainable performance (Ranganathan 1999, White and Zinkl 1999). In the example analysed above, the figures suggest that the potential social and environmental benefits to wider society are very low in relation to those enjoyed by customers. This could be due to the choice of indicators used by Kats et al. and to the difficulties of assigning a value to complex variables. Another challenge is to assess not only value added but also value subtracted, as it is important for accounting statements to illuminate both positive and negative impacts on sustainability. These are areas that require continued development and discussion (see Bennett et al. 2002, 2003, Rikhardsson et al. 2005, Schaltegger and Burritt 2000).

The strengths of the Expanded Value Added Statement lie in its ability to take a broader look at the organisation and the role of stakeholders to put this into a larger socio-economic perspective. By including non-monetary items, the EVAS presents a fuller picture of an organisation's economic, social and environmental dimensions, and of the interdependence between them. Although more work has to be done to determine acceptable valuation methods (as not everyone would agree with the estimates of projected value presented in this example), the change of focus, from a profit-oriented bottom line to an integrated economic, social and environmental bottom line, provides an opportunity for organisations and society to think about impacts in a broader sense.

This brings us back to the initial assumption stated at the beginning of the paper, that accounting is a driver of behaviour and can be conceived of as an explicit change agent in order to move organisations towards sustainability. By synthesising financial data with social and environmental data, the Expanded Value Added Statement is one mechanism for understanding the dynamics of an organisation and the inter-related economic-social-environmental implications of various choices made in day-to-day operations. In making these relationships more visible, hopefully the EVAS can help create a new awareness, which in turn can shape more sustainable attitudes and behaviours in organisations, and communicate this to a wider audience.

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PART III

REPORTING EXTERNAL ACCOUNTING FRAMEWORKS AND BENCHMARKING

Chapter 13

CORPORATE SUSTAINABILITY REPORTING

An Overview

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Abstract: Reporting and external corporate communication play an important role in corporate sustainability. As well as economic reasons, the vision of sustainable development also emphasizes the importance of corporate sustainability reporting. On the one hand, companies depend on a supply of resources from various stakeholders, so that management is challenged to secure social acceptance by communicating the benefits that the company creates for society and the sustainability effects of its activities. On the other hand, the vision of sustainable development requires participation, which in turn requires the reporting and communication of sustainability-relevant issues and activities. No participation is possible without communication.

This contribution provides an overview of the main goals and benefits of corporate sustainability reporting and its development over recent decades, and an outlook on current challenges and developments.

1. INTRODUCTION

Because of their social embeddedness in their stakeholder environment, companies cannot act in isolation from their social environment. The purposes of a company are determined by various stakeholders who pursue different economic, ecological and social goals and who demand information related to their goals. In consequence, corporate sustainability management is challenged not only to manage the economic, ecological and social effects of corporate activities systematically, but also to provide stakeholders with information about sustainability-relevant issues and how the company is

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 301-324.

dealing with them. Sustainability management designs processes and structures in order to ensure sustainable corporate and business development and to contribute positively to the sustainable development of society generally (Schaltegger and Burritt 2005). This means that information creation and information flows have to be organized in line with reporting, communication and dialogue requirements with key stakeholders.

2. GOALS AND BENEFITS OF SUSTAINABILITY REPORTING

An increasing number of companies are issuing environmental and sustainability reports, which raises questions about the reasons for these corporate activities and of the benefits that sustainability reporting creates for companies. Among the most important goals and benefits of sustainability reporting are:

- Legitimation of corporate activities, products and services which create environmental and social impacts
- Increase in corporate reputation and brand value
- Gaining a competitive advantage
- Signalling superior competitiveness, with sustainability reporting activities as a proxy indicator for overall performance
- Comparison and benchmarking against competitors
- Increasing transparency and accountability within the company
- Establishing and supporting employee motivation as well as internal information and control processes

An essential goal in informing key stakeholder groups about non-financial issues is to secure the *legitimation* of corporate activities and the *supply of important resources*. This applies for the public acceptance of the company generally, as well as for the acceptance of particular management decisions and activities which may sometimes be compromising. A specific goal may also be to ensure acceptance by key stakeholders (e.g. government, media, or employees) and pressure groups (e.g. environment protection groups, human rights associations). To provide confidence in the company and its corporate activities, the reporting must be reliable. One way to deal with this is the formulation of guidelines, rules or standards for sustainability reporting, some of which are related to the principles of financial reporting, such as the qualitative characteristics of the International Financial Accounting Standards (IFAS, see e.g. Schaltegger and Burritt 2000:337ff.). Such characteristics cover aspects such as transparency, inclusiveness, completeness, relevance, sustainability context, accuracy, neutrality, comparability, clarity, timeliness and auditability (see e.g. GRI 2002). Reporting non-financial corporate activities signals a willingness to communicate about and deal with societal issues, and may serve to secure a continuing good relationship with the company's stakeholders (Herzig and Schaltegger 2005, Wild 2002).

Furthermore, companies may be interested in enhancing their *reputation* by dealing more systematically and seriously with sustainability matters (see e.g. House of Mandag Morgen 1999). In particular, reputation may be enhanced by reporting about successful engagement in non-market matters, i.e. in social and environmental projects which are not considered to be part of core business activities. Outstanding corporate reputation is often related to higher brand value and may contribute to increasing business success (e.g. Fombrun 1996, 2001). Enterprises which are perceived as being simultaneously high performers both in the market and for society face less frictions and problems in their business relationships with suppliers, traders, public authorities and further stakeholders**.**

Sustainability reporting can provide a *signalling effect to stakeholders*. Given that comparing sustainability performance between companies is often very difficult, their reporting activities are sometimes perceived as a proxy indicator for performance (irrespective of whether or not this is justified).

Based on these effects, companies can try to gain a *competitive advantage* in comparison to other companies which do not engage in societal projects or which do not communicate their achievements effectively enough. Reporting of outstanding quality – which may even be awarded e.g. with a high ranking in a sustainability reports competition – may contribute to a positive reputation and to the documentation of superior competitiveness generally.

With the increasing *standardisation* of sustainability reports, the potential to *compare and benchmark* sustainability-relevant corporate performance may improve over time (see GRI 2002, Herzig and Schaltegger 2004). Whereas *external benchmarking with competitors* is sometimes a driving force for management to deal with sustainability reporting, other companies may prefer to establish *company-internal benchmarking* processes and systems to compare business units, production sites, etc. Benchmarking is in most cases strongly linked to a wish to increase *transparency and accountability* within the company. Reporting – no matter whether internal or external – requires the collection of information, its analysis, and its internal communication in working groups and to middle and top management. As a consequence, *sustainability reporting is often a key driver in the organisation in creating transparency about responsibilities and accountability for activities and performance.*

Last but not least, sustainability reporting may serve as a motivation for middle management and employees to deal seriously and in more detail with corporate sustainability issues. *Sustainability reporting provides an official company-internal reason to deal with corporate sustainability, it initiates processes of awareness, and it can establish routines for considering sustainability-related information to be part of business information.* With the collection and analysis of information as well as the creation of higher transparency, the sustainability reporting process may support internal information and control processes. It supports the *information and motivation of employees* as well as *performance control* (e.g. House of Mandag Morgen 1999). Sustainability reporting may motivate employees to collect information and implement measures to realize sustainable corporate development (see e.g. INEM 2001).

Which of these goals and benefits motivate management most to deal with sustainability reporting depends on the company-specific situation and on industry and market conditions, as well as on stakeholder constellations and management preferences. To achieve the potential benefits requires in any case a well-designed approach to sustainability reporting which is well linked both to information management and accounting and to strategic management.

The next section provides a historical overview of the main developments in environmental, social and sustainability reporting.

3. DEVELOPMENT OF SUSTAINABILITY REPORTING

Reviewing the historical development of sustainability reporting over recent decades, companies have changed the perspectives and directions of their non-financial reports in response to different societal challenges (see Schaltegger and Herzig 2005). Figure 13-1 illustrates the different stages and forms of reporting, particularly in Europe, with regard to the three-pillar approach to sustainable development. The basic development path which is sketched here of course does not reflect the possibility that some very forward-looking companies may have taken the respective steps earlier, and that some laggards may still be behind.

Financial reporting originated in the 19th century and focuses exclusively on monetary principles. It was first complemented and extended in the 1970s to *social aspects*. The essential concern was to inform internal and external stakeholders about the company's activities, products and services and about related positive and negative social impacts. The focus was on *social effects*, or *socio-effectiveness*, and only partially on *socio-efficiency* (e.g. in the context of value-added reports). About a decade later, *environmental reporting* emerged and to a large extent superseded the early social reporting activities. The main focus of environmental reporting is mostly on *ecological effectiveness* or, in other words, the absolute level of environmental impacts such as air and water emissions, amounts of wastes, etc. In addition, and sometimes succeeding these rather one-dimensionally oriented communication activities, reporting started to focus on *two-dimensional links between the economic and the environmental dimensions (eco-efficiency)* or – more rarely – the *link between the economic and the social dimensions (socio-efficiency)*. Currently, the main attempts are to issue *integrative sustainability reports* which address all three dimensions and the links between them. The main challenges in integrative sustainability reporting are, firstly, the *contextual integration challenge* to outline the impacts of corporate activities from the different angles of the three perspectives including conflicting goals, dilemmas, synergies, priorities, and decision-making processes. Secondly, integrative sustainability reports face a *methodological integration challenge* to interweave the different forms of existing reports, further communication activities and channels, and the underlying information management and accounting approaches which provide the reporting information. In the following, their development will be explained further in detail, with a special focus on European developments.

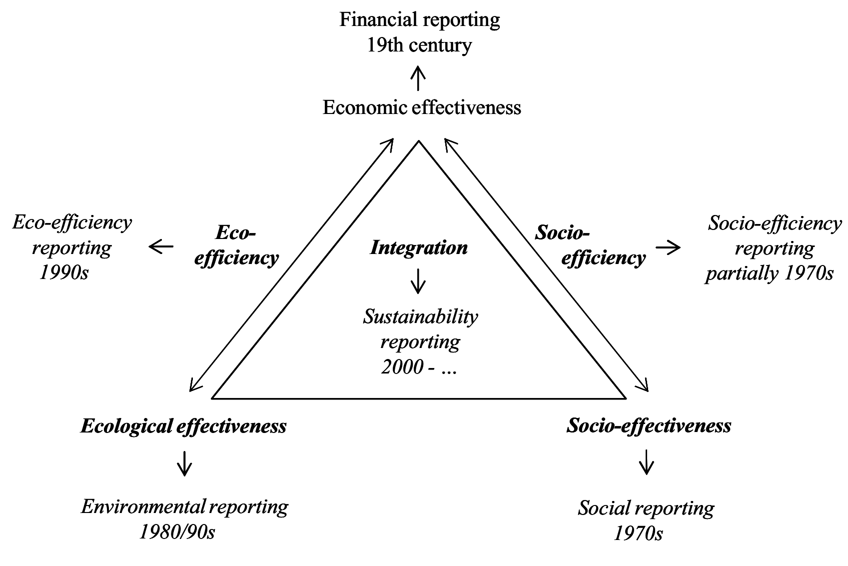

Figure 13-1. Perspectives of sustainable development and development of sustainability reporting (source: based on Schaltegger et al. 2002).

In the 1970s, higher income levels were achieved and the focus of society and politics moved to the quality of life, whereas the negative effects of quantitative economic growth and a Tayloristic organisation of production processes took centre stage in most parts of Europe. At that time, several companies started to publish their social goals, activities and impacts – none of which were part of traditional corporate financial reporting – in specific social reports (e.g. Wysocki 1981). At the end of the 1970s, the reporting of *social balances* and the publication of *specific social reports* disappeared to a large extent. Among the reasons for this development are (Dierkes 1976; Hemmer 1996):

- Inadequate target group orientation
- The information interests of most stakeholders were not met by social reports which were often scientifically designed and remote from the reality of most people's lives
- The instrumentalisation of social reporting as a public relations tool reduced its credibility
- The insufficient integration of social and financial reporting
- The positive economic and political development of Europe, with job movements to the services sector and improved working conditions

In the last couple of years, corporate reporting practice and a multitude of reporting-related initiatives by NGOs, ministries and industry associations have produced a *large variety of corporate non-financial reports* such as the "Corporate Citizenship Report" (e.g. Volvo) or the "Corporate Social Responsibility Report" (e.g. Siemens). Unlike the 1970s, companies deal today *more globally* and often also *more comprehensively* with moral and ethical questions of sustainable development such as child labour in the supply chain, human rights, gender issues, trading relationships, etc.

Environmental reporting emerged in the late 1980s and early 1990s mostly as a *reaction to accidents and environmental disasters* such as Bhopal, Schweizerhalle and Chernobyl, and to other hazardous incidents such as, for example, the accidents at Hoechst AG in the 1990s. In consequence, companies were perceived to be the major creators and causes of environmental problems. To avoid losing societal legitimation, companies started – partly forced by new laws (compulsory reporting), partly voluntarily – to provide information about environmentally relevant corporate activities for a multitude of stakeholders (e.g. Fichter 1998). The *number of environmental reports* and the *attention they receive in the media and society* has increased significantly since then, and their *average quality* has also improved steadily (Fichter et al. 1997). Furthermore, over 3,000 companies in Europe are certified according to EMAS and as a result are obliged to publish an environmental statement as per annex III, EG Eco Audit Directive.

Since the mid-1990s, companies have increasingly disclosed information about the interrelation between economic output and ecological input *(eco-efficiency) in their environmental, business and financial reports* (Schaltegger et al. 2002). The concept of eco-efficiency, first developed in academia (Schaltegger and Sturm 1990), has been popularised by the World Business Council for Sustainable Development (Schmidheiny 1992, WBCSD 1997) which subsequently took the lead in disseminating the eco-efficiency approach into business practice. In contrast to the history of the eco-efficiency concept, an analogous analysis and presentation of socio-efficiency, as the link between social and economic issues, is still comparatively negligible in business reports. Reasons for this may be the drawbacks at the beginning of social reporting as well as difficulties in quantifying social aspects. In addition, the aggregation of monetary and non-monetary social factors leads to more problems than with environmental issues (Schaltegger et al. 2002).

Since the mid-1990s, and increasingly towards the end of that decade, the number of companies reporting on *three dimensions of sustainability*, i.e. the number of companies which combine information about ecological, social and economic aspects within their reporting, has increased substantially (e.g. Kolk 2004). This reflects those companies´ claims to depict an overall picture of their corporate sustainability activities and to inform stakeholders to what extent they contribute to sustainable development, and how. So far, these aspects have usually been considered in an *additive manner*. Leading corporations are currently attempting to integrate environmental, social and financial accounting information in very different ways, which has led to the extension of existing reports, to a large variety and various combinations of different reporting formats, and to the development of new kinds of reports:

- *Specific sustainability report in addition to the financial report:* Some companies have started to publish so-called sustainability reports in addition to their financial report. These reports constitute a single publication which simultaneously provides information about the company's ecological, social and economic sustainability activities and performance, often following the format of an earlier environmental report. A well-known example is the so-called "Triple P-Report" (People, Planet and Profits) of Shell, published in 1999, which is one of the first of this kind, and whose title already indicates its three-dimensional reporting character.
- *Extended business and financial reports:* Because of the increasing financial importance of environmental and social issues, an increasing number of companies are integrating sustainability aspects into their financial report, in either the balance sheet or profit and loss account. Some companies have decided to go a step further and integrate their whole environmental and social reporting into their business reports (e.g. Renault Group 2002). They try to compile a sustainability report which is

completely integrated into the business report. The development to integrate non-financial information into the annual financial report is sometimes supported by legislation, such as in France since 2001.
- *Several different specific reports:* Instead of producing a separate sustainability report or integrating non-financial issues into an extended business report, other companies have decided to publish a series of several different company reports (e.g. environmental report, social report, corporate responsibility report, corporate citizenship report, etc.). These each deal with a specific challenge of corporate sustainability and address different stakeholder groups.

In conclusion, the number of companies issuing a sustainability report is increasing whilst at the same time new forms of corporate sustainability reporting are being developed. Most companies are searching for a reporting and communication format which is ideal for their own purposes, and the consequence of this experimentation process is that reporting contents and formats often change from year to year.

4. SPECIFIC CHALLENGES IN SUSTAINABILITY REPORTING

In contrast to corporate reporting generally, sustainability communication and reporting are characterized by some specific management challenges. Among the most important *challenges related to company internal communication* are:
- Agreement over the terms “sustainability” or “sustainable development” is usually rather difficult and not made explicit. In consequence, sustainability reports currently change their main focus fairly fast and often between different sustainability perspectives. This challenges management to establish an approach to identify what contextual priorities should be chosen in each reporting period and how to define and communicate its understanding of corporate sustainability.
- It is often difficult to identify and analyse sustainability issues, which requires a change in current and traditional terms and perceptions. Management is furthermore challenged to link strategic analysis and management together with information management, corporate accounting and sustainability reporting.
- The complexity of corporate sustainability as a set of interrelated goals leads to problems for management in operationalisation, measurement and communication. Sustainability reporting must therefore be backed up with a systematic accounting and information management system which

provides a comprehensive basis for all sustainability issues but which, nevertheless, is not excessive in size.
- Developing solutions often requires interdisciplinary teamwork and lateral organisation processes. Experts who are accustomed to communicating in their own scientific or professional "language" have to open up to the approaches, terms and interpretations of other sciences and professions. Successful sustainability reporting and communication, like sustainability management in general, therefore requires the development of interdisciplinary employee skills with a strong fundamental training in sustainability management, communication and soft skills.

These challenges currently complicate the development of confidence and credibility in communication processes within companies, as well as between enterprises and their stakeholders. In addition, corporate sustainability reporting is confronted with sustainability-specific *challenges to company external communication* (Herzig and Schaltegger 2004) such as:
- On the one side, information about the sustainability of a company is not simple for stakeholders to access directly and they can often do this only with difficulty, and its acquisition can involve very high costs in both time and money. This leads to *information asymmetry* between the company and its stakeholders (Schaltegger 1997). Situations of asymmetric information tend to create a *climate of low credibility* which the company has to overcome with specific communication and management activities such as warrants, verifications, labels certified by credible NGOs, etc.
- Companies, on the other hand, do not always have sufficient *knowledge about the information needs of stakeholders.* As a result current sustainability reports do not always meet stakeholders' information needs and often only a small part of the desired readership is actually contacted (e.g. ECC Kohtes Klewes 2003). Indeed, the latter is not a sustainability-related phenomenon but the common fate of communication. So far, only a limited number of systematic and comprehensive surveys have been conducted on the reception of environmental and sustainability reports. In any case, a *stronger involvement of stakeholders into the reporting process* is needed in order to enable a better target-oriented form of reporting (e.g. ECC Kohtes Klewes 2003, GRI 2002).
- Currently, most sustainability reports are non-specific, aiming at a diffuse and excessively wide group of potential readers *(lack of target group orientation)*. This creates a risk of *information overload* and often leads to an *additive and separate treatment* of ecological, social and economic matters. The term "carpet bombing syndrome" (SustainAbility and UNEP 2002) illustrates the fact that some companies have "flooded" their readers with increasingly extensive sustainability reports – recognized

by some, but in practice mostly read by only a few. To counteract this, companies should strive for a well-balanced and clearly arranged presentation of sustainability information which *addresses a clearly defined group of readers.* This very often requires direct consideration of specific *interlinkages* between economic, social and ecological business achievements, including synergy effects and conflicts between objectives. In practice, these interfaces are discussed only rudimentarily (e.g. INEM 2001, SustainAbility and UNEP 2002).

- An improvement in the often-criticised lack of *comparability of sustainability reports* requires a consensus or a *generally accepted standard* about what information shall be disclosed and in what format. The Global Reporting Initiative (GRI) is attempting to create such a standard. In addition to information which is related to activities and management systems, *significant sustainability performance indicators* are of particular importance (but are often not in the centre of attention). The *improvement of data quality* and the *quality of data collection procedures* is an additional requirement for the comparability of published sustainability information (Schaltegger 1997). The comparability of ecological and social performance information is often limited because the procedures and practices of data collection and information management can vary over time or between companies.

So far, small and medium sized enterprises (SMEs) are particularly reluctant to issue sustainability reports. Since SMEs constitute a large part of the economy and of its social and environmental effects, it is necessary to emphasise the benefits and to *keep the costs of sustainability reporting low* (e.g. ACCA 2004, European Environment Agency 2003, GRI 2004).

The next section provides an overview of current developments relevant for sustainability reporting including guidelines, verification, auditing, ranking and rating, professionalisation of sustainability communication, and the role of and the link to accounting.

5. CURRENT DEVELOPMENTS

5.1 Guidelines and Standards

Various institutions have published guidelines, standards, regulations, sets of criteria, etc. which should help to harmonize corporate sustainability reporting and to provide some guidance for management. A *guideline* is a non-binding guidance document based on practical experiences. In practice, companies can profit from complying with a guideline issued by a renowned institution because of image transfer effects. Guidelines often precede standards or regulations. In contrast, reporting *regulations* are issued by associations and ministries and have a binding character. Regulations are often based on *standards* which, in turn, are developed by standardisation organisations and are often the basis for certification procedures. Certain core aspects, procedures and indicators are defined for a harmonized assessment, disclosure and comparison of corporate environmental, social and economic performance and impacts.

Current international examples are the guidelines of the Global Reporting Initiative (GRI 2002) and the World Business Council for Sustainable Development (WBCSD 2002), and the standard ISO 14063 for environmental communications (ISO 2004). In Europe there also exist some sector-specific guidelines for the production of environmental reports (e.g. CEFIC 1998, DEFRA 2001, Forge 2002, VfU 2001), guidelines for environmental statements (e.g. BMLFUW 2004, Commission of the European Communities 2001b), and for social, CSR and sustainability reports (e.g. CSR Europe 2000, Socialministeriet 2001). Some guidelines or handbooks specifically address SMEs (e.g. Austrian Institute for Sustainable Development 2003, European Environment Agency 2003, INEM 2001, UVM 2002). The GRI has also recognised that SMEs need specific support, which is why it has developed a “beginner’s guide” with a procedure of five basic steps and case studies on how to successfully create a sustainability report (GRI 2004). Furthermore, GRI has a key role in bundling together the different recommendations and guidelines so that company managers can keep an up-to-date overview.

5.2 Regulations

As well as guidelines and standards, the number of European countries which regulate corporate environmental and sustainability reporting is increasing (e.g. IIIEE 2002, KPMG 2005). At the beginning of this millennium, the European Commission (2001a) published a recommendation for the consideration of environmental aspects in financial reports and the management’s discussion and analysis. In 2003 the EU decided with its modernisation of the accounting regulations 2003/51/EC (EU 2003) to change the framework regulation for the annual financial report and the consolidated annual report of companies. In Germany for instance, implementation of the EU modernisation regulation with the reformed law regulating the balance sheet (“Bilanzrechtsreformgesetz”; Bundestag 2004) has forced shareholder companies since 2005 to include non-financial performance indicators, specifically also environmental and labour-related indicators, in the prognosis reports which are included in their annual reports (e.g. Kaiser 2005). The implementation of this EU regulation with the Operating and Financial Review in the United Kingdom (Secretary of State 2005) may also result in increased transparency and accuracy of company reports concerning environmental, labour, societal and community topics (UK Statutory Instruments 2005). Other European countries such as Denmark (article 4.1.8 of VLAREM II, since 1995), the Netherlands (Environmental Protection Act, since 1997), France (Law no. 2001-420 related to new economic regulations, Art. 116, since 2002), Norway (Accounting Act, Regnskapsloven, since 1999), and Sweden (amendment to the Annual Accounts Act, since 1999) have already had laws to deal with the reporting of environmental and sustainability issues for various numbers of years (e.g. IIIEE 2002, KPMG 2005, Nyquist 2003, Rikhardsson 1999).

One main goal of the regulations is to reduce the costs incurred by stakeholders in reducing the information asymmetry between themselves and companies. However, reporting regulations do not always improve the information situation for stakeholders. In some cases companies with passive or indifferent corporate environmental strategies will focus on reducing their reporting costs in order to meet the regulatory requirements by neglecting the quality of data and information in their information management procedures. This leads to an adverse selection in reports whereby bad information quality drives out good information quality (Schaltegger 1997), with the effect that the figures and statements are of little or no information value to stakeholders. A consensus, and certain standards which harmonise the information generation for sustainability-related issues, are necessary. This is one of the main topics and justifications for sustainability accounting. The reporting regulations can have a positive effect on sustainability, transparency and stakeholder involvement only if companies have adequate sustainability accounting and management approaches to ensure reliable, accurate and relevant information. The establishment of standardized information systems is especially important for multinational companies when consolidating the world-wide figures of their subsidiaries.

5.3 Internet Support

In recent years an increasing number of companies have been using the internet for their sustainability reporting (SustainAbility and UNEP 2004). The use of hyperlinks can highlight easily, effectively and at low cost, the links between financial, social and environmental reporting (e.g. Isenmann 2005, Kim 2005). In contrast to printed reports, electronic internet publications provide additional support for companies in identifying their own interlinkages and disclosing the overall picture of their corporate sustainability activities, including synergies and conflicting effects. Internet-supported sustainability reporting enables the skilled user to receive an integrated view of all the dimensions of sustainability, and for interested stakeholders to select, from a large information data base, that information which is of specific interest to them. With the media-specific linking possibilities and the use of the HTML format, reporting is no longer limited by the number of printed pages. A large quantity of information, including historical company information and links to other information sources related to the company or to other organisations such as professional associations, published rankings and media reports, etc., can be offered online without creating a "carpet bomb" for the reader. Whether printed reports are even necessary is an issue which is being discussed in the revision of the EMAS regulation (UGA 2004), driven mainly by the consideration of encouraging a wider application of EMAS by reducing the costs of publishing the environmental statement.

However, the internet and its underlying technologies and services can provide more than just new channels for the cheaper distribution of information. As well as hyper-linking, further possibilities which this offers for the design of the company's sustainability reporting include many other features such as, for example, 24-hour accessibility, addressee-specific information tailoring and distribution, individual access for stakeholders, and the combination of different media elements such as words, figures, pictures, videos, etc. (e.g. Isenmann 2005). Furthermore, internet-based sustainability reporting offers possibilities for interactive communication processes with stakeholders (e.g. Godemann et al. 2005, Kim 2005).

However, sophisticated internet-supported sustainability reporting also incurs substantial costs. "Thus, it is recommended that companies weigh the costs and benefits of such advanced sustainability reporting approaches against the target groups' information needs and the companies' resource capabilities to meet such needs" (Isenmann 2005:200). The *requirements for quality, design and functionality of the reporting approach* increase with the complexity, intensity and sophistication of the internet support. Since some stakeholders tend to be excluded from the internet (e.g. some elderly people or some developing regions) or hindered in their use of it (e.g. depending on the speed of internet access, the loading time for complex pictures may be too long), and because various stakeholders and reading situations currently still favour a printed report (such as on a train, plane or at home on the couch), the *combination and interplay of internet and printed reports* has to be thought through and *embedded in the company's overall communications approach* (e.g. including stakeholder forums, community meetings, advisory boards, press releases, etc.). Furthermore, different *stakeholder groups have different approaches to their information search* and research which have to be considered in order to address them better. This requires that the company establishes an interactive communication process with its stakeholders to learn about their information interests and search key words and to optimise the navigation on the homepage.

The *practice of corporate internet sustainability reporting* of the Global Fortune 500 (Kim 2005, Rikhardsson 2002), Global Fortune 1000 (Morhardt and Adidjaja 2004), FTSE 100, FTSE 250 and Fortune 100 (Coope 2004) as well as of the German DAX-30 (Blanke et al. 2005) shows that some companies already use the specific advantages and possibilities of the internet, but that *for most companies the potential to increase the dissemination and to improve the accessibility of corporate sustainability information with a better design of their internet reporting could be explored much better* (see also SustainAbility and UNEP 2004).

5.4 Assessment, Verification and Challenger Report

Assessment and verification of sustainability information can help to improve the credibility of sustainability reporting. The assessment and verification of information which is disclosed in corporate reports can in principle be conducted by independent external experts from accounting firms, independent associations, or renowned NGOs. The verification of published information is common and is mostly required for financial reports, but this has also started with sustainability reports too. A survey of the 100 largest companies from 16 countries by KPMG (2005) showed that 33 percent (= 525 companies) issue a separate health and safety and/or environmental, social or sustainability report; and of these, 33 percent (= 171 companies) had their reports verified.

National standards published by national associations of professional accountants include for example the German standard IDW PS 820 relating to environmental reports (IDW 1999), which has recently been complemented by the draft IDW auditing standard “Generally accepted assurance standards for the audit or review of sustainability reports” (IDW 2005), and the Dutch exposure draft standard RL 3410 assurance engagements relating to sustainability reports (Royal NIVRA 2005). Apart from national standards and international auditing standards such as the international standard on assurance engagements 3000 (IFAC 2003), the AA1000 assurance standard (2003) is increasingly often applied for the verification of sustainability reports (KPMG 2005), in particular because of its close compatibility with the GRI sustainability reporting guidelines (GRI 2002).

An interesting option for a third party assessment is the so-called *challenger report* which is usually performed by independent external experts, often research institutes or NGOs. A challenger report is a constructive critical report which identifies and highlights possibilities to make improvements, based on analysis of the existing sustainability report. Such a report can serve *internal purposes* by raising awareness of current and expected future sustainability issues, and support improvement and organisational learning. In a short version a challenger report can also support *external purposes* by signalling in the published report that an independent research or consulting institution has collaborated in the improvement process. Such a signal may help to increase the credibility of sustainability reporting, as well as of the company's sustainability management efforts in general. In a broad survey (Kohtes Klewes 2002) in the German-speaking part of Europe (Germany, Austria and Switzerland), the challenger report ranked second as a means to improve the credibility of a company's sustainability reporting – only just behind the application of GRI guideline principles, and before external verification by a professional organisation.

5.5 Rankings and Ratings

For sustainability research and rating organisations, sustainability reporting has become an *important source of information.* In addition to data from questionnaire responses from management, these organisations use publicly available company documentation such as, for example, social and environmental reports, sustainability reports, and annual reports, as well as company websites related to sustainability issues.

Furthermore, sustainability reports have themselves increasingly become a subject of *rankings and reporting competitions.* Rankings of sustainability reporting reflect the expectations of some stakeholders and the developments of reporting in practice. Such rankings can also involve recommendations for improvement in future. By this means, rankings aim to improve the quality of sustainability reporting and, to some extent, also contribute to a certain degree of standardisation. In most cases, the criteria for both ratings and rankings of sustainability reports are often generated from reporting guidelines (e.g. CEFIC 1998, GRI 2002) as well as from other standards and research activities on sustainability reporting (e.g. AA1000, SA8000).

The first rankings of environmental reports were conducted in European countries in the middle of the 90s (e.g. EERA 1996, Fichter and Clausen 1994). As the scope of non-financial reports has broadened from solely considering ecological aspects to covering a wide range of sustainability issues, several rankings of sustainability reports have been conducted recently both in Europe (e.g. Clausen et al. 2005, Daub and Karlsson 2005, ESRA 2005) and internationally (e.g. Kim 2005, SustainAbility and UNEP 2004). Since 1996, the European Sustainability Reporting Awards (ESRA 2005) has annually awarded the best external environmental and sustainability reports of private as well as public organisations across Europe. The participants in this European competition (formerly European Environmental Reporting Awards, EERA) are accountancy bodies from 15 European countries, which each conduct separate national reporting schemes (e.g. DURA 2005) and submit the national winning reports into the European Sustainability Reporting Awards. Separate awards are given to large companies and to small and medium-sized enterprises respectively.

The focus of this paper is in part the question of how the quality of reporting can be improved as an effective communication of a company's actual sustainability performance. The approach of basing reporting activities on the company's strategic priorities and sustainability accounting indicators is characterized as an *"inside-out" perspective*. In practice, however, company managers increasingly often design their sustainability reports with an *"outside-in" approach* (see Schaltegger and Wagner 2006), i.e. they structure the company's sustainability reporting on the basis of the criteria applied by rating agencies, ranking schemes, and published guidelines. This approach contrasts with the strategic inside-out approach of sustainability performance measurement, management and reporting in which managers first analyse the company's main sustainability weaknesses, then design problem solutions, implement them, establish a measurement and indicator system, and set up a sustainability accounting and data monitoring system in order finally to report the actual situation, the achievements and the goals for future improvements.

With the outside-in approach on the other hand, managers systematically collect and provide that information which is requested externally in order to meet the demands of rating agencies and to excel in external benchmarking schemes and reporting awards. The outside-in approach to sustainability reporting has its *strengths and weaknesses.* It is geared towards stakeholder perceptions, media attention and improving rating results, and furthermore it prevents management from sub-optimising reporting in relation to stakeholder preferences and reactions. Although the outside-in approach is by its nature more reactive and adaptive than the inside-out approach, the latter may tend to neglect some issues which are considered important by some relevant stakeholders. Only a sufficient consideration of external criteria schemes can ensure that the company acts in accordance with society's perceptions and goals.

Nevertheless, taken to its extreme, the outside-in approach implies a risk that information is generated and reported without a sufficiently critical reflection on the themes and corporate activities which are actually relevant for successful sustainable business development. External stakeholders often do not have the necessary insight into production processes, product formulae, etc. to judge the main corporate weaknesses, and to know which changes are necessary in order to maximise improvements. The issues and approaches which are relevant for the company-specific sustainability issues may not be considered sufficiently if they are not covered in the general criteria catalogues of external rating and reward schemes. However, this does not mean that general criteria catalogues, ratings and competitions are pointless, since they constitute important drivers of sustainability reporting and often also of corporate sustainability management. However, with their fairly general character, they have only a limited effect in achieving a substantial improvement in sustainability reporting and corporate sustainability since they cannot cover the necessary details of those issues which are of highest relevance for a company's sustainable development. As a consequence, *sustainability reporting should be embedded in a double-path approach which combines the strategic inside-out approach of performance measurement and management with the outside-in approach of adapting to the rating and assessment schemes of external key stakeholders.*

6. FUTURE DEVELOPMENTS

Guidelines, rankings and ratings, regulations, internet support, and the verification of sustainability reports, are topics which are widely discussed in practice and in the literature related to sustainability reporting. In the following, special consideration is given to two areas which have been rather neglected in the discussion about sustainability reporting: the professionalisation of sustainability communication, and the link between reporting and accounting. Both approaches are considered likely to play a core role in the future development of sustainability reporting.

6.1 Professionalisation of Sustainability Communication

Corporate sustainability reports are usually developed by either employees from the environmental or sustainability department or from the corporate communications unit, or by an external public relations agency. All three groups tend to lack some relevant knowledge for sustainability reporting, if they are not trained adequately or if they do not collaborate in an interdisciplinary working group. Successful sustainability reporting requires the sustainability department's knowledge about sustainable development in general and the sustainability issues which are relevant for the company. In addition, however, the reporting activities should be embedded in the general corporate communications concept and related to the company's brand, reputation and marketing approach, which is managed by the marketing and corporate communications department. If it is also accepted that the inside-out and outside-in approaches to reporting need to be combined, knowledge about external rating and assessment schemes, evaluation criteria, and sustainability trends in the media also become a crucial part of sustainability reporting which may have to be considered by engaging a public relations agency which specializes in sustainability issues. Developing successful sustainability reporting will in any case require a well managed team-based process involving different departments or external communication agencies. The involvement of a scientific research institution to challenge the reporting process and results from time to time may also provide further stimuli.

For sustainability reporting, this implies that more efforts should focus on the systematisation and consolidation of experiences which improve the knowledge and skills of sustainability managers, marketers, brand managers, reporters and communicators. Successful sustainability reporting risks remaining partly unsystematic or adaptive so long as the skills of the designers of the company's sustainability reporting are not adequately developed. The challenge of sustainability reporting and communication cannot be met successfully without managers and employees who have a combined knowledge in sustainable development, corporate sustainability management, and communication in media-conform ways (similarly, Franz-Balsen and Godemann 2003, Michelsen and Godemann 2002), as well as in the organisation of inter-disciplinary team processes.

6.2 The Role of and the Link to Accounting

If sustainability reporting aims to go beyond diffuse qualitative statements then it must include quantitative measures describing the state of practice, the goals and the progress made. Furthermore, sustainability reporting of quantitative measures requires an accounting system which provides the necessary information.

Sustainability accounting can be defined as a subset of accounting that deals with the activities, methods and systems that are required in order to record, analyse and report: firstly, environmentally and socially induced economic impacts; secondly, a company's ecological and social impacts, production site, etc.; and thirdly, and perhaps the most important, measurement of the interactions and links between the social, environmental and economic issues which constitute the three dimensions of sustainability (for an overview of environmental and sustainability accounting see e.g. Bebbington and Thomson 1996, Bennett and James 1997, Bennett et al. 2002, Bennett et al. 2003, Burritt et al. 2003, Gray 1992, Schaltegger and Burritt 2000). By providing information for strategic management and for reporting purposes, sustainability accounting serves as an important link to reporting. With an inside-out approach, information requirements are deduced from strategic management, collected and analysed using sustainability accounting, and communicated externally through sustainability reporting (Schaltegger and Wagner 2006). Sustainability accounting has a strong strategic character and provides information that can be used to devise and implement corporate strategy.

A first step towards integrated sustainability reporting therefore requires the design of internal information and reporting systems in a way that ensures that the correct company-internal information is made available in order to calculate the key performance indicators which are identified in strategic management (Schaltegger and Burritt 2000). This is the core function of sustainability accounting.

The challenge for management is to link business success and value creation with environmental and social considerations, including accountability for risk (see e.g. Burritt 2005, Scharmann 2003). Based on the company's business and financial goals, which can differ substantially between different organisations, sustainability accounting supports the formulation of key performance indicators and the design of the reporting system. Furthermore, sustainability accounting shows how effective operational activities are by providing information on the key performance indicators which have been identified as relevant for the content of sustainability reports. A strategy-focused design for sustainability performance management requires a substantial change in conventional corporate accounting systems in order to incorporate environmental and social issues and their financial impacts. One way to establish links between the measurement of corporate social and environmental issues, business success, and sustainability reporting, is to determine key performance indicators and to orientate the accounting systems towards providing the data which is necessary for these indicators and for reporting.

Such an approach distinguishes itself clearly from any accounting approach which tries to measure an overall sustainability performance. Strategically oriented sustainability accounting focuses on the provision of those strategic and operational indicators which have been identified as key to business success. Such a sustainability accounting system will, in most cases, provide a mixture of strategic and operational, monetary and non-monetary, quantitative and qualitative information.

7. OUTLOOK

In the light of the increasing and currently still underestimated relevance of sustainability reporting for the reputation and social acceptance of a company, it can be expected that an increasing number of companies will be addressing this topic. Sustainability reporting is more than the publication of a print or internet report, and should be embedded in a comprehensive sustainability communications approach and in the company's general communications concept if it is to become more effective. Guidelines and standards as well as auditing and verification processes may provide assistance for management, but will not be sufficient so long as the link between corporate strategy, information management and the reporting activities is not designed in a systematic manner. In order to create corporate credibility, the sustainability reporting activities themselves have to be credible. This requires that the underlying corporate activities are not just for show but are systematically designed for effect and for the improvement of corporate sustainability. Communication and management action have to be in line with each other. The rapid change of public attention on different sustainability issues, as for example documented recently by the increased use of terms such as "corporate citizenship", "corporate responsibility", "corporate social responsibility", etc., works against a clearly structured inside-out approach and constitutes a particular challenge to management. To incorporate public developments in the sustainability debate without losing a clear strategic line, and without creating a public image of a reactive company which moves with every fashion, represents a continuing challenge for management.

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Chapter 14

TAKING THE GRI TO SCALE

Towards the Next Generation of Sustainability Reporting Guidelines

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Abstract: Among the various contributions to the advancement of a partnership-based approach to sustainable development made by the 2002 UN World Summit on Sustainable Development (WSSD), one in particular invited special attention. This is the reference - in paragraph 18 of the WSSD Plan of Implementation - to the Global Reporting Initiative (GRI)'s *Sustainability Reporting Guidelines*, the only 'global public policy initiative' to be specifically referenced in the Summit outcomes. A decade earlier, at the 1992 Rio de Janeiro 'Earth Summit', the concept of sustainability reporting did not yet exist. At the 1997 'Rio + 5' Summit, the GRI itself did not yet exist. Today nearly 500 organisations headquartered in 45 countries use the GRI *Guidelines* to report on their sustainability performance. How has sustainability reporting – and the rise of GRI as one of the most important information exchange platforms - occurred so rapidly? The success factor is the multi-stakeholder component which underlies all of GRI's product development and product revisions.

1. INTRODUCTION: THE MULTI-STAKEHOLDER SUCCESS FACTOR

GRI was born in 1997 when CERES and UNEP began a dialogue among a wide network of individuals and organizations interested in the development of a globally applicable framework for reporting on sustainable development. By ensuring participation and striving for consensus from business, civil society, investors, labour, academia, accountants and others, the *Guidelines* enjoy a unique credibility. The thousand's of individuals and organizations

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 325-337.

that have been involved over the years feel some degree of ownership of this public good, and all know that they have a place where their voice can be heard.

This contribution to EMAN's book captures the results of the most significant global discussion on sustainability reporting ever held. Over an eight month period GRI engaged with nearly 450 individuals from diverse stakeholder backgrounds and geographies in order to gather their feedback on the existing version of the *Guidelines.* This chapter will outline how this global dialogue has informed the design of a process that will result in a quantum leap for sustainability reporting and GRI's portfolio of reporting guidance.

2. A GLOBAL DIALOGUE ON THE 2002 GUIDELINES: RESULTS FROM THE STRUCTURED FEEDBACK PROCESS

Consensus that transparency around an agreed set of sustainability indicators was the driver that stood clearly in the forefront during the development stages that led to the current version of GRI *Guidelines* – released during the WSSD in 2002. Now, two years later, GRI is facing its next challenge: the innovation of a new generation of GRI *Guidelines*, expected to be published in early 2006, that build on the existing framework, increase comparability of data across organizations and bridge the delivery gap between report preparers and information seekers. This challenge carries with it the opportunity to move sustainability reporting into the mainstream of business practice, expanding the total number of reporting organisations from 500 to thousands in the next years.

Between July 2003 and March 2004 GRI conducted a process designed to solicit feedback on the 2002 *Guidelines* from all constituencies that have used them as reporting guidance and/or use GRI-based reports for benchmarking, assessing and surveying corporate performance, rating and ranking as well as for making investment decisions. This engagement exercise is known as the Structured Feedback Process (SFP), and is part of GRI's regular revisions and development process for all of its technical documents.

The design of the SFP needed to ensure a diverse geographic spread of participants to better frame the wide varieties of regional pictures about the awareness, readiness and usage of the current *Guidelines,* and how these might change in the future. Keeping in mind GRI had to engage report preparers and information seekers across the globe, three different feedback loops were offered for all participants:

- Phase 1: A questionnaire about the 2002 *Guidelines* that was posted on the GRI website, open for all interested parties to contribute their responses
- Phase 2: Seven regional roundtables to gather additional feedback (photos, participants lists and meeting summaries for each roundtable are available at Internet URL: <http://www.globalreporting.org/sfp>)
- Phase 3: Summary roundtable reports were sent to all participants so they could incorporate their final reflections on the topics discussed

Overall, the Structured Feedback Process for the 2002 *Guidelines* was the largest and most widespread single outreach project ever undertaken by GRI:

- 112 direct responses to the questionnaire were inserted to the analysis and helped to inform and design the interactive roundtables
- 416 organizations took part in regional roundtables in Belo Horizonte (South America), New York (North America), Melbourne (Oceania), Hong Kong (Asia/Pacific), Johannesburg (Africa), Geneva (Europe) and Tokyo (Japan)

Capacity constraints and the interactive roundtable design did not allow for more than one person per organization and a maximum of 60 organizations per roundtable. The total number of applications for spaces at SFP roundtables worldwide (758) shows that interest in the *Guidelines* and contributing to their revisions and innovation has never been higher.

The results of the questionnaire analysis informed the design of the roundtable discussions and also helped to tease out discussions that needed to recognize the different angles and layers around several sets of issues. Designing the dialogue sessions proved rather complex. It was clear from the beginning that many of the most important issues to be discussed around the GRI 2002 *Guidelines* were interrelated and couldn't be separated from each other. For example:

- A discussion on changing the concept of incremental reporting would need to be linked to consequences for the concept of *in accordance* reporting
- A discussion about more flexibility when using the Guidelines couldn't be discussed without spending time talking about the effects on the comparability of report information

GRI took this interconnectedness into account and organized breakout groups around interrelated topics. The structure as shown in Figure 14-1 gives an overview of how the multi-stakeholder discussions at the roundtables were organized. A resulting set of "10 main messages" emerged from these discussions, and are presented in the subsections below.

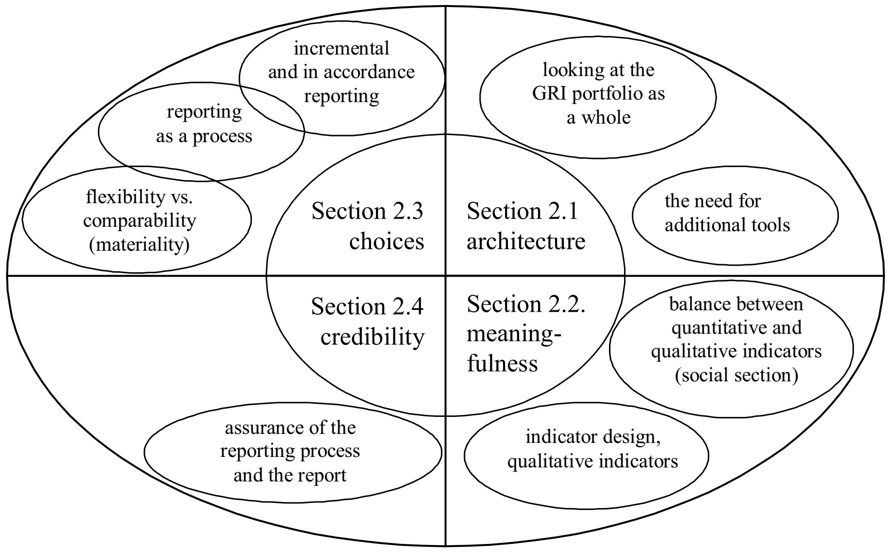

Figure 14-1. Areas of importance for the revision of the GRI 2002 Guidelines.

2.1 Architecture

A first set of issues was tackling the understanding and the design of GRI's product portfolio as a whole, and identifying whether additional tools are needed. How do the various pieces of the portfolio fit together? Where are areas for improvement? What additional tools are needed? Here are the main messages from the SFP:

"A full set of Technical Protocols is needed to strengthen the positioning of GRI as the leading platform for sustainability reporting. Sector Supplements and Resource Documents should help to complete the GRI Framework where funding is feasible."

Currently GRI only offers an incomplete set of Technical Protocols, six Sector Supplements and one Resource Document on HIV/AIDS (For a full description of the GRI Portfolio of documents see Internet URL: <http://www.globalreporting.org/guidelines/framework.asp>). The roundtable participants recommended focusing efforts on completing a full set of Technical Protocols to help increase the possibility of making more comparable information available. This will also increase the willingness of information seekers to build their assessments around GRI-based report information.

The overall framework and portfolio design was also often discussed in relation to helping reporting organizations to better define material reporting information (aspects and indicators) for their reports. It was generally agreed that a growing number of Sector Supplements, based on a clear indication of relevance and funding prospects by the respective sectors will strengthen GRI's position as the most important point of reference for sustainability reporting across diverse industry sectors.

The roundtables also encouraged GRI to work on additional documents. Examples of proposed areas to cover include:

- How to deal with dilemma situations and how to better cross-reference data to clarify the reporting organization's business case for sustainability (integrated approach, ethical behaviour, link to overall company strategy and vision)
- How to address changes of the product mix as well as reflecting outsourcing and supply chain issues (GRI began a Boundaries Working Group in 2004 that partly covers these issues; possibly an addition of supply chain indicators in the next *Guidelines* version will help to better tackle this issue. See Internet URL: <http://www.globalreporting.org/boundaries> for more)
- Notes on the general use of metrics and the normalization of data as well as general guidance on the value of aggregating and disaggregating data

Some roundtables saw a need for additional overall guidance for "how the GRI Framework and Portfolio pieces fit together"; this could be useful when industry specific approaches become more mature. It was left open if this should be a separate "guide" or be described in more integrated guidance at a prominent place in the next generation of the Guidelines. A software solution will help deliver the entire portfolio in a seamless manner.

"Addressing globalisation: A better understanding of the national/regional context and institutional linkages to GRI and its Portfolio is needed."

GRI defines its mission in the following way: "To produce globally accepted and globally applicable Sustainability Reporting Guidelines", however, many reporting organizations start reporting from a national or regional perspective. This seems to be true for some multinational enterprises since they often take into account the relevant environment of the country they are headquartered in first and then (over time) develop a full "global view" or develop country by country reports. GRI is seen as a "backbone" or "reference" document rather than as an "all you need" for reporting.

Some roundtables clearly stated the need for additional national or at least regional annexes, including information about national requirements (national codes, industry charters, stock exchange requirements, national indexes, etc.) and guidance on how GRI interacts with local/national/regional reporting requirements and institutions. It is not surprising that these needs were mainly and most clearly addressed in South Africa, Hong Kong, Australia and Brazil. Furthermore this approach could be a good start for an activity of national networks of GRI in several countries.

"The development of a software platform can help to bridge the gap between report preparers and information seekers and has tremendous potential to increase the uptake of the GRI portfolio"

Currently, the GRI portfolio is distributed in print or downloadable PDF files. This, added to the information flow gap between report preparers and information seekers, points to the need for GRI to enter the software era. Therefore the Secretariat has proposed software development around the next generation of GRI *Guidelines.* A software platform could enable GRI to deliver its own product(s) in a completely seamless manner. It offers all advantages of hyperlinked and step-by-step information to guide the various audiences.

The idea of a one-stop-shop repository was also generally welcomed by the roundtables. GRI therefore issued a Request for Proposals to software companies in January 2004, including such elements as a reporting wizard, a Central Repository for reported data, and the delivery of GRI's portfolio in a way that combines the necessary sectoral and regional guidance for the user. 46 companies responded and GRI has undertaken first steps to align the software development with the revisions process for the next generation of *Guidelines* (for more information on GRI software development see Internet URL: <http://www.globalreporting.org/software>). But roundtable participants also advised that GRI should not compete with software companies in their respective approaches to data gathering and data mining within a given software architecture of a company.

Further suggestions to provide benchmark help by showcasing leading good practice (without endorsement of specific companies) and offering up-to-date statistics on the use of GRI's Portfolio were seen as useful additional services. This additional guidance could be disseminated in various ways, e.g. packages to best help management understand the need for sustainability reporting through a CEO briefing and standard presentations. Specific SME help guidance should be delivered. Leading practice of assuring processes and verifying reports could be added. There was also a shared view that GRI needs to better articulate the advantages of reporting ("explaining the business case"), combined with a clear value statement beyond shareholder value and tied to sustainability. A GRI software platform could help to organize all of these elements.

2.2 Meaningfulness

This area mainly touches questions about indicators, their general design and usefulness in various contexts. Apart from all other procedural questions about how to use the GRI *Guidelines*, the section about indicators is very often the most read part of the *Guidelines* and seen as GRI's centrepiece. Here are core messages around this area:

"The overall design of the Guidelines following the "triple bottom line" was reaffirmed but more clarification on indicators needs to be achieved."

There has always been an active discussion about the best way to design and cluster indicators since sustainability is a very cross-cutting paradigm. All roundtables reaffirmed that the triple bottom line approach of structuring reporting indicators is by far most appropriate way and should not be changed. Although the question of interrelation and "integrated indicators" remains a challenge and an issue, a change in the overall approach would cause problems to existing reporters and their data gathering systems already in place. The main challenge for GRI going forward is to help organizations produce a set of data that is an "integrated" overview of their business model and how sustainability considerations were reflected in it.

This emphasizes once again that the GRI Framework needs to pursue an "as complete as possible" set of documents. This ensures easier use and increases opportunity to compare information from multiple sources. Some roundtables wanted GRI to put more emphasis on the overall products and services impact because this seems to best characterize the integrated impact of an organizations activity, but this was counterbalanced with a second message that this can be best achieved through Sector Supplements, reflecting specific groups of products as well as more specific supply and demand chain impacts.

"Showcasing real change towards sustainability: There is a demand for more quantitative and impact-related information in all indicator sections, most prominently in the social section of the Guidelines."

The statistical assessment of the SFP questionnaire clearly outlined the need for a discussion about how to better measure impacts of a reporting organization's behaviour. It was clarified that more outcome-related and quantifiable performance measures are wanted. The roundtables also discussed the overall criteria for the right balance of quantitative and qualitative indicators. Furthermore the statistical analysis clearly stated that a change towards more quantifiable and impact-related information was most wanted in the social section. There is also more clarity needed in the economic section as many economic activities result in social impacts. The need for indicator contextualization in the social section of the *Guidelines* is also seen as essential since social impacts always carry a regional or local dimension.

There is always some limitation in the sorts of data that result from presenting an indicator worded concisely in only 2-3 lines (as are most indicators in the current version of the *Guidelines*). The roundtables emphasized that a good indicator needs to include several dimensions to be widely accepted, e.g.:

- Consistency (describing, assessing and evaluating is not enough)
- Quality that puts indicators into substantive overall business case descriptions
- Preciseness without precluding or judging (good or bad)
- Comparability over time and possibility for "fair" benchmarking (also sector-wise)

The impact paradigm that leads the thinking in the economic section of the *Guidelines* is mostly not used by reporters in practice (the GRI economic indicators are designed to measure an organizations impacts on its key stakeholder groups: suppliers, customers, employees, providers of capital and public sector). This trend has caused frustration on the side of NGO's and Civil Society Organizations who resonate with the stakeholder orientation of the economic indicators. It seems to be unclear to both reporters and information seekers about how the impacts can be best described, thus more guidance is needed how to report economic impacts.

"A better explanation of organization-specific relevance of indicators will help to broaden the discussion about total number of indicators and will change the perception that GRI's framework is too prescriptive."

The SFP questionnaire asked participants about their attitude towards the number of indicators. The results show that the jury is split between those who would like to see a decrease in total number of indicators and those who wanted the number of indicators to remain about the same or increase. Interestingly this split jury is also true within the sub-sector of business participants in the questionnaire, and this split was reaffirmed during the roundtable discussions. The statistical analysis of the survey also showed that information seekers felt that the *Guidelines* cover most relevant issues and the right set of topics. In a divergence of opinion, it was clear that not all participants agreed with the depth and the set of indicators in each specific aspect area of the *Guidelines*, however, in total, a high percentage (88%) saw GRI as being on the right path to make reports more comparable.

The roundtables showed a remarkable consistency in the view that the question about the number of indicators can't be seen as a single issue and is very much linked with the combined application of GRI's reporting principles and the attitude of a reporting organization towards inclusion of stakeholders. However, reality shows that the existing number of indicators is still widely seen as a burden, especially for SME's. There is a need for more clarifying communication how to approach the *Guidelines* and the GRI Framework. There was also the view that this discussion will change over time when more sector supplements will be available and a software approach is realized.

2.3 Choices

Although GRI is still perceived by some as a prescriptive checklist of "need-to-cover" issues (especially by those who only read the indicator section of the *Guidelines*), GRI offers a lot of flexibility for reporting organizations. But where is the right threshold between choices on the one hand and need for benchmarkable and comparable information on the other?

"Defining a continuum: Incremental reporting remains an important starting point for reporting organizations but more clarity is needed to better assess where reporting organizations currently stand in their efforts, what they are striving for, and the relevance of being "in accordance" reporters."

The GRI *Guidelines* currently give no clarification on how to evaluate performance of organizations that use bits and pieces of the GRI Guidelines – known as an incremental approach. To illustrate, take the example of a company that releases a report using 10 GRI indicators. The audience does not know if this is a good first step, or if the organisation feels they have covered all relevant topics and will not strive to cover further indicators in later years. This leaves many information seekers with the feeling that more clarity for reporting organizations and seekers alike is needed in the next generation of the *Guidelines* so that report quality can better be assessed.

In relation to the concept of incremental reporting many roundtable participants suggested that a series of defined stages and associated targets needs to be developed. This approach would help a reporting organization to progressively improve the quality of its report while also providing clarification for report readers on the intended depth and scope of the report. Such an approach would help to build support internally and would strengthen the vision of performance as a continuous improvement that needs to grow over time. Offering a staggered approach also needs to take into account the specific burdens and needs small and medium sized enterprises have.

Externally, a series of defined stages would help to inform public statements of engagement with the *Guidelines*. Each level should have a corresponding title or statement. Several proposals were made about how to approach a sub-categorization for incremental reporting, amongst them were: using the GRI Content Index concept for incremental reporting; define a "bronze/silver/gold/platinum" classification; sub-categorize each indicator with explicit wording; use balanced scorecard thinking and include green/ yellow red and/or spider web applications; finally, being transparent about the different levels of stakeholder engagement was also mentioned as an option.

Stakeholder dialogue is an essential ingredient for continuous improvement. It helps to shape a reporting organization's approach towards sustainability. However, there is still hesitation to see stakeholder dialogue as both a necessary and a normal ingredient. Combining a staggered approach of incremental reporting with defined step by step stakeholder dialogue performance can be one way to help make “inclusiveness” a more relevant principle.

“The in accordance requirements and the communication approach towards in accordance need to be re-examined.”

The current version of the *Guidelines* offers “*in accordance*” status for reporters that are ready for a high level of reporting and who seek to distinguish themselves as leaders in the field. The conditions for reporting *in accordance* balance comparability and flexibility. Five conditions need to be met, including a CEO or Board statement and the use of explanations for omissions when not reporting on some of the core indicators. At the moment about 25 companies report *in accordance*. Although an increase of that number can be expected for this calendar year the amount of *in accordance* reports is still below 10 percent of all GRI reporters.

It was stated in all roundtables that the understanding about “what *in accordance* really means” differs and is therefore still a difficult concept for reporting organizations and information seekers. This is further complicated by a lack of clarity about how the relationship between stakeholder dialogues, the application of GRI’s reporting principles and the use of the indicator set is evaluated for *in accordance* status. There is a communication gap between clarifying the flexibility of the combined approach and a notion of seeing the full indicator set as required. In other words, GRI’s current approach that favours *transparency* seems to be sometimes overshadowed by the perception that it demands *completeness*.

In combination with the availability of (more) sector supplements roundtable participants mentioned a combined approach of lowering the number of core indicators in the Guidelines if specific related sector supplement indicators would then be decided on as core for the sector. This could also offer an option of “lowering the bar” for SME’s that would make use of the *Guidelines* only. But there were also concerns mentioned because this approach needs a full set of Technical Protocols to be maximized and this brings a risk of making the reporting process more complicated and could in fact, lead to de-harmonization. Any future use of the in accordance status must be communicated with extreme clarity, including how this status fits in with the *Guidelines* alone and with the overall GRI Framework.

Another issue connected with the *in accordance* requirements was whether to make external verification a requirement for *in accordance* (i.e. is a report *in accordance*?). There was more negative response to this proposal in North America, Europe and in the Asia/Pacific region, but other regions seemed to be in favour of such an approach.

Clear signals were sent that GRI needs to avoid a clash between the materiality issue (term mainly used in the UK and the Commonwealth countries) and the *in accordance* requirements. The *in accordance* status needs to be a clear signal to report readers (especially for the financial community and for NGO's) that a reporting organization has managed to address all material issues and needs to avoid the perception of being prescriptive (as mentioned above).

"From report to reporting: A new generation of GRI Guidelines needs to include more specific guidance for report preparers on the process of reporting and for information seekers on how to make best use of GRI-based report information."

In the past, GRI concentrated work around the design of the *Guidelines* and its associated framework. All roundtables concluded that more guidance from GRI is needed on how to manage the overall process of reporting within a reporting organization. This includes tasks ranging from data gathering, the inclusion of information into Management Information Systems (MIS form the backbone for corporate governance processes and strategy development), procedural guidance on issues from how to best organize stakeholder dialogue to advice about means of reporting. There is also more guidance needed for different user groups on how to use GRI-based reporting information. It was emphasized that GRI should focus on information and capacity building for different user groups (investor community, CSOs/NGOs, trade and labour unions, public authorities) and facilitate good practice exchange for these constituencies as well. Both issues should be better described through a guide or embedded guidance information into the next generation of *Guidelines*. Furthermore it was recommended that GRI should organize a practice information exchange for all aspects of reporting.

A widely discussed option was finding ways to include indicators that describe reporting process performance through the indicator section of the *Guidelines*. Performance indicators on stakeholder dialogue and the level of inclusion into the mainstream MIS were amongst the proposals.

Stakeholder dialogue was an essential discussion focus in all roundtables. GRI was asked to offer specific guidance on different options for stakeholder engagement. This guidance would cover questions such as when to engage, with whom, in what ways (depth of dialogue, from pure information up to involvement in decision making), with what consequences? Discussions also reflected different views on stakeholder dialogue from being a part of an ideal reporting process mechanism up to seeing it as necessary behaviour to assure good overall management quality.

2.4 Credibility

The questionnaire assessment revealed a "changing climate" for external assurance of GRI-based reporting. Two years ago the GRI network was still undecided about the value of external assurance and emphasized that this must be seen in the context of individual decision making of each company. The majority of participants in the SFP (including a majority from business) seemed to see benefit in external assurance today, both in terms of adding credibility externally and adding benefits internally.

"Assuring assurance: External assurance of reporting processes and verification of GRI-based reports gained more support and are seen as a future requirements for best-in-class reports."

The current version of the *Guidelines* gives no clear recommendation on a preferred solution for GRI-based report assurance. External assurance is mentioned as one amongst many different options of assurance. In 2002 the GRI network was not able to gather a clear view that external assurance would be a beneficial element to sustainability reporting. The statistical analysis of the SFP questionnaire showed a changing attitude towards the value of external assurance. Although the questionnaire inquiries were not very specific, about 80% of respondents saw or appreciated external assurance as useful.

The discussions in the roundtables then covered more specific questions and focused mostly on the following topics:

- The differences between auditability, assurance and verification
- The general attitude towards assurance and verification ("praise, don't accuse")
- The auditability of data gathering processes ("data integrity")
- The assurance of the reporting process ("process accuracy")
- The verification of GRI-based reports ("report credibility")
- Making external assurance a requirement for GRI reporting, at least for *in accordance*
- Questions around the qualifications of the assuror and the related cost burden of external assurance
- The ways and timing of inclusion of stakeholders into the assurance process

The roundtables recommended that GRI should come up with more guidance on how to refer to these questions and should also give specific guidance on how best to identify and include stakeholders in the assurance process; also GRI should identify priority issues for report verification.

GRI should stay away from report and verification judgments. This view was shared by all participants of the Structured Feedback Process. However, several roundtables recommended that GRI should seriously consider the accreditation of external assurance providers.

3. PREPARING FOR A NEXT GENERATION OF GRI GUIDELINES

The Structured Feedback Process was an invaluable source of inspiration and advice from the GRI network. After approval by the Board of Directors, GRI started with process preparations to actually develop the next generation of GRI *Guidelines*, the process lasted 18 months starting in September 2004. Workstreams covered the issues mentioned in the Structured Feedback Process and helped in developing basic material in the areas of performance indicators, reporting as a process and with regard to the architecture and the linkage with other standards. Cross-cutting aspects have been tackled throughout the whole process, e.g. assurability, clarification of the business case, financial market needs and the cost burden of reporting are amongst those issues. After a first drafting phase extending into mid-2005, a public comment period of 90 days gave all individuals and organizations – all reporting organizations and information seekers – worldwide, a vehicle to submit their thoughts and reflections on how the next generation is shaping up.

Software was mentioned as an interesting and promising second major focus to make reporting easier and to increase the accessibility and assessability of report information. Furthermore software can help to deliver GRI's products easily so that they can be understood better. So GRI has started aligning the development of software with the development of the next generation of *Guidelines*.

GRI invites all interested individuals and organizations to take part in this exciting new development. Keep abreast of all new developments and calls for participation through GRI's monthly news update at Internet URL: <http://www.globalreporting.org/news/registernews.asp>.

Chapter 15

THE JEPIX INITIATIVE IN JAPAN

A New Ecological Accounting System for a Better Measurement of Eco-Efficiency

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Abstract: Currently in Japan, in addition to some officially or publicly authorized environmental accounting methods recommended by governmental agencies, a newly advocated and privately developed Japan Environmental Policy Priorities Index (JEPIX) is attracting attention. Many of Japan's leading companies, eager to introduce and develop ecological and eco-efficiency accounting systems, are introducing JEPIX in order to obtain data with relevance, reliability and comparability. JEPIX is a set of indices which makes different types of environmental interventions and impacts (originally measured in physical units) fully comparable in a common measurement unit of the Environmental Impact Point (EIP). The calculation is based on the Swiss eco-scarcity method, a Distance to Target approach which has been developed mainly by Ahbe and Braunschweig over the last ten years, conceptually based on the ecological bookkeeping (ökologische Buchhaltung) method advocated by Müller-Wenk (1978). Since 1991, the eco-scarcity concept has been applied in several European countries. Since 2003, 12 Japanese companies have voluntarily formed the JEPIX Forum initiative group, which aims to establish democratically a comprehensive standard of eco-efficiency accounting in Japan by introducing JEPIX into their own environmental management and environmental reporting systems, and by exchanging opinions with each other based on their experience. In this paper, some basic methodological and theoretical features of the JEPIX method will be introduced (in Section 2) followed by an elaborated explanation of the motivations and present activities of the JEPIX Forum as well as a characterization of the participating companies (in Section 3). Thereafter, a typical and practical benchmark application of JEPIX in an actual environmental report by Komatsu – a Japanese manufacturer of construction machinery – will be discussed (in Section 4). We address the fundamental reasons for why JEPIX is so appealing to Japanese companies (in Section 5) before, in Section 6, we finally present perspectives for future improvements of the method and its application.

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1. INTRODUCTION: ESTABLISHING A PRACTICAL ECOLOGICAL ACCOUNTING STSTEM IN JAPAN

Currently some environmental accounting methods, which are related to monetarily measured environmental costs and benefits (so-called *environmentally differentiated accounting*, Schaltegger and Burritt 2000, or *monetary environmental accounting,* Burritt et al. 2002) as well as to physically calculated environmental impacts (so-called *ecological accounting*, Schaltegger and Burritt 2000, or *physical environmental accounting,* Burritt et al. 2002), are strongly recommended by governmental agencies such as Japan's Ministry of Environment (MoE) and Ministry of Economy, Trade and Industry (METI). It is already a common phenomenon for a leading Japanese company to adopt a few of these officially recommended methods for its environmental management, even simultaneously, and to provide some kinds of eco-efficiency data (sometimes with sustainability data including on corporate social responsibility) in its annually published environmental report (Miyazaki 2000:721ff.).

In this situation today, a newly advocated, privately and democratically developed environmental accounting method, the *Japan Environmental Policy Priorities Index (JEPIX)* system is attracting the attention of many Japanese leading companies which are eager to introduce and develop ecological and eco-efficiency accounting systems in their own companies in order to obtain data with relevance, reliability and comparability.

In the following sections, some basic features of JEPIX and the related activity of the JEPIX voluntary initiative group, *JEPIX-Forum*, will be described, and the fundamental reasons for the remarkable progress of this private accounting initiative will be analyzed.

2. FUNDAMENTAL FEATURES OF JEPIX SYSTEM

JEPIX is a set of indices which make different types of environmental impacts comparable and make it possible to express with a single figure of EIP (environmental impact point) the environmental impact caused by the activities of a company. Some basic features of JEPIX are as follows.

Firstly, the JEPIX project was inspired by the eco-scarcity concept originally founded and advocated by Müller-Wenk (1978, 1980) with his unique name of *ecological bookkeeping* (or *ecological accounting: ökologische Buchhaltung* in German). The theory has been developed further in the publication of Braunschweig (1990) which deals with the environmental policies of several Swiss cities, and also in some publications of the Swiss Environmental

Agency (Bundesamt für Umwelt, Wald und Landschaft: BUWAL) (Ahbe et al. 1990, BUWAL 1998). The fundamental idea of eco-scarcity theory is expressed in the Equation:

$$\text{Ecofactor} = F/Fk*1/Fk \qquad (1)$$

Here the numerator F stands for "*actual* flow" of one category of environmental intervention or impact (for example: CO_2, NOx, SOx, etc.), whereas the denominator Fk stands for "*critical* flow" (or means rather "target flow", Goedkoop 1995) of this category of environmental intervention or impact. As the actual flow F gradually approaches the critical flow Fk and even exceeds Fk (the latter case is the essential situation for which JEPIX indicators are actually calculated), the environmental condition will become worse, which means that environmental scarcity increases.

The second most important feature of JEPIX is the establishment of a *single-score index, Environmental Impact Point (EIP)* which will clearly indicate the priorities of action in an alternative situation because the alternative environmental measures, production processes or new products can be evaluated from an environmental standpoint in comparable EIP figures.

Thirdly, JEPIX reflects *Japanese environmental policies*, which means that the priorities derived from applying JEPIX will correspond with the (democratically legitimised) environmental policies of the government of Japan (in Table 15-1) and with international treaties such as the United Nations Climate Convention or the Montreal Protocol.

Table 15-1. Environmental categories covered by JEPIX.

12 categories covered by JEPIX	Laws and measures covered by JEPIX
• Greenhouse gases • Ozone-depleting gases • Toxic substances including dioxin • Photochemical oxidants • NOx • SPM10 • BOD • COD • N • P • Land reclamation • Road noise	• IPCC guidelines • Montreal protocol • Ozone Layer Protection Law • PRTR law • Voluntary control plan of toxic air pollutants • Automobile NOx Law • Air Pollution Control Law • Water Pollution Control Law • Environmental guidelines set by the Ministry of the Environment, etc.

The indices, as described above, are basically calculated as a ratio between the actual and the target flow of emissions which indicates the distance to the target, and the estimation of the target flow reflects the environmental policies of the government of Japan. A list of the main data sources for calculating the actual and target flows of JEPIX Indicators is shown in Table 15-2.

As a result, the priorities which are set by the government will automatically be the priorities of each company which adopts JEPIX for its environmental management because if a governmental environmental target becomes stricter (i.e., if the target flow figure is estimated to be lower), the corresponding eco-factor of JEPIX will rise and hence result in a higher score for the environmental intervention or impact under consideration. In such a situation, a reasonable decision of management would be to increase attention on this particular environmental policy priority subject.

Table 15-2. List of main data sources for calculating the JEPIX indicators.

	Actual flow	Target flow	Main data sources and remarks
Greenhouse gases (GHG)	Japan's Third Report on the Framework Convention on Climate Change, by the MoE	IPCC Third Report on Global Warming	Calculates GHG other than CO_2, on a GWP100 basis (greenhouse warmth potential for hundred years).
Ozone-depleting potential (ODP)	National CFC Phase-out Plan (July 2001)	National CFC Phase-out Plan (July 2001). Amount of foaming agent stock	Calculates substances other than R11, on an ODP basis (ozone depletion potential).
Photochemical oxidants	METI's voluntary control plan of toxic air pollutants (OECD).	Calculated based on differences from environmental guidelines	Numerical environmental databases of the Environmental Information Center, National Institute for Environmental Studies
Dioxin and other toxic substances	12 substances are listed in METI's voluntary control plan of toxic air pollutants.	12 substances are listed in METI's voluntary control plan of toxic air pollutants.	Materials of the 5th meeting of the WG on toxic air pollutants under the Risk Management Subcommittee, Chemicals and Bio-industry Committee, Industrial Structure Council, METI Third report on PRTR research by the Japan Federation of Economic Organizations
Biochemical oxygen demand (BOD)	Estimates based on household emission data from the White Paper on the Environment and data from experts in Japan	Estimated from environmental guidelines	Lake research data and chronological tables of flow by the Ministry of Land, Infrastructure and Transport

continued on next page

Table 15-2. Continued.

	Actual flow	Target flow	Main data sources and remarks
Chemical oxygen demand (COD)	Estimates virtual flows based on the actual flows of Tokyo Bay, Ise Bay, and the Seto Inland Sea	Same as the left	Office of Environmental Management of Enclosed Coastal Seas, Water Environment Management Division, Water Environment Department, MoE
Total nitrogen, total phosphorus	Report to the Japanese government and the secretariat of the UNFCCC	Calculated based on the target values of 6 prefectures	Automobile NOx Law, reports of the Investigative Committee on Reduction of Total Automobile NOx Emissions
NOx	Estimates based on the composition ratio of PM emissions	Calculated by comparing data in observatories that do not meet environmental guidelines against average concentrations in prefectures that do meet the guidelines	Investigation of fixed sources of air pollution in 1999 by the MoE Numerical environmental databases of the Environmental Information Center, National Institute for Environmental Studies
SPM10	Materials published by the MoE (OECD).	Materials published by the MoE (OECD)	Environmental Performance Review
Emission control, landfill capacity	Total travel distance of regular cars and large-size cars.	Calculated based on the achievement ratio of the environmental guidelines on noise.	Hearing from the Ministry of Land, Infrastructure and Transport; HP of the MoE.

Fourthly, JEPIX is based on a private “*bottom-up approach*” in contrast to the *Ministry Guideline*. The Guideline was stimulated and published by the MoE, and is therefore close to a “top-down approach”. In contrast, the JEPIX project was stimulated by the strong and enduring initiative of Siegenthaler and has been developed by the JEPIX research team (co-leaders: Siegenthaler and Miyazaki; members: Kumagai, Shinozuka, Nagayama, Schoenbaum, Azuma and Nakamura (Miyazaki et al. 2003:1f.)), which can be characterized as a voluntary and private organization. Financial support was provided by the Japan Science and Technology Corporation (National Agency of Science and Technology) as a part of the Eco-Rating Project for the fiscal years 2001-2003.

3. JEPIX FORUM: PRACTICING ECO-CONTROLLING WITH JEPIX-ECOBALANCES

In the autumn of 2003, 12 large Japanese industrial companies (TEPCO, Canon, Suntory, J-Power, and others) voluntarily organized the JEPIX Forum on the initiative of the JEPIX development team (co-leaders: Miyazaki and Siegenthaler; now comprising 27 companies, including 15 companies which belong to the 2^{nd} enlarged JEPIX Forum). The 12 pioneering companies (the names and some related data are shown in Table 15-3) have been preparing for the application of JEPIX based on their experience with Eco-Balances and eco-efficiency measures, discussing the strengths and shortcomings of JEPIX, and improving the relevance and utility of JEPIX by exchanging their own experiences gathered within their companies.

Table 15-3. Participating companies in JEPIX Forum 2003.

Company name	Sales amount	Type of industry
Canon	¥3,198 billion	Copying machines, Digital cameras, Video Camcorders, Printers
Sekisui Chemical	¥845 billion	Housing, High Performance Plastics, Urban Infrastructure
Bosch in Japan	¥192 billion	Automotive Technology, Power Tools, Industrial Technology
Alps Electronic company	¥602 billion	Magnetic devices, Automotive products, Peripheral products
Mitsubishi Estate	¥681 billion	Building Business, Residential Development, Urban Development
Railway Technical Research Institute	¥17 billion	Research Institute
Fujifilm	¥795 billion	Copying machines, Film, Digital cameras, Information media
J-Power	¥546 billion	Power supply
KAO	¥900 billion	Fabric and Home Care, Personal care, Chemical Products, Health care
Suntory	¥1383 billion	Alcohol (Whisky, Beer, Wine), Soft drinks, Food
Tepco	¥4,919 billion	Power supply
Komatsu	¥1,089 billion	Lift Trucks, Outdoor Power Equipment & Hobby Engines, Diesel Engines & Hydraulic Equipment, Industrial Machinery
Yamatake	¥50 billion	Industrial automation systems, Building automation systems

The JEPIX Forum is financially supported by the *Ministry of Education, Culture, Science and Technology, Japan* as a part of the *'21st Century Center of Excellence (COE) Program'* of the International Christian University (ICU) for the fiscal years 2003-2007. In addition, the development of the JEPIX method has been endorsed by many institutions of world authority.

4. CASE STUDY: AN EXAMPLE OF JEPIX APPLICATION IN KOMATSU

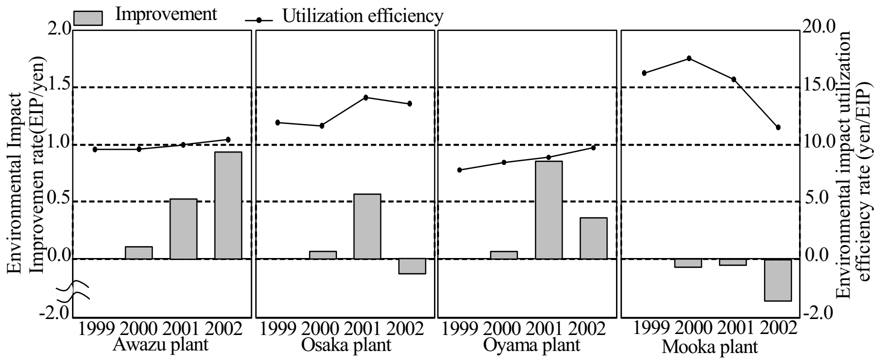
4.1 Application of Environmental Accounting Guideline

Komatsu, one of the largest manufacturers in Japan, manufactures and sells construction and mining equipment, electronics products, industrial machinery and vehicles, and environment-related systems. To achieve more efficient environmental management, Komatsu has adopted the *Environmental Accounting Guideline* (JEA 1999, JME 2002) and has been disclosing its results through its environmental reports since 1999, now including its subsidiaries abroad.

Although the financial and economic situation of environmental conservation can be made fairly clear by application of the Guideline, there are still many physical figures which as a whole can be interpreted in various ways and lead to different conclusions. Most importantly, the impacts on the environment take place in many different ways and are measured in different units, such as the emissions of greenhouse gases, contamination of water, and production of solid waste. This makes it impossible to compare the different environmental impacts rationally.

4.2 Application of JEPIX

To eliminate or mitigate the difficulty above, Komatsu decided to apply JEPIX from 2003, which has made it possible to compare and assess different types of environmental impacts with a consistent unit in a holistic way (JEPIX Forum 2004:175ff.). Komatsu applied JEPIX to four of its domestic factories. By using two types of eco-efficiency index, it became possible to compare their efficiency and effectiveness in environmental conservation, based on a single unit of EIP. The results are shown in Figure 15-1, which shows the recent trends and comparison of two types of eco-efficiency figures of Komatsu's four manufacturing plants.



Improvement rate:
*Effect of environmental impact reduction in relation to cost (EIP/yen) for environmental conservation activities, enabling us to measure the extent of environmental impact reduction for each monetary unit of 1 yen for environmental conservation activities.
*This enables us to assess the effectiveness of environmental conservation activities.

Utilization efficiency rate:
*Added value of manufacturing in relation to the degree of environmental impact (yen/EIP), enabling us to measure the amount of monetary value added (added value) in relation to the degree of environmental impact
*This enables us to assess the environmental impact utilization efficiency rate directly related to business activities.

Cost of environmental conservation activities: costs + investment amounts – depreciation

EIP: Environmental Impact Points

Figure 15-1. Comparison of utilization efficiency and recent trends for environmental impact (source: Komatsu Environmental Report 2003:8f.).

4.3 Summary of Case Study

The results show that the *Awazu* plant has recorded the highest “improvement rate” for the fiscal year of 2002, which means the efficiency of its environmental conservation activities. The *Osaka* plant achieved the best “utilization efficiency rate”, meaning the equivalent value added with the least environmental impact. In conclusion, *Awazu* plant has carried out the most efficient environmental conservation, while *Osaka* plant has been the most environmentally friendly plant when expressed in quantitative terms. In addition, *Oyama* plant has been steadily reducing its environmental impact year by year.

The adoption of JEPIX has made it feasible for top management to judge easily which factory has created the least/most environmental impact, based on a single unit of EIP. Combination of these EIP data with monetary environmental costs and economical value added has enabled further comparison and evaluation from the point of eco-efficiency. Komatsu plans to apply this method also to Komatsu Group manufacturing facilities (including overseas manufacturing facilities) in order to practice ecological business administration on a consolidated basis.

5. ATTRACTIVENESS OF JEPIX FOR JAPANESE COMPANIES: BUSINESS PERSPECTIVE WITH AN OVERALL ECO-EFFICIENCY FIGURE

The last part of this short paper will argue about the reason why JEPIX prevails among Japanese leading companies today. It is mainly because JEPIX enables company management, especially top management, to make it possible to calculate *overall eco-efficiency indicators* by providing *aggregate ecological figures* in a single unit of EIP, which will be described below.

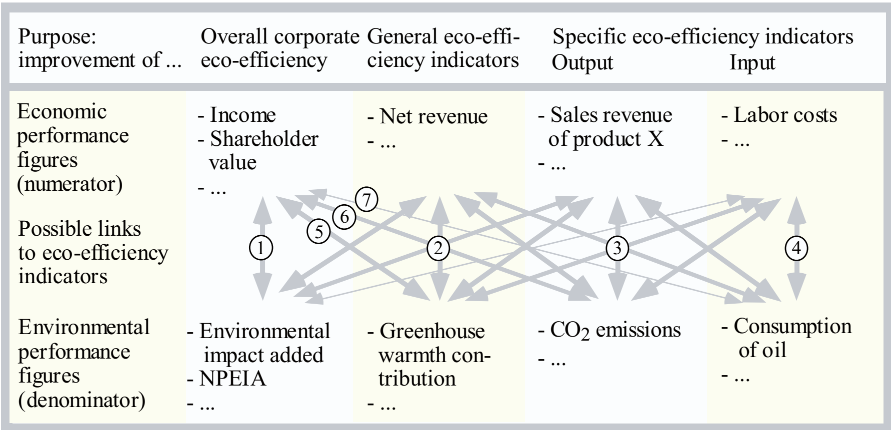
5.1 Eco-Efficiency as Relevant Management Guide

In the present economy, where companies pursue more profit for themselves while reducing impact on the environment in a continuous business effort, consistent pursuit of the principles of economy and ecology is vitally necessary for rational and sustainable management (Schaltegger and Sturm 1990: 282ff.). Ecological consciousness is today not only a necessary condition of sustainability but also an inevitable foundation of a company’s legitimacy in society, which should be firmly established in corporate business strategy, taking precedence over other business purposes. In this double-track situation, the most practical strategy for companies is not the absolute reduction of environmental impact, but the relative reduction of environmental impact compared with their business performances (e.g. sales, value added, net profit etc.).

Therefore, eco-efficiency indicators measured through the transformation or integration of a set of economic and ecological indices/indicators (one from economic/monetary accounting and the other from ecological/physical accounting, where the former is usually the numerator, and the latter the denominator) are theoretically one of the most relevant management guides for companies (Schaltegger and Burritt 2000:361).

5.2 Overall Eco-Efficiency Indicators have Vital Importance for Management

What is important here is that theoretically (as well as practically, Kawamura 2003:54), a vast number of combinations of economic and ecological figures are possible, reflecting the multi-dimensional character of the eco-efficiency concept, which generates many links for deriving overall, general and specific eco-efficiency indicators as seen in Figure 15-2 (Schaltegger and Burritt 2000:362f.).



*NPEIA = net present environmental impact added

Figure 15-2. Systematic collection of eco-efficiency information (source: Schaltegger and Burritt 2000:362).

Among these many links, overall (and general) eco-efficiency links have vital importance for management decision-making (especially for that of top management) because of their ability to provide a comprehensive view of the economic and ecological situations actually faced by the company.

The importance of aggregate numbers cannot be stressed too much, because not many eco-efficiency calculations can be thought of without aggregate figures. In case of only using detail figures, there would be as many categories of eco-efficiency data as the numbers of individual environmental interventions, and these vast numbers of eco-efficiency figures might bring about only a chaotic situation without any holistic perspective to correspond to the view taken by top management.

Although various methods (e.g. Centrum for Milieukunde, CML) do exist to assess and trace specific environmental impacts such as global warming, acidification, smog, etc., such methods leave decision-makers with a series of indices. However, these methods have not yet seen a comprehensive uptake by managers. Their application seems more appropriate for engineers, for example in product development, but they leave the evaluation of priorities to the users who then have to decide what relevance each impact has for them.

In contrast, aggregate indices aim for comprehensive evaluation and reproducible priorities, which will ensure the accountability of eco-efficiency monitoring and communication, and thereby serve the concept of Corporate Social Responsibility. In the case of a policy-based method such as JEPIX, the results can be seen as an early warning indicator of the future environmental costs that might result from more stringent legal regulation to cope with the gap between actual flows and political targets, so that it can support the company's risk management where top management has the main responsibility to take quick action (and without fatal delay), and for whose rapid and relevant decision-making JEPIX single unit indicators can be very useful.

5.3 Necessary Aggregated Ecological Data are Not Available

In the eco-efficiency schema (Figure 15-2), aggregate figures of economic performance, such as net income, value added, free cash flow, sales, net revenue, etc., are not difficult to acquire because most of these financial figures are currently prepared in the process of a company's (internal) management accounting and (external) financial reporting.

Compared with such high availability of aggregated data in a single (comparable) monetary unit (or in some monetary units), aggregated ecological figures in a common unit (or some equivalent units) such as (net present) environmental impact added, etc., are usually very difficult or even impossible to acquire, although they will enable overall decision-making and provide a foundation for rational environmental management (Braunschweig and Müller-Wenk 1993:43, Schaltegger and Burritt 2000:364).

Using the language of Life Cycle Assessment (LCA), company decision-makers need a practical approach to impact assessment in order to assess environmental interventions from an ecological standpoint, i.e. through reducing the numerous available environmental measures to just a few units, or even only a single unit of measurement, after the aggregation of each physically identified intervention.

5.4 Why are Aggregate Ecological Figures Not Available in Japan?

The main reason for the absence of widely-accepted aggregate ecological data of relevance in Japan is the lack of an acknowledged ecological accounting system (meaning in Japan substantially *life cycle assessment (LCA) + environmental performance evaluation (EPE) + eco-labelling (EL)*) because of the lack of an acknowledged ecological accounting standard-setting committee or body so far (Schaltegger and Burritt 2000:276).

In Japan, to break through this difficult situation, many attempts at integrating different environmental impacts into aggregated, comparable numbers (including those with a top-down approach by the government) have been made for about ten years. They have not, however, proven to be very successful because many of the leading Japanese companies have not introduced them, in spite of the efforts of various governmental bodies such as ministries and agencies as well as research institutions and universities.

Therefore, generally accepted weighting factors (GAWF) for environmental impacts (the principles, methods and results for them) which will enable comprehensive and fair ecological valuation (pricing) have not yet been developed and are not yet publicly available, because these early attempts have not been successful in gaining substantial support and participation from industry. Considering the importance of generally accepted accounting principles (GAAP) as the basis for the availability of comprehensive and fair accounting information, especially in American accounting practices and international accounting standards setting, this immature situation has been far from satisfactory, or even frustrating, for all stakeholder groups. But why are GAWF lacking?

Though the importance and much experience of the preceding attempts for determining relevant valuation factors cannot be denied, it must be pointed out that they have usually lacked (1) *established principles* (e.g. the eco-scarcity principle for JEPIX) *with high practicability* as a basic foundation of developing any methods, (2) *enduring and consistent scientific study with international and interdisciplinary cooperation* (e.g. JEPIX international research team), and (3) supporting sufficiently large *company organizations with eagerness and experience* (e.g. JEPIX Forum). Regarding (3), it is worth mentioning here that with a top-down approach by the government, many participating Japanese companies had never seriously committed themselves with real and positive motivation to the developing work, which seems quite different from the developing work of JEPIX with its bottom-up approach based on a voluntary initiative.

5.5 JEPIX as the Basis of a Standard Ecological Accounting System

JEPIX (the Japan Environmental Policy Priorities Index) is the most recent result of the efforts which have been dedicated to breaking through these difficult situations by establishing a set of generally accepted weighting factors (GAWF) for environmental interventions and impacts (which are closely related with environmental priorities for management), a de facto standard of ecological accounting system with a bottom-up approach. JEPIX has until now been given the voluntary support of many kinds of public and private organizations including about 30 leading large Japanese industrial companies, which have enabled full and explicit comparison of their aggregate environmental impact figures and overall eco-efficiency indicators between participating companies of JEPIX-Forum fairly well.

6. FUTURE PERSPECTIVES

Even now, there are some critical opinions about the so-called arbitrary nature of JEPIX because it is fundamentally based on political target figures, which cannot practically avoid all the (undesirable) subjective elements (for the historical list of important critics including Callenbach et al. 1990:26, see Miyazaki 2000:418ff.). Hence, logical consistency and a scientific attitude are always required for determining the JEPIX index figures.

In order to determine JEPIX more scientifically and objectively, consideration of the following points will be of essential importance in the near future: (1) examination of the appropriateness and reasonability of *categorization in 12 fundamental environmental themes* by up-to-date knowledge of environmental sciences, especially LCA studies, (2) precise and objective determination of *target figures*, especially the choice of environmental laws and regulations, (3) inquiry into the legislation process of environmental policy law, not excluding the possible large influence of *economic powers and political pressure groups* on environmental laws, (4) correct determination of *periodical and geographic boundaries* for calculating indicators as well as for their application, (5) periodic correct and reasonable *matching* of EIP data with economic data (Miyazaki and Azuma 2003), (6) comparison with *other impact assessment methods*, especially the Life Cycle Impact Assessment Method based on Endpoint Modeling (LIME) (RCLCA 2001-2003) and Eco-Indicator 99 (Goedkoop and Spriensma 2000), (7) introduction of Excel Sheet for easy and comfortable use for *environmental reporting* with JEPIX and (8) *accreditation or certification* of JEPIX figures by authoritative third parties.

From an accounting point of view, (1) *completeness*, (2) *alternativeness* and (8) *verifiability* are certainly the most important elements to consider for the list of points above.

Concerning the *completeness of categories* (1), it is probable that there are some further additional important environmental categories to consider. So long as such possibilities cannot be eliminated theoretically, periodic re-examination of the advance of scientific knowledge in environmental sciences and of actual significant environmental issues are necessary for securing the scientific neutrality of categorization. For example, the inclusion in JEPIX of scarcity of non-renewable resources (energy and materials) might be considered in the near future.

There are today, both theoretically and practically, often *alternative* domestic and international *laws and regulations* (2) to adopt as a target value for JEPIX, which is comparable to that of traditional, financial accounting with numerous alternative accounting methods. There is no rational best solution, but at least, as in the case of BUWAL SR 297 (BUWAL 1998), the *binding power* of each law ought to be considered and described clearly. Generally speaking, laws with greater binding power possess priority compared with those of small binding power.

Thirdly, the importance of *verifiability* (8) of the Ecofactors will grow with its application by the many companies. In order to enhance the reliability and comparability of data, the participation of many companies from various industrial fields is not sufficient. Most desirably, a formal, established certification procedure by professional experts of neutral institutions (environmental experts, certified accountants, etc.) should be taken to both JEPIX determination procedures and the application of JEPIX figures to the corresponding inventory data of each company.

As of now, the activity of the JEPIX-Forum is still in the beginning stage. Further efforts to ensure the *relevance, reliability* and *comparability* of JEPIX figures are needed in order to make them a more useful accounting tool for stakeholders. More than 100 participating companies and groups in the JEPIX-Forum are needed in practice to make the environmental performance evaluated by JEPIX fully comparable in many industrial fields, including service industries such as banking and insurance, and also non-profit organizations such as universities, municipalities and Non Governmental Organizations (NGOs).

Finally, it will be important to cooperate with other domestic and foreign organizations, including legislative bodies and LCA research institutes. At the same time, critical opinions from both the academic and the practical fields will be extremely important for the enhancement of the interdisciplinary methodology of JEPIX.

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Chapter 16

THE GREEN-BUDGET MATRIX MODEL

Theory and Cases in Japanese Companies

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Abstract: A number of Japanese companies have introduced Environmental Management Systems (EMS) and environmental accounting, although most companies have focused only on the external reporting aspects of environmental accounting and do not consider any future action plans and budgets concerning their environmental management. To utilize EMS more effectively, an action-plan which provides a map to drive activities, and a budget which guarantees that the plan is put into effect, are essential for environmental management. The Green-Budget Matrix Model which is introduced in this paper is a tool to support managers in identifying the type of activities that drive excellent environmental performance and in effectively allocating their economic resources. The process of preparing the matrix also generates useful information for analyzing the status quo, foreseeing the future of environmental management, and promoting a shared mutual recognition of their mission amongst members of the organization. The principal aim of this paper is to explain the idea and structure of the Green-Budget Matrix Model, and to examine its application in practice.

1. INTRODUCTION

In recent years a number of Japanese companies have been certified under ISO 14001, the international standard for environmental management systems (EMS). A survey initiated by the Japanese Standards Association found that 18,820 organisations had been registered under ISO14001 up to August 2005, and 356 listed companies and 177 non-listed companies have

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 355-372.

disclosed environmental accounting information in either their environmental report or their annual report in Japan (MoE 2004). It seems that publication of environmental accounting guidelines by the Ministry of the Environment (MoE) in 1999, 2000 and 2002 has encouraged many companies to introduce environmental accounting (MoE 2002).

This tendency of Japanese companies to adopt environmental accounting continues up to the present, although most companies have not connected their environmental accounting with their EMS. This is because their main purpose in introducing environmental accounting is to collect environmental information for external stakeholders, such as shareholders and creditors, and it also seems that their main purpose in registering for ISO 14001 is to raise the company's reputation. Consequently, with the exception of a few top-tier companies, most Japanese companies have not yet substantially engaged with environmental management.

The underlying concept of EMS is to reduce the environmental impacts of companies' operations through continual improvements (Epstein and Roy 1997, ISO 1996, Kawano 1998). All EMS standards, such as ISO 14001 and EMAS, emphasize the need for environmental management and for the measurement of physical environmental performance as an important part of this (Schaltegger et al. 2003). They also require that organizational objectives and targets be established in order to improve environmental performance and the implementation of appropriate management activities in order to accomplish those targets.

If one of the purposes of environmental accounting is to express the result of EMS, it has to formulate action plans to guide the actual implementations of EMS, as well as budgets that will make these plans a reality. In other words, since considerable economic resources such as labour, goods and money are invested in EMS, budgeting for these activities is essential for their proper implementation.

The Green-Budget Matrix Model (GBMM) that will be introduced in this paper is a practical tool to support the effective operation of EMS so that routine activities can lead to a reduced environmental burden. It derives environmental conservation plans and budget proposals logically, and generates information that encourages the effective use of business resources. GBMM therefore encourages companies to construct their EMS in a strategic way.

This paper will firstly focus on the contribution of GBMM, and the procedure for preparing the matrix. A case will then be introduced featuring the application of the model in a Japanese manufacturing company, and finally some concluding comments will be made.

2. NECESSITY OF AN ENVIRONMENTAL BUDGETING TOOL

2.1 Operational Budgeting for Environmental Management

In general, a budget "is the quantitative expression of a proposed plan of action by management for a specified period and an aid to coordinating what needs to be done to implement that plan", with four useful characteristics (Horngren et al. 2003:176f.):

- "Compels strategic planning and implementation of plans"
- "Provides a framework for judging performance"
- "Motivates managers and employees"
- "Promotes coordination and communication among sub-units within the company"

From these characteristics, it is clear that the budget is one of the systems that are necessary for the normal conduct of corporations' operations in their pursuit of profits. In other words, it is impossible to conduct actual business activities satisfactorily without setting up and implementing a budget. Since environmental management activities by companies consume considerable economic resources such as labour, goods and money, budgeting (which is the design process for these activities) is essential for their proper implementation.

Although a number of Japanese companies have introduced an EMS, there are also other companies which have formulated and implemented budgeting for environmental conservation activities, but there are few studies of environmental budgeting. Burritt and Schaltegger (2002) is one study that proposed the integration of eco-efficiency with environmental budgeting. Their reason for focusing on budgeting is that budgets look towards the future. Budgeting to assist with environmental management has played important roles in the verification of targets, analysis of budget variances, and the motivations of management and employees. Moreover, while conventional management accounting information is based on past events and is orientated towards financial terms, budgets are orientated towards future events and can incorporate non-financial terms into their scope.

Burritt and Schaltegger (2002) made the notion of eco-efficiency central to their argument, so this must be given due consideration. Generally, efficiency can be defined as the ability to generate a high level of output from a certain input, or to generate a certain output from less input. Burritt and Schaltegger take these notions of efficiency and apply them to the environmental or ecological dimension. They proposed the adoption of eco-efficiency indicators which are calculated by employing a financial variable as the numerator and a physical variable as the denominator, and made them an integral part of corporate decision-making since eco-efficiency is a useful indicator that can integrate environmental effects into conventional financial information. They pointed out the need to integrate eco-efficiency indicators into corporate operational budgeting.

Their aim was to integrate the methods of activity-based budgeting (ABB) with materials and energy flow cost accounting, which they called "Materials and Energy Activity-Based Budgeting" (MEABB). This MEABB model emphasises the way in which budgeted environmental costs are allocated, depending on materials and energy flows. This method of allocation can also help to identify which products with negative environmental effects cause large environmental costs.

MEABB has a future-orientated approach which takes into account potential environmental costs relating to materials and energy flows. It can thus contribute to reducing environmental costs compared to *ex post* approaches, such as using end-of-pipe technology (Burritt and Schaltegger 2002). GBMM has the same future-orientated approach as MEABB, and also focuses on eco-efficiency as the basis of performance evaluation for environmental protection/conservation activities. In other words, eco-efficiency is one of the elements to achieve the objectives of GBMM, with another being quality costing which provides GBMM with a methodological framework.

2.2 Quality Costing for the Environment

Quality costing is a "win-win" approach which aims at not only cost reduction but also quality improvement. It classifies quality costs between prevention, appraisal, internal failure, and external failure costs, in line with the PAF (prevention-appraisal-failure) approach. Both environmental management and quality management are closely related activities, the objective of which is to accomplish a specific level of *quality* for manufactured goods and services (Kawano 2002:41f.). At the same time, quality management tools can provide environmental management with useful methods. In particular, since environmental costs and quality costs share many common characteristics, the "quality costing" framework has recently come to be seen as a useful approach that could be extended to environmental problems also.

For example, Diependaal and de Walle (1994) considered that quality control concepts could be transplanted to corporate environmental management since ISO 9000 has been widely adopted worldwide. Similarly, the concepts of quality costing could be applied to the field of environmental accounting. They referred to the case study of a furniture manufacturing company and argued that investing more economic resources into prevention activities could contribute to reducing those costs which are driven by *ex post* activities.

Hughes and Willis (1995) provide another important contribution to this approach to quality costing for the environment (QCfE). They pointed out the risk of huge environmental liabilities as a result of strict environmental regulation, such as the Superfund law, and proposed environmental cost management from a quality cost management viewpoint in order to avoid these liabilities. They also emphasized that prevention was the most cost-effective way to balance the goals of achieving ever-higher levels of quality, decreasing costs, and generating increased profitability and customer satisfaction.

Like Hughes and Willis, Diependaal and de Walle (1994) considered quality management and environmental management as essentially existing in the same dimension. In addition, both studies gave a high priority to preventive activities, as these activities lead to a reduction in other costs such as failure costs. QCfE has three common steps, the first of which is to classify environmental costs based on the PAF approach. The second step is the cost-effectiveness (eco-efficiency) analysis of corporate environmental conservation activities, and the final step is to create information on environmental care that can be used for decision-making by management.

Since companies invest considerable economic resources into corporate environmental conservation activities, it is necessary to draw up a plan. Next, estimated costs should be allocated to planned activities, and then the budget has to be devised and executed. There must be close relationships between environmental conservation activities and the budget; however, there are few tools available to help with planning processes. This is the main reason for the introduction of the new QCfE procedures proposed here.

The Green-Budget Matrix, which is prepared using the process of QCfE, can provide useful information for planning and budgeting for the next fiscal year. The process of preparation of the Matrix, which is the major concern of the GBMM, can also contribute to:

- Identify the principal and most serious environmental problems within the organization
- Formulate plans for activities to reduce the environmental burden
- Allocate business resources to these activities.

Hence, it can be seen that GBMM is a tool to help managers to implement effective EMS in order to establish "economically-ecologically integrated eco-control" (Schaltegger 1996:254), which can be defined as both the "processes of evaluation and steering of financial and ecological impacts of corporate activities", and "institutionalised, internal management process based on environmental accounting and reporting" (Schaltegger 1996:250ff., Schaltegger and Burritt 2000:379ff.).

3. THE GREEN-BUDGET MATRIX MODEL AS A TOOL FOR ENVIRONMENTAL BUDGETING PRACTICES

3.1 What is GBMM?

In Japan the quality cost matrix model was advocated by Ito (2001) as a radical tool to support quality management, and it has recently been implemented in some companies. GBMM refers to an approach which adapts the framework of the quality cost matrix model to environmental cost management.

The aim of the model is not only the reduction of environmental costs. Environmental protection activities of course cause costs but, if designed well, can also reduce costs, and sometimes the cost savings or economic benefits even exceed these costs. The main objective of GBMM is to generate information which will support the preparation of plans, such as for environmental investment projects or environmental conservation measures, in order to ensure that the economical and social benefits exceed the costs. The model is a tool that allows environmental conservation planning or budgeting for environmental conservation activities to be considered in a logical way, and holds the possibility of "win-win" potential to realize higher economic performance through more effective environmental management.

3.2 Classification of Environmental Costs in GBMM

As mentioned above, the reason for GBMM to follow the classification of quality costs is that the characteristics of quality are similar to those of the environment. As shown in Table 16-1, environmental costs are classified in accordance with quality costs. This classification reflects an understanding of the similarity between environmental costs and costs of quality. However, especially with regard to failure costs, environmental costs differ in a number of aspects.

For example "external environmental losses", which can regarded as "external failure costs" under the quality cost classification, refer to those losses that are borne by the community or consumers, or those losses for which it is not possible to specify who is liable. In the field of quality costing, failure costs refer to those losses which are borne by the manufacturer so that a reduction in failure costs can contribute to improving financial performance.

However reductions in external environmental losses are not directly related to financial performance.

Table 16-1. Basic classification of environmental costs.

Classifications	Definition and examples
Environmental conservation costs	The *ex ante* expenses which are designed to prevent environmental problems from arising and to reduce future outlays: for example, operational expenses for environmental management systems, expenses for pollution treatment, the balance of the expenses of green procurement and design for the environment (DfE), expenses for recycling, expenses for environmental insurance, etc.
Environmental appraisal costs	The expenses of monitoring the environmental effects for which a company is responsible, and the expenses of checks and inspections to prevent the design, development and shipping of environmentally harmful products. For example, expenses related to life cycle costing (LCC) and environmental impact assessment (EIA), expenses for toxicity testing, and other checking and inspection expenses.
Internal environmental losses	The losses caused by imperfect environmental conservation measures, inspection, etc.: for example, the costs of waste materials (including costs of non-product outputs and materials flows), waste treatment expenses, pollution treatment expenses, waste products collection and recycling expenses, compensation costs, and budget forecasts of energy and packaging expenses which are inaccurate despite being based on rational and reasonable assumptions.
External environmental losses	The losses borne by the community or local residents. These are caused by inadequacies in a company's environmental conservation measures, inspection procedures, etc. This type of loss includes environmental burden where the liability could not be currently identified such as air pollution, land contamination, and water pollution caused by the emission of CO_2, NO_x, CFC, etc.

It is for the reasons stated above that these losses are excluded from the category of environmental costs by the MoE classification (MoE 2002). However, against a background of ever more stringent regulations, it is impossible to evaluate the results of environmental conservation activities without measuring these losses. The reason is that the objective of these activities is to reduce social costs or environmental burden, so it is therefore appropriate to include external environmental losses as a major category within environmental costs.

Another difference between the costs of quality and environmental costs exists in the GPMM. With the costs of quality, the main aim of cost management is to identify those processes which lead to failure costs, since failure in the market can give rise to large economic losses, compared with internal losses in general. On the other hand, environmental costs cannot be fully controlled by companies on their own, and the community and consumers also have some responsibility for meeting these costs. Therefore, any company may be required to implement production activities associated with risks that it may not be able to manage, so that it is impossible to decide the extent to which any damage is the company's own responsibility.

Moreover, it is difficult to measure most external environmental losses on a monetary scale, so GBMM therefore does not employ monetary measurements for external environmental losses. Instead, each environmental problem or effect is measured by an appropriate physical unit. Of course, the possible utility of monetary measurement is not rejected, but it is essential to point out that the difficulty of using this for external environmental losses does not present an obstacle to the use of the matrix model for the purpose of analyzing and evaluating the environmental burden.

3.3 Structure of GBMM and the Process of Preparing the Matrix

Table 16-2 shows the basic structure of the Green-Budget Matrix. The matrix is a work sheet which takes into account environmental conservation costs and the relationship between internal and external environmental losses.

The items of environmental conservation costs and appraisal costs are arranged in rows in the matrix. This classification could be applied by companies which comply with the MoE's guideline on the measurement of environmental costs. Companies could of course apply their own classification of environmental costs instead, in which case it would be required that the environmental cost items should correspond to the environmental conservation activities undertaken by the company.

The detailed items of internal and external environmental losses are arranged in columns in the matrix. For example, internal environmental losses are seen as environmental damage costs, which are categorized as one of the environmental costs according to the MoE's guideline. Of course, various different ways of itemising environmental losses could be considered.

For example, the full amount of energy consumption costs is included in internal environmental costs in the matrix without considering whether they are related to the environment. This is because energy consumption costs cannot be classified against each separate objective, and it would be counterproductive to exclude non-environmentally related energy consumption when considering the overall energy savings. Also, if a company were to cause serious environmental problems, it would be important to take opportunity costs into consideration. These opportunity costs are a similar concept to the loss of corporate brand prestige or the social image of a company and are almost impossible to measure in monetary terms, although fortunately the main objective of the matrix is not to attempt to measure these losses precisely. This is because the matrix is designed to provide feed-forward information to management on environmental conservation costs, not to manage internal or external losses, despite there being an assumption that planning and implementing environmental conservation measures could lead to a reduction in these losses. The measurement of environmental losses itself is therefore not a central concern in this context. The most serious problem is that because of the difficulty of measuring these losses, they may be excluded and therefore overlooked in environmental conservation planning.

Table 16-2. Conceptual model of the Green-Budget Matrix.

	Details of expenses	Details of activities Actual amount	Environmental conservation costs (C_j) (j=1.2…m) (+Environm. appraisal costs) C_1	C_2	C_3	-	-	-	-	C_m	Materiality	Targeted amount of losses	Difficulty	Absolute weight	Relative weight
Internal environmental losses	L_1 (*1)	-	R_{ij} (*2)		-	-	-	-	-	-	-	-	-	-	-
	L_2	-	-		-	-	-	-	-	-	-	-	-	-	-
	L_3	50	-	○ 1.2/4.0	Δ 0.4/4.0	-	● 2.0/4.0	-	Δ 0.4/4.0	-	5	10	4	20	4.0
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
External environmental losses	-	-	-	● 2.2/5.0	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	Δ 1.4/3.0	-	-	-	-	-	-	-	-	-	-	-
	L_m	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green budget weight				4.8								Total absolute weight		500	100%
Estimated environmental costs and/or losses				168							Total		€3,500		
Actual environmental costs and/or losses				175							Total		€3,850		

(*1) Li = Environmental internal and external losses (i = 1.2…..n)
(*2) Rij = Correlation between costs and losses (j = 1.2…..m)

3.4 Process of Preparing the Green-Budget Matrix

The process of preparation of the Green-Budget Matrix has the following steps:

1. Identifying the details of internal environmental losses and external environmental losses.

   Each detailed item of internal and external environmental losses is arranged in rows in the matrix. Moreover, each item of losses ($L_{1, 2, 3 \ldots n}$) is expressed as the actual current amount or quantity in the matrix. However, it is necessary to classify the losses systematically and accurately in order to ascertain these amounts or quantities.Evaluating the materiality of each environmental loss.

   Materiality, which refers to the priority given to tackling the problem depending on the seriousness or the company's situation, is evaluated according to a five-point scale for each item of loss. For example, the materiality of "L3" is evaluated as "5" in Table 16-2 based on the current amount or quantity. However, materiality is not decided simply according to the amount or quantity, but should also take into account the advantage for competitors.

3. Setting targets for each item and evaluating the difficulty of accomplishing each of these targets.

   The next period's targets are determined by each item's loss, and then the difficulty will be evaluated again according to the five-point scale in order to accomplish these targets. For example, the difficulty of "L_3" is evaluated as "4" in Table 16-2.

4. Deciding the absolute weight (Wa_i) and the relative weight of losses (Wr_i).

   The absolute weight is calculated by multiplying the materiality and the difficulty by each item of loss (Wa_i). The product is regarded as a quantified indicator for evaluating the influence of each environmental loss on the business.

   Next, sum up all of the absolute weights and then decide the relative weight of losses. This can be calculated using the following formula:

$$Wr_i = \frac{Wa_i}{WA}, \quad WA = \sum_{i=1}^{n} Wa_i$$

For example, as shown in Table 16-2, the absolute weight is calculated by multiplying "5" and "4". Then if, for example, the total absolute weight is calculated as "500", the relative weight of losses is calculated as 4.0%.

5. Listing environmental conservation activities.

   The items of environmental conservation costs and appraisal costs are arranged by column in the matrix ($C_{1,\ 2,\ 3 \ldots\ n}$). Since it appears that each item of the conservation costs is totalled by environmental conservation activities, in general, this process is almost synonymous with the listing of environmental conservation activities.

   The same process is applied to environmental appraisal costs, although in fact there are many cost categories that can be identified as appraisal costs, and in any case it is not very important to make a distinction between conservation costs and appraisal costs. From a practical point of view, it seems that appraisal costs could be incorporated into conservation costs.
6. Evaluating the relationship between cost and loss in each cell.

   The relationship between the costs ($C_{1,\ 2,\ 3 \ldots\ m}$) and losses ($L_{1,\ 2,\ 3 \ldots\ n}$) is evaluated with the correlation between the various items of environmental conservation costs and of environmental losses being graded for each cell as “double circle” (strong correlation), “circle” (correlation), and “triangle” (weak correlation). These are weighted as “5”, “3”, and “1” in turn. Also, it is expressed in Table 16-2 as an intersection between the row (L_3) and the column (C_3). This grading is able to evaluate the extent of environmental conservation activities which contribute to reducing environmental losses.
7. Calculating the Green-Budget weight.

   When all the cells are weighted, then the numerical values of each cell are added with respect to each item of the environmental conservation costs. This is the process of deciding the Green-Budget weight in Table 16-2. The Green-Budget weights are the quantitative expressions of weighting when a company allocates business resources to each environmental conservation activity. For example, the Green-Budget weight of column “C_3” is calculated as “4.8” in Table 16-2.
8. Environmental budgeting.

   The final step of the preparation of the Green-Budget is to formulate the environmental budget. The total amount available to spend on environmental conservation costs is allocated to each activity in proportion to its ratio of the Green-Budget weight. For example, the estimated environmental costs and losses of the “C_3” column are calculated by multiplying total amount “€3,500” and the Green-Budget weight “4.8%” so that it is calculated as “€168” as shown in Table 16-2

   In principle, the matrix should be prepared for each individual division or factory. However, there are some companies that do not set a budgeted amount at this level. In this situation, the actual performance figures for previous fiscal years could be used as a provisional budgeted amount.

Moreover, if managers evaluate and analyze the actual costs incurred in the preceding period, then they can rationally consider the appropriateness of prior allocations of business resources to environmental conservation measures.

GBMM clearly distinguishes between internal environmental losses and external environmental losses, and thereby helps managers to prepare effective environmental management plans and to compile a budget. In this case, since the reduction of internal environmental losses could be directly tied to higher profits, managers could draw up measures on cost-effectiveness. On the other hand, with regard to the external losses, GBMM could help managers to decide on environmental measures within the limits of the financial resources available to them, and help them to produce good results within these financial constraints.

3.5 The Contribution of GBMM

GBMM plays three major roles in its preparation process. Firstly, it helps managers to identify principal and serious environmental problems within the organization by estimating and weighting each loss according to both its impact (materiality) on the business and the difficulty of reducing it. Secondly, in order to reduce internal or external environmental losses, GBMM supports the selection of actions and formulation of plans for environmental conservation by evaluating the cost-effectiveness and eco-efficiency of each activity. Thirdly, since business resources are allocated to activities according to the contribution of each, GBMM generates more feasible budgets for environmental conservation activities.

Six Japanese companies have implemented GBMM since 2001: Nitto Denko Corporation, Toyo Seikan Kaisha Ltd., Nissan Motor Co. Ltd., Kirin Brewery Co. Ltd., Toshiba Corporation, and Kyusyu Electric Power Co. Inc. Since these companies are classified under several different categories of business, it is clear that the contribution which GBMM can offer is by no means limited to only a specific industry sector. The next section discusses the case of Nitto Denko.

4. A CASE STUDY AT AN INDUSTRIAL PRODUCTS MANUFACTURING COMPANY

4.1 Environmental Budgeting at Nitto Denko Corp.

Nitto Denko is a Japanese industrial products manufacturing company which is shifting its environmental management from end-of-pipe measures to upstream/process-integrated measures. In line with this policy, in each year since fiscal year 2000 it has developed an environmental budget whose characteristics are as follows (Nitto Denko Corporation 2003):

- An environmental budget is compiled by each division and by the Company Group in order to identify individual environmental themes and responsibilities.
- In addition to the “environmental conservation costs” that are indicated in the MoE guidelines, the purchasing and processing costs of materials that do not become products (industrial wastes), and the purchasing cost of energy, solvents and water consumed in in-house manufacturing, are also defined and recognized as “environmental impact costs”.
- By effectively sharing the “environmental conservation costs”, reducing the “environmental impact costs” produces good environmental performance. The goal is to reduce total costs by improving the productivity with which natural resources are used.

Since Nitto Denko has already introduced the PAF classification, which can measure and analyze quality costs, as a support tool for quality improvement, it seemed that the company has the background to apply GBMM. That is, for a company such as Nitto Denko which pursues the reduction of the cost of its industrial wastes, quality cost management and environmental cost management have similar characteristics that “aim at maximum output with minimum input, in other words, cope with both environment and economy”.

For example, the environmental aspect “industrial waste reduction activities” could be connected with the quality aspect “failure products eradication activities”. Hence, details of environmental costs that were accrued in line with materials flows have, to some extent, common characteristics with items of appraisal costs and internal failure costs. The matrix could therefore help managers who plan to fuse environmental costs and quality costs in the future.

4.2 A Trial of the Green-Budget Matrix at the Company

As mentioned above, since each division in Nitto Denko compiles an environmental budget in order to identify individual responsibilities, the division is trialling GBMM. The main items of "environmental impact costs" correspond to internal environmental losses, and the main items of "A Request of Preparing Voluntary Plans in Relation to the Environment" published by the Ministry of Economy, Trade and Industry, correspond to external environmental losses. Nitto Denko therefore determined the correlation between these losses and environmental conservation costs, materiality and difficulty, and undertook a trial calculation of the next period's environmental budget based on previous actual figures (see Table 16-3).

Since one of the characteristics of GBMM is to reduce "environmental impact costs" by inputting appropriate environmental conservation costs, the correlation between "environmental impact costs" and environmental conservation costs is considered by using the matrix.

As a result of the pilot project, Nitto Denko has realized a number of benefits through preparing GBMM. These are:

- Since the budget matrix was compiled in relation to targets to reduce environmental losses, environmental costs were effectively allocated to each activity at the beginning of the budgeting process, so that the company would be able to make an effective reduction in its environmental burden.
- Since the company is able to accumulate data on environmental losses in a time series, managers can utilize the unique feed-forward function of the matrix and then compile a future capital investment plan which takes into account the environmental effects of their operation.

Nitto Denko has also tackled reducing the costs of industrial wastes by implementing "materials flow cost accounting". Both GBMM and materials flow cost accounting have similar characteristics in terms of their concentration on industrial waste. Both tools measure materials costs and waste costs, including conversion costs, distribution costs and disposal costs, in monetary terms, and then evaluate "the negative value" of the company. Hence, both tools could contribute to clearing up the causes of the generation of wastes, and to planning and analyzing improvement measures.

In this respect, both GBMM and materials flow cost accounting pursue ecological as well as economic objectives so that their linkage in the future has a natural logic.

Table 16-3. Green-Budget Matrix prepared by a division of Nitto Denko Corp. (source: JEMAI 2003:216).

		Details of activities		Environmental conservation costs (3)															
				Pollution prevention costs			Resource circulation costs						R&D costs						
Details of expenses			Actual amount	Preventing air pollution	Preventing water pollution	Preventing other types of pollution	Saving energy consumption	The efficient utilisation of resources	Conservation of water and the utilisation of rainwater	Appropriate disposal of waste	Recycling waste	Administration costs	Operational costs	Personnel expenses	Materiality	Targeted amount of losses	Difficulty	Absolute weight (1)	Relative weight (2) %
Internal environm. loss (monetary conversion)	Losses caused by inefficient use of resources	SOx levy (materials containing sulfer)	308.0 Kyen	○ 0.7/2.1			● 1.05/2.1					Δ 0.35/2.1			1	300 Kyen	3	3	2.1
		Value of industrial waste (original estimation)	374.8 Myen					○ 3.9/17.6				○ 3.9/17.6	○ 3.9/17.6	● 5.9/17.6	5	337 Myen	5	25	17.6
		Energy	129.4 Myen	○ 1.5/11.3			● 2.3/11.3		○ 1.5/11.3		○ 1.5/11.3	○ 1.5/11.3	○ 1.5/11.3	○ 1.5/11.3	4	128 Myen	4	16	11.3
		Organic solvents	70.6 Myen	○ 1.9/14.1	Δ 0.9/14.1		Δ 0.9/14.1	○ 1.9/14.1			○ 1.9/14.1	○ 1.9/14.1	○ 1.9/14.1	● 2.8/14.1	4	64 Myen	5	20	14.1
		Water	3.6 Myen		○ 0.4/2.1	Δ 0.2/2.1			● 0.6/2.1		○ 0.4/2.1	○ 0.4/2.1			1	3.6 Myen	3	3	2.1
External environm. loss (mass conversion)	METI's "Voluntary Plan"	Waste recycling rate	98.0%							○ 1.4/6.3	● 2.1/6.3	○ 1.4/6.3	Δ 0.7/ 6.3	Δ 0.7/6.3	3	100%	3	9	6.3
		Value of industrial waste ratio	9.5%					○ 2.7/17.6		○ 2.7/17.6	○ 2.7/17.6	○ 2.7/17.6	○ 2.7/17.6	● 4.1/17.6	5	8.4%	5	25	17.6
		Consumption of energy per product unit	843 (l/Myen)	○ 1.7/11.3			● 2.6/11.3				○ 1.7/11.3	○ 1.7/11.3	○ 1.7/11.3	○ 1.7/11.3	4	831 (l/Myen)	4	16	11.3
		Solvent emission ratio	7.8%	● 4.4/17.6	Δ 1.5/17.6					○ 2.9/17.6	○ 2.9/17.6	○ 2.9/17.6	Δ 1.5/17.6	Δ 1.5/17.6	5	4.5%	5	25	17.6
Green budget weight (4)				10.2	2.8	0.2	6.8	8.5	2.1	7.1	13.3	16.9	13.9	18.2		Total absolute weight		142	100

4.3 Estimations of Opportunity Losses

Since the main objective of GBMM is to measure accurate environmental conservation costs, the model does not attempt to make a budget for internal and external environmental losses. Of course, the matrix has cells where the amount or quantity and estimated volume of these losses can be entered, but this is only one of the factors that are needed in the estimation of environmental conservation costs. However, if these losses are estimated incorrectly, the usefulness of the environmental conservation cost information considered in the matrix will inevitably be reduced.

Consequently, an annoying problem occurring in the analysis stage of GBMM is the measurement of an opportunity loss, such as a decrease in sales arising from a suspension of operations due to the occurrence of environmental problems or an accident, or from a loss of corporate brand/prestige. They also refer to future costs/liabilities of current environmental impacts, so it is still difficult to estimate opportunity losses in precise terms. Nitto Denko has therefore not yet attempted to evaluate them, although it perceives them potentially to be elements of internal environmental losses.

In contrast, Toshiba, which is another typical Japanese company which is implementing GBMM, evaluates in monetary units as "risk prevention benefits" the avoidance of future opportunity losses for present capital investments and environmental conservation activities. Toshiba also estimates customer benefits which refer to the reduction of environmental impacts of products throughout their life-cycles. These benefits are depicted as "economic benefits for environment" in Toshiba's GBMM. The company's matrix has three major categories of columns: "economic benefits for environment", "internal" and "external environmental losses".

Notes for Table 16-3:
(1) Absolute weight: multiplying the materiality and difficulties for each item.
(2) Relative weight: sum all items, and then calculate the environmental weight of losses that can be calculated to make the volume of each item re-converting to a percentage.
(3) Environmental conservation costs: the grade could be assigned numerical values, such as "●" (5 points), "○" (3 points), and "∆" (1 point), and then allocate the weight of the environmental losses to each cell by each row in the work sheet proportionally. These costs include depreciation, but exclude investment.
(4) Environmental budget weight: the numerical values of each cell are aggregated for each item of the environmental conservation costs.

5. CONCLUSIONS

Several Japanese companies have focused exclusively on the external reporting aspect of environmental accounting and have calculated only the environmental costs of conforming to the MoE guidelines, and do not consider any future action plan and budget concerning their environment management in the next fiscal year.

Although environmental accounting intends to show the results of the company's EMS, an EMS cannot be expected to be successful without having an action-plan which provides a map for driving activities and a budget which guarantees to put the plan into effect. The lack of these budgets is evidence that the EMS of Japanese companies do not work well. In the case examined, the Green-Budget Matrix was found to be a most useful instrument for supporting managers in this context.

GBMM is a tool designed to help managers identify the sort of activities that drive excellent environmental performance through the effective allocation of economic resources. It also provides useful information for analysing the status quo, foreseeing the future of the EMS, and promoting a mutual shared recognition between members of the organization of their mission through the matrix preparation process.

GBMM can also contribute to other objectives. Budgeting is mainly a short-term future-orientated activity whereas environmental planning requires more long-term orientated decisions. By applying GBMM to capital budgeting, it can be used as a strong support tool for decision-making for long-term environmental capital investments. In fact, Toyo Seikan has adopted the matrix and uses it for capital budgeting.

GBMM has also become a driving force towards the Sustainability Balanced Scorecard (SBSC). The identification of business relevance of different environmental issues is a core goal of the SBSC (Figge et al. 2003). GBMM evaluates the relevance on its own logic, and helps to identify the initiatives or actions for realizing the goals, especially in the case of integration with capital budgeting.

The practical way of implementing SBSC, however, has not yet really been settled. It is necessary to have further discussion on this issue and to verify how GBMM supports SBSC.

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Chapter 17

QUALITY OF PHYSICAL ENVIRONMENTAL MANAGEMENT ACCOUNTING INFORMATION

Lessons from Pollutant Release and Transfer Registers

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Abstract: It has been claimed that in many cases the quality of pollutant release and transfer register (PRTR) information is hard for recipients to assess, thereby leading to poor-quality information driving out good-quality information (Schaltegger and Burritt 2000:334). In this paper an assessment of recent PRTR developments in a cohort of international countries is examined in order to assess the contemporary quality of PRTR information. The paper provides an overview of each PRTR system, comments on the usability of pollutant release and transfer information based on a set of criteria including understandability, relevance, reliability and comparability; examines data measurement processes and reveals several data quality problems still needing to be addressed. Developments in Australia, Canada, Japan, the Netherlands, the United Kingdom (UK) and the United States of America (USA) are examined and conclusions drawn about the future for PRTR physical environmental management accounting information, including the potential for the linkage of PRTR data with materials flow cost accounting.

1. INTRODUCTION

A number of national and regional government organisations have developed systems to collect and disseminate data on releases and transfers of chemical emissions from industrial facilities. For example, one regional organisation defines a *Pollutant Release and Transfer Register* as a national environmental database of harmful releases to air, water, land and waste, filed

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annually by individual facilities (European Commission 2003). In 1999 twenty-two countries were identified by the United Nations Environment Programme (UNEP) as possessing such systems (UNEP Chemicals 1999a). (The countries identified are: Australia, Belgium, Canada, Czech Republic, Denmark, Egypt, Finland, Germany, Hungary, India, Italy, Japan, Korea, Netherlands, Norway, Russian Federation, South Africa, Sweden, Switzerland, Thailand, United Kingdom, and the United States). These systems are called Pollutant Release and Transfer Registers (PRTRs). There are three distinct stages at which transmission of data/information can occur: i) by the facility/company to the manager of the PRTR database; ii) by the PRTR database manager to the public, or at least some subset of them; and iii) by the company to the public independently of the need to provide information to the regulator. This paper uses the term ‘filing’ to refer to the first stage, ‘disclosure’ to refer to the second stage, and ‘reporting’ to refer to the third stage.

First, key substances that are considered by government to be hazardous to human health or ecological systems, and in some cases substances transferred outside industrial facilities in the form of waste, are identified. Then, the facility records periodic emissions of the physical quantity of specific chemical substances released to the environment. Finally, based on the list of chemicals, facilities that release one or more of such chemicals file information periodically on the amount released and/or transferred and on the environmental media involved (atmosphere, water, land). Data about emissions is gathered and used by government regulators and management of the facilities emitting pollutants, and in general, filed data are disclosed to the public as an aid to transparency and external accountability (OECD 2001:12).

PRTRs have a number of key characteristics. The central feature of any PRTR is a database of emissions and transfers established and managed by government or a government-appointed body such as a regulator. The government defines both the population of the database (that is, the chemicals, transfers, etc. to be included) and the parties within that country required to provide data. Company facilities provide the data on a regular basis to the managers of the PRTR database, who then enter the information into the PRTR. Recorded data are normally made available to the public through Web disclosure and are sometimes independently verified. PRTRs are introduced for a number of reasons which, as examined below, vary between different countries and include: the government/regulator checking compliance, public accountability through disclosure, and improved environmental management (OECD 1997a).

As PRTRs are implemented through country-specific legislation, there is a legal accountability obligation on the data provider (the company facilities that are required to file their data) to the regulator. Data gathering and disclosure is a necessary step in the accountability process, whether it is used by management or whether others use it. However, it has been claimed that in most cases the quality of pollutant release and transfer register information cannot be assessed by recipients, thereby leading to poor-quality information driving out good-quality information (Schaltegger and Burritt 2000:334). In the process of reconsidering this claim the paper has the following structure. In Section 2 an overview of PRTR information and related systems in a cohort of international countries is provided. Section 3 lists criteria for assessing the quality of PRTR data, typical data measurement processes and data quality problems for users. Problems are identified relating to the diversity in regulatory requirements for PRTR disclosure between countries, international comparability considerations and data comprehensiveness issues. Section 4 examines the quality of corporate PRTR data. This section concludes with a practical example for a multinational company of PRTR data and its use.

Finally, through the effect on reputation, the development of PRTR information can stimulate proactive voluntary initiatives by companies and facilities to reduce their releases and transfers of toxic chemicals and the adoption of corporate Environmental Management Accounting (EMA) systems. Section 5 draws inferences about the links between PRTR data and EMA tools, including the potential for linkage with materials flow cost accounting. Section 6 concludes the paper and suggests some directions for future research.

2. OVERVIEW OF A COHORT OF PRTR INFORMATION AND SYSTEMS

PRTRs existed prior to 1992 – for example, the Dutch Emission Inventory System (also called the Pollutant Emission Register) was introduced in 1976 in an effort to create a complete inventory of sources of air pollutants. However, an added stimulus for their development was the recognition, at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, of the right of communities and workers to know about toxic chemicals and the importance of chemical inventories (OECD 2004). In addition, there is concern that toxic and dangerous substances are being transferred across international borders in contravention of existing national legislation and international instruments, to the detriment of the environment and public health, especially in developing countries. UNCED's Agenda 21, Chapter 19, calls on governments, in co-operation, to implement and improve databases for chemicals, including inventories for emissions. It proposes that industrial firms provide data on substances they produce, specifically for the assessment of potential risks to human health and the environment. In 1993, as a follow-up to UNCED, the Organisation for Economic Cooperation and Development (OECD) countries asked the OECD Secretariat to prepare a guidance manual for governments considering the establishment of a PRTR. In 1996, the PRTR Guidance Manual for Governments was completed and in the same year, under the *OECD Council Act on Implementing Pollution Release and Transfer Registers,* the OECD recommended that its Member countries introduce the PRTR system (OECD 2001:11).

Initially PRTR data tended to be gathered or estimated by engineers in government agencies, but gradually the function has been passed over to corporations and their disclosing sites and facilities (UNEP Chemicals 1999b). Each site has considerable flexibility in the methods for measurement and estimation of the physical flows, thereby creating a potential quality issue where comparative information is needed. Several international and regional organisations provide guidance on the production of PRTR information, measurement and estimation, such as the OECD; UNEP's International Register of Potentially Toxic Chemicals (IRPTC); the World Health Organisation (WHO); the Commission for Environmental Cooperation; the European Union; the United Nations Institute for Training and Research (UNITAR), etc. However there is no agreed single basis for comparison, even though this is encouraged by Agenda 21.

The OECD claims that all of the PRTR programs that exist today are based on the principles found in the OECD PRTR Council Act, yet each is designed differently because of different national environment needs, priorities and circumstances (OECD 2001:12f.). Goals and objectives are not the only factors affecting the design and implementation of a PRTR. Other factors include available resources, scale of economy, type and size of industrial sectors, program and register expertise, national policy priorities, geographic or political circumstances, and environmental needs. However, an overriding need for comparable information exists for assessing the performance of facilities of a single company operating in many countries. Of course, the other possibility for acquiring this information is that a single group environmental report, or separate environmental reports for each organisation that makes up a multinational company, may be available and contain the data.

Although PRTRs are designed to be country-specific, some *commonalities* between the programs do exist – common characteristics that create the backbone of a PRTR system. These include: i) a listing of potentially hazardous chemicals; ii) multi-media filing and disclosure (or integrated filing and disclosure) of releases to air, water and land and transfers; iii) filing and disclosure of data by source/facility; iv) filing and disclosure on a periodic basis (usually annually); and v) making data and information available to the public, normally on a site-by-site (facility-by-facility) basis (OECD 2001:12f.).

Comparisons of these and other characteristics are made here for a cohort of PRTRs in six countries. Choice of country is based partly on the desire to include both some countries that have had lengthy experience with PRTR implementation and also some newcomers, the language skills of the two authors (Japanese and English), and the time available for the comparison.

Table 17-1 provides comparative information for six PRTRs: Australia, Canada, Japan, the Netherlands, the UK and the USA. The names of each PRTR system and a note about the regulator and duration of the PRTR duration are recorded below.

The *Australian* PRTR system is called the National Pollutant Inventory. It was developed as a National Environment Protection Measure enacted by the Commonwealth of Australia in 1998 and is managed by the Commonwealth Department of the Environment and Heritage, whose name was recently changed from Environment Australia.

Canada established its PRTR system, the National Pollutant Release Inventory, in 1993. This inventory is similar in structure to the U.S. Toxic Release Inventory (OECD 1997a:7). Environment Canada manages the Inventory.

The *Japanese* PRTR system is the youngest in the cohort and commenced in April 2001, after a pilot project had been operational for three years. The Ministry of Environment and the Ministry of Economy, Trade and Industry (METI) cooperate with each other in aggregating and sorting the data to be disclosed, for example by type of industry and geographic region. One unusual aspect of the system in Japan is that data about individual facilities are not disclosed, and so it is available only by request to the Ministry (METI and MOE 2001:1ff.).

The PRTR system in the *Netherlands* has the longest history of any in the cohort. It commenced in 1976 and an updated system was introduced in 1999. The current system is called the Emission Inventory System and is managed by the Ministry of Housing, Spatial Planning and the Environment. The System is composed of two separate inventory systems: the Individual Emission Inventory and the Collective Emission Inventory (OECD 2002:61).

The PRTR program in the *UK*, called the Pollution Inventory, is managed by the Environment Agency. This system grew out of the previous system known as the Chemical Release Inventory that commenced in 1991. The first full year for the Pollutant Inventory was 1998 (OECD 2002:66).

Table 17-1. Overview of the PRTR information and systems in a cohort of six countries.

	Australia	Canada	Japan	Netherlands	UK	USA
Name of Program	National Pollutant Inventory	National Pollutant Release Inventory	Pollutant Release and Transfer Register	Emission Inventory System	Pollution Inventory	Toxic Release Inventory
Government Ministry or Agency	Department of the Environment and Heritage	Environment Canada	Ministry of Environment and the Ministry of Economy, Trade and Industry	Ministry of Housing, Spatial Planning and the Environment	Environment Agency	Environmental Protection Agency
Homepage	http://www.npi.gov.au	http://www.ec.gc.ca/pdb/npri	http://www.prtr-info.jp/index.html	http://www.emissieregistratie.nl/en/index.htm	http://www.environment-agency.gov.uk/	http://www.epa.gov/tri
Data available from	1998	1993	2001	1976 (1999 for the new system)	1991 (1998 for the new system)	1987
Disclosure cycle	Annual	Annual	Annual	Annual	Annual	Annual
Mandatory/ Voluntary	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory
Number of notifications by facilities	Almost 3,000 facilities	Over 2,000 facilities	34,830 facilities	Over 2,000 facilities	Almost 4,000 facilities on the chemicals list and about 600 facilities for radio-active substances	Almost 25,000 facilities
Publication of data	Individual facility and aggregate data	Individual facility and aggregate data	Aggregate data only. Individual facility data is provided when requested	Password is needed to get data	Individual facility and aggregate data	Individual facility and aggregate data
Environmental media covered	Air, Water, Land	Air, Water, Land	Air, Water, Land	Air, Water, Land	Air, Water, Land	Air, Water, Land
Transfers off-site included	No	Yes	Yes	Yes	No	Yes
NPO/NGO information source	None	Pollution Watch http://www.pollutionwatch.org/	Toxic Watch Network: http://www.toxwatch.net/. Organisation for Research and Communication on Environmental Risk of Chemicals http://env.safetyeng.bsk.ynu.ac.jp/ecochemi/	None	Factory Watch: http://www.foe.co.uk/campaigns/industry_and_pollution/factorywatch/ (site now closed)	Scorecard: http://www.scorecard.org. TRI Search: http://d1.rtknet.org/tri/

The program in the *USA* is known as the USA Toxic Release Inventory database and is managed by the USA Environmental Protection Agency. The Toxic Release Inventory was created in 1987 by the *Emergency Planning and Community Right-to-Know Act* to encourage greater participation by communities in environmental matters, and to foster increased dialogue and cooperation between the public and local industrial facilities (OECD 1997a:9).

Table 17-1 reveals for the cohort of countries:

- Different nomenclature in each country
- Responsibility for the PRTR can rest with one or more government agencies
- Each country discloses PRTR information on the Internet (the Table provides website addresses).
- As outlined above, PRTRs have been operated over different time periods, from as early as 1976 (Netherlands) to as recently as 2001 (Japan).
- Disclosure, although voluntary in the first instance in some countries, is now mandatory and on an annual basis, being enforced by law in each country (OECD 2001:19f.).
- The number of facilities filing ranges from 2,000 (in each of Canada and the Netherlands) to over 34,000 (in Japan).
- Individual facility and aggregate data about pollutants are not easy to access in certain countries (for example, the database is password-protected in the Netherlands). The term “aggregate data” usually refers to the total releases in an area or country – when “aggregate” refers to a company, the term “consolidated” is used.
- Transfer information is not filed in Australia and the UK. Transfers include, for example, amounts commissioned to waste disposal and treatment contractors and amounts released into public sewage systems. In essence, responsibility for the emission is transferred to another party. This raises issues of environmental justice, such as when pollutants are transferred to developing countries.
- In three countries in the cohort, non-government organisations (NGOs) voluntarily compare, analyse and report on the emissions disclosures made by different facilities (see the separate Internet sites listed in Table 17-1).

Some additional comments on Table 17-1 are also merited. First, the kind of the PRTR data that is published varies between the countries examined. In most of the countries, both individual facility and aggregate data are available on the Web. However, in Japan facility-specific data are provided only when requested. In the Netherlands, publication is based on printed documents, perhaps because the Dutch system originated as a tool for monitoring environmental policy. Changes to simplify and broaden public accessibility to the emission registration data mean that, since 2001, the information has been made available on the Internet through the DataWarehouse Emission Register. In the initial test phase the database is available only to a limited group of professionals through on-line registration and password access. In due course, all users will have access (Koch et al. 2001:12).

Secondly, although releases to air, water or land are defined in a similar manner in all countries, there is limited consistency between national PRTRs when it comes to the breadth and definition of transfers. Views differ on whether filing of information should be required in relation to the removal of certain chemicals in wastes from the place of generation to a recovery operation, treatment, storage or off-site disposal facility, and whether potentially harmful chemicals transferred in products should be filed. Indeed, in Australia the lack of inclusion of such information led to a non-government organisation withdrawing from the process of establishing the National Pollutant Inventory. The manner in which PRTR releases and transfers are filed also differs. For example, in Japan, when transferring or supplying designated chemical substances to other facilities, the transferring facility has to provide the transferee with information on properties and handling of the chemical substances concerned (through a Requirement of Distributing Material Safety Data Sheet (MSDS)). In consequence, certain releases and/or transfers are easier to identify in the data filed (OECD 2001:17).

Finally, the way in which companies are held to account differs. In some countries, NGOs voluntarily analyze, rank or map PRTR information. Australia is an exception, as no NGO regularly analyzes National Pollutant Inventory data since Greenpeace withdrew from initial discussions about the establishment of the inventory. In Canada, *Pollution Watch* provides a list of polluters, pollution ranking, pollution maps, pollution timeline, and regulatory information, etc. In Japan, there are two NGOs active in Japanese PRTR analysis. The *Toxic Watch Network,* established in April 2002, includes in its homepage PRTR database software to allow searches by company, area, industry and substance, something that is not available through the Ministry of Environment/Ministry of Economy, Trade and Industry (MOE/METI) PRTR which discloses only aggregate data. The second NGO is the *Organization for Research and Communication on Environmental Risk of Chemicals.* On its homepage it reports the toxicity and location of target PRTR substances. In the UK, Friends of the Earth used to report through *FACTORY WATCH* but its website on factory pollution has been closed down (see Internet URL: <:http://www.foe.co.uk/campaigns/industry_and_pollution/factorywatch>). In the USA, there are two active NGOs. One is *Scorecard* operated by Environmental Defense. The *Scorecard* homepage provides various rankings, maps of the data, postal code search software, a site navigation pick list, and a site-wide search engine, etc., based on Toxic Release Inventory (TRI) data. The second NGO is the Right-To-Know Network's *TRI Search.* Through its website users can search PRTR data by geographic area, facility, industry, parent company and offsite waste transfer. Access to data about emissions of individual facilities, of companies, and in particular areas is considerably improved in some cases through NGO activity, especially where the government agency's PRTR data are inadequate as is currently the case in Japan.

In the following section, qualitative characteristics of PRTR data are examined for each country in the cohort.

3. QUALITATIVE CHARACTERISTICS OF PRTR DATA

There are many factors that influence the quality of PRTR information. For example, the OECD suggests that *accuracy* is difficult to establish in inventory development efforts, since the "*truth*" of any specific emission rate or emissions magnitude is rarely known (OECD 2001:27). In Australia, National Pollutant Inventory staff have advised the authors that about 10% of the data for National Pollutant Inventory filings provided to the Commonwealth regulator by State and Territory regulators is not published because of issues relating to poor quality, especially inaccurate data submissions from facilities ('Commonwealth' and 'State and Territory' levels of government represent two of the three levels in Australia – local government is the third). Instead of using a random selection of criteria, in this section an assessment is made of how information provided in country PRTRs measures up to a set of qualitative characteristics that has been suggested by the International Accounting Standards Committee (IASC 1989). The quality criteria suggested in the International Accounting Standards Committee's conceptual framework are adopted, because the framework is the *de facto* basis for financial reporting disclosures in an ever-growing number of countries. The framework considers qualitative characteristics for financial statements that reflect the accountability of management for the resources entrusted to it (IASC 1989:14). This framework is also useful for discussion about PRTR data because PRTR data is a part of the information that shows the results of the accountability of management for the resources entrusted to it, not their monetary aspects but their physical aspects, both of which are necessary for the computation of financial statements.

The IASC framework suggests four main qualitative characteristics: *understandability, relevance, reliability* and *comparability.* The relevance of information is affected by its *nature* and *materiality*. Reliability consists of *faithful representation, substance over form, neutrality, prudence* and *completeness*. Constraints on relevant and reliable information are *timeliness*, *balance between benefit and cost* and *balance between qualitative characteristics* (IASC 1989:24ff.). Based on these characteristics, the quality of PRTR information for each country is discussed below.

3.1 Understandability

An essential quality of the information provided in the PRTR is that it is understandable by users. The substance of the information contents should be

Table 17-2. Understandability.

Country	Searchable site	Mapping	Integrated with geographic/spatial or other information systems?
Australia	Yes	Yes	The database containing National Pollutant Inventory emissions data has interactive geographic information.
Canada	Yes	Yes	The facility-specific information includes geographic co-ordinates in order that it can be integrated with geographic information systems.
Japan	Not by facility	Yes	No
Netherlands	Available only for a limited group	Yes (only by printed document)	Integrated with a global information system, but not with a risk system.
UK	Yes	Yes	The Environment Agency has placed the data on a global information systems mapping interface on its Internet site.
USA	Yes	Yes	The Envirofacts system operated by the USA Environmental Protection Agency provides comprehensive access to environmental information collected under various environmental programs, including the PRTR. On Envirofacts, the user can create maps that show the locations of facilities disclosing PRTR as well as other data.

easy to understand. Ability to search, and mapping and integration with geographic or other information systems form an integral part of the understandability of PRTR data. However, there are variations in these characteristics between the six countries as shown in Table 17-2 (OECD 2000:52f.).

As indicated before, the system in the Netherlands allows only limited access to data. In some countries, NGOs attempt to cover any shortfall in the PRTR data disclosed by the regulators. For example, in Japan, facility data disclosed is too voluminous to read directly into spreadsheet software, so that the only practical possibility is to examine the data by prefecture rather than by facility (there are two levels of government in Japan: local (or prefecture) and national (or State)). Data are organised into 47 prefectures that need to be accessed one at a time if aggregate company data are to be recovered. Data search by facility is available through the NGO's homepage (e.g. Toxic Watch Network); hence, this additional feature makes it more understandable than the government regulator's data.

3.2 Relevance

To be of general use, information must be relevant to the decision-making needs of users. Each country has different goals and objectives for their PRTR systems. Generally, PRTR objectives are classified into four goals: i) public right-to-know; ii) voluntary pollution prevention and reduction, and cleaner production; iii) environmental policy development and evaluation; and iv) risk/impact assessment (OECD 2001:24ff.). The goals for each country included in the cohort are shown in Table 17-3 (OECD 2001:31ff.).

The goal and objectives of a PRTR play a critical role in how the system is designed. For example, PRTRs having the public right-to-know as their primary goal might list a broad range of potentially toxic chemicals from a large number of sources, as well as actively disseminating data through a variety of communication methods. PRTR systems whose goal is to evaluate the progress of specific environmental policies are more likely to include only chemicals that are specifically noted by regulations or other legal measures. These data may or may not be actively disseminated to the public, or may be made accessible only in an aggregate form as for example in Japan (OECD 2001:16).

Table 17-3. Relevance (source: OECD 2001).

Country	Goals and	Objectives of the PRTR System
Australia	a,b,c *	Provide information to enhance and facilitate policy formulation and decision making for environmental planning and management. Provide publicly accessible and available information, on a geographic basis, about specified emissions to the environment, including those of a hazardous nature or involving significant impacts. Promote and assist with the facilitation of waste minimization and cleaner production programs for industry, government, and the community.
Canada	a,b,c,d	Encourage voluntary action, monitor progress, provide information for the public, and support targeted regulatory initiatives.
Japan	a,b,c	To promote the company's voluntary improvements in the management of specific chemical substances and to prevent any impediments to environmental protection.
Netherlands	a,b,c	To monitor the annual emission of air, water and soil pollutants as well as the waste flows from all sources on a (sub)-national scale. To verify the progress of environmental policy. To provide official emission data to national and international bodies. To disseminate emission data to the public and facilitate pollution modelling.
UK	a,b,c,d	To provide the public with easily accessible data about pollution from industrial and other sources in their local area and nationally. To help environmental regulators to protect the environment. To help government meet national and international commitments and obligations.
USA	a,b,c,d	Raising community awareness, Raising public awareness, Raising industry awareness, Targeting, Prioritisation, Risk management, Tracking trends, Communication, Education, Empowering the public.

* a) public right-to-know
b) voluntary pollution prevention and reduction, and cleaner production
c) environmental policy development and evaluation
d) risk/impact assessment

3.3 Materiality

The relevance of information is affected by its materiality. Information is material if its omission could influence the decision taken. Materiality is seen to provide a threshold or cut-off point in terms of relevance, rather than being a primary qualitative characteristic which information must have if it is to be useful (IASC 1989:29f.).

Table 17-4. Materiality.

Country	Filing Threshold
Australia	The National Pollutant Inventory has the following threshold categories: Category 1 contains a broad range of substances. The filing threshold for a Category 1 substance is exceeded if a facility uses more than 10 tons of that substance in a filing period. Category 1a contains Total Volatile Organic Compounds. The disclosure threshold for Category 1a is exceeded if a facility uses more than 25 tons in a year or if it has a bulk storage facility design capacity greater than 25 kilotons. Category 2a contains a group of substances that are usually common products of combustion or other thermal processes. The filing threshold for Category 2a is exceeded if a facility burns 400 tons or more of fuel or waste in a filing period, or if it burns 1 ton or more of fuel or waste in an hour at any time during the disclosure period. Category 2b also contains substances that are common products of combustion or thermal processes. The filing threshold for Category 2b is exceeded if a facility: 1) burns 2,000 tons or more of fuel or waste in a year; or 2) if it consumes 60,000 megawatt hours or more of energy in a year; or 3) if the maximum potential power consumption of the facility at any time in the year is rated at 20 megawatts or more. Category 3 contains Total Nitrogen and Total Phosphorus. The filing threshold for Category 3 is exceeded if a facility's annual emissions to water exceed 15 tons per year for total Nitrogen and 3 tons per year for total Phosphorus.
Canada	Where employees work a total of 20,000 hours or more, and owners or operators of facilities that manufacture, process or otherwise use one or more of the substances listed in the National Pollutant Release Inventory under prescribed conditions, they are required to file data.
Japan	1) Business (company) that belongs to any of the 23 listed industrial categories. 2) Business (company) that has 21 or more employees. 3) Business (company) that manufactures and/or uses 1 or more tons per year of any of the 354 chemicals listed in a Cabinet Order (annual quantity of the substance handled by each company: 1 t/year or more of Specific Class 1 substances; 5 t/year or more for the initial 2 years, fiscal 2001 and 2002)
Netherlands	Facilities that are required to receive permission under the Environmental Management Law.
UK	Companies that belong to any of 8 industries (Fuel and power production, Metal production and processing, Mineral industries, Chemical industries, Waste disposal and recycling, Other industries that include paper, pulp and board manufacturing, and tar and bitumen activities) Sewage treatment works, and nuclear industries if they have certain activities on site (e.g. combustion plant greater than 50 megawatts) may have to file data).
USA	The USA PRTR has an employee threshold of 10 or more full time employees and two chemical use thresholds: 1) the facility manufactures or processes 25,000 pounds or more of a chemical, 2) the facility uses 10,000 pounds or more of a chemical

The filing thresholds for the size of the facility and type of economic activity generally differ from country to country. Choice of a threshold relates to the notion of materiality. Table 17-4 shows how filing thresholds differ between countries. First, countries use different kinds of thresholds as a basis for filing data. Thresholds are usually based on the number of employees at a filing facility and/or the amount of chemicals produced, processed or used, although the quantitative value of the thresholds may differ. Variation in these threshold requirements means that similar sources of pollution in different countries may not have the same filing requirements (OECD 2001:18). Even within a single company, filing requirements may differ according to the location of the facility and, accordingly, different PRTR data are disclosed by similar facilities located in different countries. In consequence, it is impossible for information users to compare multinational company facility data, thereby reducing the relevance of data disclosed.

3.4 Reliability

To be useful, information must also be reliable (IASC 1989:31). Information is said to possess the quality of reliability when it provides a *faithful representation, substance over form, neutrality, prudence,* and *completeness.*

3.4.1 Faithful Representation

To be reliable, information must provide faithful representation of what is being represented. However, information is subject to the risk of being less than a faithful representation of that which it purports to portray. This is not necessarily because of any bias, but is related to inherent difficulties in the application of measurement techniques (IASC 1989:33f.). Table 17-5 shows the measurement techniques for PRTR data that are used in the six cohort countries.

Representation issues are related to the goal and objective of each country's PRTR. There is variation between the data gathering techniques in each country. Data gathered reflects a mix of measurement and estimation techniques, and this raises concerns about the mix of methods used to derive data in each country as well as its accuracy. Although direct measurement provides better representation than estimation, pursuit of more faithful representation tends to be more costly for the facility and government agency. There is a trade-off between obtaining more representative data and the cost of tools to obtain such data.

Table 17-5. Faithful representation.

Country	Measurement techniques
Australia	Four types of emission estimation techniques are available: sampling or direct measurement, mass balance, fuel analysis, emission factors.
Canada	One of the following methods: monitoring or direct measurements, mass balance calculations, emission factors, engineering estimates.
Japan	One of the methodologies determined as being appropriate by the company: direct measurement, or materials balance or emission factors.
Netherlands	Based on: a) a large number of measurements from representative sources, b) measurements from sources partly representative for a part of the sector, c) a small number of measurements, complemented with estimates based on technical knowledge of the process, d) a small number of measurements, complemented with estimates based on assumption, e) technical calculations based on assumptions.
UK	Direct monitoring, mass balance, chemical-specific emission factors, engineering calculations, indirect monitoring, engineering judgment.
USA	The Toxic Release Inventory programme does not identify or recommend specific estimation methods. Each facility is given complete flexibility in choosing a method to use, and all reasonably documented methods are allowed.

3.4.2 Substance over Form

The substance of what is being recorded needs to be faithfully represented, not just its strict legal form (IASC 1989:35). Consultation processes are in place with parties interested in the PRTR system in order to bring forward the substance of what should be filed. The consultation processes adopted in different countries is shown in Table 17-6 (OECD 2000b:55f.).

All countries have a consultation process involving affected and interested parties, although the way that stakeholders are engaged differs between countries.

Table 17-6. Substance over form.

Country	In the initial development of the PRTR, was there a consultation process with interested parties?
Australia	Yes: open and transparent process in the development of National Environment Protection Measures (NEPMs). Management and consultative groups were established during the development of the National Pollutant Inventory NEPM. The consultation process included public meetings in cities and regional centres, developing a discussion paper and inviting public submissions on it, and the formation of an advisory committee.
Canada	Yes: provinces, other federal government departments, major industrial associations, and environmental organisations were/are contacted. The selection of participants representing the environmental organisations is co-ordinated by the Canadian Environmental Network.
Japan	Yes: public notification to submit comments on the interim report of the pilot program is conducted by the environment agency. Direct invitation to the Technical Advisory Committee to evaluate the outcome of the pilot test.
Netherlands	Yes: written documentation, co-ordinating committees, etc.
UK	Yes: a stakeholder meeting and an external advisory committee with representatives of industry, trade associations, environmental groups, government departments and fellow regulators.
USA	Yes: the USA has several processes for engaging stakeholders in all changes to the PRTR system.

3.4.3 Neutrality

To be reliable, the information must be neutral, that is, free from bias in the selection process (IASC 1989:36). To be neutral, it is important that the PRTR system has a data verification process in place. Each country's data verification method is shown in Table 17-7 (OECD 2000b:83f.). The question asked by the OECD was "Briefly describe how reported data are [will be] verified and checked for quality, e.g. what type of quality assurance/ quality control programme exists?" There are two points in the verification process: first, the data that companies submit to the PRTR database, and second, entry into the database itself by the regulator. Unfortunately no distinction is made between these in answers given to the OECD's question. The only general comment that can be made is that all countries apart from Japan have a data verification process in place.

Table 17-7. Neutrality.

Country	Data Verification Method
Australia	The States and Territories are responsible for assessing the integrity of data filed by facilities within their jurisdiction (level of government) before providing the information to the Commonwealth.
Canada	The data are verified using error-checking routines in the filing software. Filed data is also analyzed and outliers are identified and verified. Analysis by industrial sector is also performed.
Japan	No verification process. Local governments may add their opinions when forwarding such disclosures to the national government. The State and local governments give technical advice to companies.
Nether-lands	Expert judgment and consensus.
UK	Data provided by the operator are entered by Agency administrative staff for integrated pollution control processes. The Agency Pollution Inspector responsible for the process will compare the data against the original form to ensure accuracy in input and to assess the accuracy of the original information provided by the operator. Various other electronic checks are also carried out.
USA	The USA Environment Protection Agency conducts numerous data quality checks to ensure that data are correctly entered into the database. The USA Environment Protection Agency conducts the following activities to assure the greatest degree of data accuracy: 4% verification, 100,000 pound review, facility review, comparisons with state PRTR data.

3.4.4 Prudence

Although the PRTR is a system under which facilities assess the quantity of specific chemical substances that are hazardous to human health or the ecological system, judgement about toxicity levels, for example, is required because of scientific uncertainty about what exactly is a critical toxic level when, for example, bioaccumulation occurs. The precautionary principle of ecologically sustainable development suggests that, in the face of uncertain scientific evidence, decisions should err on the side of limiting potential environmental impacts (Schaltegger and Burritt 2000:344). Such uncertainties can be reduced through the gathering and disclosure of data about the substance's nature and risk. Table 17-8 shows whether each country discloses information about the risks associated with each substance. This information is usually provided in the form of a link from PRTR data to a related Web page.

Table 17-8. Prudence.

Country	Link to substance risk information
Australia	Yes: link to chemical properties, health effects, environmental effects and sources of information.
Canada	Yes: link to physical chemical information and toxicity information.
Japan	Yes: not directly linked with PRTR data but database published including toxicity data, properties data, and related regulations.
Nether-lands	No: data not included in published printed data disclosures.
UK	Yes: link to chemical properties, sources of releases, local effects, global effects, and health effects.
USA	Yes: link to reference dose for chronic oral exposure, reference concentration for Chronic Inhalation Exposure, carcinogenicity assessment for lifetime exposure, bibliography, revision history, and synonyms.

3.4.5 Completeness

To be reliable, the information must be complete within the bounds of materiality and cost. An omission could cause information to be false or misleading and thus unreliable and deficient in terms of its relevance (IASC 1989:38). For PRTR data, a proxy for completeness could be the number of substances on which data must be gathered and filed. These are illustrated in Table 17-9.

As shown in Table 17-9, the number of substances and the scope of industries covered by PRTRs differs significantly between countries examined. A number of reasons lead to this situation: differences in national priorities (e.g. what chemicals are already regulated under other programs, and what potentially toxic chemicals are of public concern); the economic activities of a country; and the degree of maturity of the PRTR system. It is generally the case that PRTR filing lists are extended or modified over time (OECD 2001:17): for example, Australia commenced with 36 substances and has increased this to 90 substances.

Direct comparisons between sectors or activities in different countries may not be possible because of variations in the scope of activities covered as well as in the sources of emissions. North American countries have developed the North American Industrial Classification System (NAICS). European countries use the Nomenclature for Sources of Emission and Nomenclature for Economic Activity systems. Other countries, such as Japan, have a national system for classifying sources and economic activities. The end result is that not all activity codes correspond to the International Standard Industrial Codes or to a similar international system. In consequence, there is variation in the specific scope of some of the activities covered as well as in the substances filed as PRTR data (OECD 2001:21).

Table 17-9. Completeness.

Country	Number of Substances	The scope of industries covered in PRTR
Australia	90 (36 for the first three filing years)	All facilities that exceed the thresholds must file data. The following are exceptions: a mobile emissions source, a petroleum retailing facility, a dry cleaning facility employing less than 20 persons, a scrap metal handling facility trading metal, a facility engaged in agricultural production.
Canada	245	All point-sources unless specifically exempted. Exceptions include: schools, laboratories, hospitals, motor vehicle repair, retail distribution and sale of goods, fuel distribution, and growing or extraction of natural resources.
Japan	354	Business (companies) from the following industrial sectors are required to submit: metal mining, crude oil and natural gas mining, manufacturing, electricity, gas, heat supply, sewage, railways, warehouses, petroleum, scrap iron, automobiles, fuel retail, laundry, photography, automobile maintenance, machinery and equipment repairs, product testing, measurement certification, household waste disposal, industrial waste disposal, higher educational institutions, research institutes for natural science.
Netherlands	170	All major facilities larger than a specified size including chemical production facilities, energy production facilities, petroleum refineries, and sewage treatment plants.
UK	170	Companies that belong to any of the following *eight* industries (Fuel and power production, Metal production and processing, Mineral industries, Chemical industries, Waste disposal and recycling, Other industries that include paper, pulp and board manufacturing, and tar and bitumen activities).
USA	667	The following are required to file data: all manufacturing industries, electricity generating facilities, coal mining facilities, metal mining facilities, petroleum bulk storage facilities, chemical wholesale facilities, federal facilities, hazardous waste treatment facilities, solvent recovery facilities.

In addition, Australia and the Netherlands provide estimates about releases from small and medium-sized enterprises. In Australia, the Commonwealth environmental regulator collects such data from their State and Territory government regulators, while in the Netherlands estimates are made at a national level for this purpose. In other countries, the estimates of releases contained in the PRTR are limited to industry data (OECD 2001:19).

3.5 Comparability

Users must be able to compare the PRTR data for different facilities across countries in order to evaluate relative global position or performance. Table 17-10 reveals information about the international comparison of PRTR data (shared and across borders) (OECD 2000b:97ff.).

Table 17-10. Comparability.

Country	International comparison provided
Australia	No
Canada	The Canadian PRTR is similar to that in the USA so that there is a large body of comparable data available. Canada uses USA Standard Industrialisation Codes in its system to permit cross-border studies of PRTR data. The Commission for Environmental Co-operation publishes annual disclosures of USA and Canadian PRTR data.
Japan	No
Netherlands	To be shared through the Core Inventory of Air Emissions (CORINAIR), the Oslo and Paris Commissions of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPARCOM), the European Environment Agency, the European Statistical Agency (EUROSTAT), and the European Union.
UK	Used to provide requirements for a PRTR under the Integrated Pollution Prevention and Control directive to the European Environment Agency.
USA	The USA Environment Protection Agency presently shares and compares PRTR data with Canada. There are plans to share and compare the USA PRTR data with Mexico also.

For comparability, the PRTR data needs to be harmonized between countries. The variations between PRTR systems mentioned above limit the possibility for direct comparability between countries. The Table shows that some efforts have been made to improve comparability. For example, users in Canada and the USA can compare data on a facility-specific basis because they have adopted similar program components. Both collect information about quantities of chemicals transferred off-site for disposal, treatment, combustion for energy recovery, and recycling (OECD 2001:23). Another factor encouraging comparability is that many of the emission factors used in the industry guidance manuals of the Australian PRTR program are based on the emission factors provided by the USA Environmental Protection Agency (OECD 2002:52).

In achieving a balance between relevance and reliability, the overriding consideration is how best to satisfy the decision-making needs of users, including management (IASC 1989:43). Constraints on relevant and reliable information are *timeliness, balance between benefit and cost* and *balance between qualitative characteristics*.

3.6 Timeliness

Although, as shown in Table 17-1, annual filing of data is common to PRTR programs in all countries, the timeliness of data release is also important. If there is undue delay in the filing of information it may lose its relevance (IASC 1989:43). Longer periods, for example filing every three years, as with the European Pollutant Emission Register, could actually result in the most recent data being up to five years old (OECD 2001:20). National governments of all European Union countries are required to provide inventtory emission data from specified industrial sources and to disclose the emission data to the European Commission. The first disclosure cycle is in June 2003 on emissions for 2001; the next disclosure cycle will be in June 2006 on emissions in 2004. Every three years the Commission will disclose the inventoried emissions and their specific sources (OECD 2000a:34).

Table 17-11. Timeliness.

Country	Period to data publication
Australia	8 months. Disclosing year is from July to June. Facilities collect data and send to their State or Territory jurisdiction (level of government) by 30 September. Jurisdictions send the checked data to the Commonwealth regulator by 30 November. The Commonwealth environmental regulator uploads the data by 30 January.
Canada	9 months. Disclosing year is calendar year. Upload of the 2002 data for preliminary version is 30th September 2003.
Japan	1 year. Disclosing year is from April to March. Facilities collect data and send to their local (prefectural) government jurisdiction by 30 June. After local governments gather the data, it is sent to the national government regulators, MOE and METI, by the end of February. MOE and METI publish the data in March.
Netherlands	More than 2 years for emission data and more than 1 year for estimation data (Calendar year).
UK	More than 1 year. Disclosing year is by calendar year. Deadline for disclosing 2003 emissions is 28 February 2004.
USA	1½ years. Disclosing year is the calendar year. Facilities collect data and send to the USA Environment Protection Agency and their State Environment Protection Agency by 1 July. The USA Environment Protection Agency releases the data on 30 June each year. The 2001 Toxic Release Inventory data were published on 30 June, 2003.

Table 17-11 shows the normal delay in publication. The shortest filing period is in Australia, which is 8 months. In the Netherlands emission data can be up to two years old when published and this may disadvantage filing facilities that are keen for their actions to reduce emissions to be recognised. Releasing data only years after the chemical substances have been emitted delays opportunities for cross-country comparisons.

3.7 Balance between Benefit and Cost

The balance between benefit and cost is a pervasive consideration rather than a qualitative characteristic. Evaluation of benefits and costs is, however, difficult (IASC 1989:44) and involves costs to the producer, regulator and user.

Table 17-12 shows the direct cost to users of getting PRTR data from country websites. With the exception of Japan, all countries allow free access to data by users. In Japan aggregate PRTR data is freely available on the Web. However, it costs 1,090 yen (approximately US$10) to obtain individual facility data, following a direct request to the MOE or METI.

Table 17-12. Balance between benefit and cost.

Country	Cost to user to obtain PRTR information
Australia	No cost
Canada	No cost
Japan	Request to Ministry of Environment with 1,090 yen is needed to get facility data (Individual facility data is available only by request).
Netherlands	No cost, but needs a password.
UK	No cost
USA	No cost

In practice, judgement is required as a *balance between qualitative characteristics* needs to be achieved (see also IASC 1989:45, UNCTAD 2004). For example, neutrality needs to be balanced with prudence as the two impacts on data quality could be in conflict.

4. PRTR DATA COMPARISON

In this section, the problems alluded to above are examined within the context of corporate environmental reports – one other potential source of obtaining high quality PRTR data. By way of example, the environmental reports of Toyota, the second largest motor vehicle company in the world based in Japan (based on sales volume for 2003), are considered. In Japan, Toyota discloses materials balance information for PRTR target substances in its "Environmental and Social Report" (Toyota Motor Corporation 2002a). The company also publishes a separate report entitled "Environmental and Social Report Supplement Toyota Motor Corporation Plant Data" (Toyota Motor Corporation 2002b) that contains PRTR target substances data for 12 facilities located in Japan. Toyota publishes a North America environmental report entitled "Toyota North America Environmental Report" (Toyota Motor Corporation 2002c), a European version "European Environmental Report" (Toyota Motor Corporation 2002d), and an Australian version called "Sustainable Future" (Toyota Motor Corporation 2002e).

This section proceeds as follows: first, by way of example Toyota data are compared from Registers across several countries in the cohort; second, Toyota environmental report PRTR data are compared with Register sources. In both cases the purpose is to reveal whether issues are revealed about the quality of data presented.

4.1 Comparing Toyota PRTR Data from Several Countries

Government agency PRTR data for Toyota are available in Australia, Canada, Japan and the USA. PRTR information for Toyota is not available on the Netherlands and the UK databases because Dutch data is available for only a limited group of organisations and UK data does not include the motor vehicle industry. Therefore PRTR data from Australia, Canada, Japan and USA are used as the basis for the comparison of quality.

To illustrate data quality issues that remain of concern, data for these four countries about "xylene" are examined. Xylene is found in thinners used as purge solvents in painting processes, most of which are discharged into the atmosphere (Toyota Motor Corporation 2002a:30) and it is chosen here because it is the largest emitted substance filed by Toyota, accounting for 43% of the total volume of its emissions. The comparison is shown in Table 17-13.

Table 17-13. Xylene data comparison*.

	Australia National Pollutant Inventory	Canada National Pollutant Release Inventory	Japan Pollutant Release and Transfer Register	USA Toxic Release Inventory
Company name	Toyota Motor Corporation Australia Ltd	Toyota Motor Manufacturing Canada Inc	Toyota Headquarter Plant	Toyota Motor Manufacturing Kentucky Inc
Filing year	From July 2002 to June 2003	From January 2002 to December 2002	From April 2001 to March 2002	From January 2001 to December 2001
Unit	kg	ton	kg	pound
Total Production-related Waste Managed	-	-	-	848,961
Total Air Emission	12,000	101.44	50,000	282,148
Release to Land	0	0	0	0
Release to Water	0	0	0	0
Energy Recovery On-site	-	-	-	218,660
Transfers to Recycling	-	88.95	-	250,102
Transfers to Energy Recovery	-	0.16	-	95,064
Transfers to Treatment	-	0	0	2,987
Transfers to POTWs	-	0	0	0
Anticipated Releases data	-	Y2003 – 104.71 Y2004 – 134.31 Y2005 – 134.31	-	-
Anticipated Recycling	-	Y2003 – 91.97 Y2004 – 117.97 Y2005 – 117.97	-	-

*Data for Australia, Canada and the USA viewed on websites as at 3 February 2004. Data for Japan has been extracted from Ministry of Environment CD-ROM (MOE 2003d).

A glance at Table 17-13 reveals the variety of practices existing between countries and reasons why there is a lack of immediate comparability between PRTR data in the four countries.

- First, although data were examined on agency websites as at 3 February 2004, data disclosed covers several periods: for example, Australian data relates to the fiscal year July 2002 to June 2003, on the other hand, USA data relates to the calendar year January 2001 to December 2001;
- Second, each country expresses its substances in different terms and units of account, making it difficult for comparisons to be made. For example, the USA refers to "Transfers to Publicly Owned Treatment Works", however, Canada uses the term "Off-site Transfers for Disposal - Municipal Sewage Treatment Plant". Units of account appearing in PRTR data also differ with three different units being used: kilograms, pounds and tons;
- Finally, the Canadian National Pollutant Release Inventory provides information about anticipated release data and anticipated recycling data, but other countries' PRTRs do not include such data. The decision-making importance of forward-looking data for corporate and government agency eco-control cannot be underestimated, but the disclosed data are predominantly *ex post* and disengaged from any strategic intent.

Differences in the objectives of each PRTR system examined reveal, in the case illustrated for Toyota data, that the absence of data, different units of measurement, different disclosure periods, and lack of uniform expectational data, reduce data quality. In effect it is impossible to access sufficient data to gain a 'whole of Toyota' perspective on emissions across the company's facilities, even for a single substance. As each PRTR system has its own objectives, harmonization is a practical necessity if comparability of PRTR data disclosed by government agencies is to be realised. As a first step in any potential attempts at harmonization, it is necessary to realize that existing PRTRs still have critical limitations in relation to data quality.

4.2 Comparing PRTR Data from Government Agency Sources with Data from Corporate Environmental Reports

An alternative source for corporate PRTR data is the corporate environmental report. PRTRs and corporate environmental reporting have grown in parallel over the past ten years. Publication of environmental reports brings company-specific environmental data, which may include PRTR information or similar data, to the attention of managers and other stakeholders.

In this section, PRTR data from government agency sources and PRTR data from Toyota's corporate environmental report are compared. Several problems constrain the practical possibility for such a comparison. Indeed, it is striking that there is no PRTR data contained in the Toyota environmental reports for North America, Europe or Australia. Hence, the focus on the cohort of countries being examined is quickly reduced to a comparison of Japanese PRTR data. This is accessible both through the Japanese MOE and METI CD-ROM and corresponding data disclosed in Toyota's "Environmental Report 2002 Supplement – Toyota Motor Corporation Plant Data" (Toyota Motor Corporation 2002b).

Table 17-14 shows that the MOE/METI PRTR data records include the name of the substance, the code number for the substance, the volumes released to air, to water (including the name of the river or lake or sea area), and to land, as well as the volume of landfill disposal, type of landfill disposal, volume released to the sewerage system, and volume transferred. In Japan, which is in an early stage with its PRTR, these are the records required for the first year and are subject to development.

Table 17-14. PRTR information in MOE/METI data and the "Environmental Report 2002 Supplement - Toyota Motor Corporation Plant Data".

	Japanese regulatory data	Toyota environmental report
Name of the substances	X	X
Amount handled		X
Released volume to air	X	X
Released volume to water	X	X
Name of the river or lake or sea area	X	
Released volume to soil and landfill disposal	X	X
Type of landfill disposal	X	
Transferred volume to sewerage and as waste	X	X
Recycled volume		X
Removed volume		X
Consumption volume		X
Generated volume		X

In its "Environmental Report 2002 Supplement – Toyota Motor Corporation Plant Data" (Toyota Motor Corporation 2002b), Toyota discloses not only the major data required to be submitted to the government agencies but also additional facility data including: the amount handled, volume recycled, volume removed, volume consumed and volume generated (see Table 17-14). Toyota's environmental report plant disclosures clearly overcome some of the data shortages in the MOE/METI PRTR database.

Toyota clearly has an EMA system that provides PRTR data for internal management use as well as for external reporting. It appears that management chooses to report additional types of PRTR data in the Toyota environmental report from that filed with and disclosed by the government regulators, although the reasons for this are not yet clear. The EMA system integrates physical data for each facility, and the quality of output from the system is subject to government agency checks and review in relation to data that may be made public.

The need for a cost-effective, integrated physical EMA system, to provide data for corporate management and government agency purposes, relates to the issue of *consolidation* (Schaltegger and Burritt 2000:347ff.). Consolidated environmental information is necessary for the implementation of consolidated environmental management, as it is for assessment of aggregate corporate information. Consolidation of data by company, or by country in which the company operates, is needed for example to gain an overall picture of substances emitted by Toyota such as xylene, perhaps for comparison with other companies or facilities, or for considering whether different strategies towards pollution are or should be adopted by different Toyota subsidiaries in different countries. In Toyota's "Environmental and Social Report", a 12-page section addresses "Consolidated Environmental Management" (14% of the report). It contains details about the Environmental Information Network System for consolidated environmental management that has been introduced at Toyota. Names of the main companies included in the consolidated Environmental Management System are provided. Data are included about: actions and results, environmental initiatives taken, physical environmental data, and examples of environmental initiatives at overseas plants.

The intention is commendable, but the descriptions and data are both limited. No consolidated data for PRTR is provided, although there is a description of the materials balance figure for PRTR data, goals for reduction of PRTR substances for the next year, and unconsolidated trend data for the past four years of discharges of materials subject to PRTR. As mentioned before, Toyota publishes environmental reports in Japan, North America, Europe and Australia. However, each environmental report ranges widely in volume, contents, and even title, and PRTR data and descriptions appear only in the Japanese environmental report, making it impossible to obtain an overall understanding of Toyota's world-wide PRTR information. To obtain PRTR data about Toyota facilities other than those located in Japan, stakeholders would have to search through each country's government agency sources facility by facility. Even if this effort is made, difficulties with comparison and data quality remain because, as examined in the previous section, the data available from PRTRs differs on a country by country basis.

In summary, the paper so far reveals that there are considerable problems for those trying to obtain and compare aggregate corporate PRTR data within each country and across countries:

- *Lack of government agency PRTR data.* First, is the absence of relevant government agency PRTR data in some countries. For example, there is no motor industry data in the UK, and there is the obstacle created by the need for a password to access data in the Netherlands. (Both authors tried, in January/February 2004, to obtain a password to access to the Dutch PRTR database. To date, no password or response to emails has been received).
- *Poor quality of agency PRTR data.* Second, difficulties for country by country data comparison exist because of various issues associated with the quality of data that are illustrated in Tables 17-2 to 17-12.
- *Lack of detail in agency data*. Third, access to global data for multinationals is hindered by the lack of detail in agency data as illustrated in Table 17-13 for the substance xylene.
- *Absence of data in corporate environmental reports.* Fourth, the absence of PRTR data in corporate environmental reports removes these as an alternative source to agency data for corporate comparison. For example, although the three largest multinational motor companies, General Motors, Toyota and Ford, disclose some PRTR information, the fourth and fifth largest companies, Volkswagen and DaimlerChrysler, do not disclose PRTR data in their environmental reports (as at the date of the corporate website survey). A brief search of other industries reveals that it is hard to find PRTR data included in at least two corporate environmental reports as a basis for comparison or benchmarking. In many companies, there seems to be no environmental reporting about PRTR data at all. This is particularly disturbing given the importance that, for example, the chemicals industry attaches to Toxic Release Inventory data disclosure in the USA.
- *Absence of PRTR data in consolidated corporate environmental reports*. Fifth, where PRTR data are included in consolidated environmental reports they are often selective as they relates to several, but not all corporate facilities. In the case of Toyota examined here, PRTR data are disclosed only for facilities located in Japan, in spite of the fact that Toyota publishes environmental reports in other countries.

The existence of these problems highlights some of the difficulties of obtaining high-quality information even when two systems operate side by side – the compulsory government agency system which is hampered by cost-benefit and monitoring considerations, and the voluntary system through which companies provide data in environmental reports. At present, there is no international standard that requires companies to report PRTR information in their corporate reports (whether in disaggregated or consolidated (aggregated) form), and no harmonised system to ensure comparability between country-by-country reports to government regulators made to the agencies and disclosed to the public.

In Japan, however, the MOE published an *Environmental Report Preparation Standard (Exposure Draft*) in December 2003 (MOE 2003a). In this standard draft, reporting on environmental performance is required with PRTR data being included as an example of environmental performance. Moreover, the standard draft requires calculation of consolidated (aggregated) environmental performance. This is a step in the direction of higher quality, comparable PRTR corporate data that could be examined and emulated in other countries. However, even if the standard is introduced, different interpretation of the standard is possible, and the result may still be inconsistent data about environmental performance. To solve this problem, the MOE published *Environmental Report Guideline 2003 version (Exposure Draft*) at the same time (MOE 2003b). The guideline provides detailed information about recommended disclosures. In addition, it published an *Environmental Report Review Standard (Exposure Draft*) to address verification issues (MOE 2003c). These series of standards and guidelines promote corporate disclosure of high-quality and comparable PRTR data within Japan. Development of a physical corporate EMA system will become a necessity if the standard and guidelines are to be implemented.

In the next section, the potential links between corporate PRTR data and physical EMA are examined.

5. LINKS WITH ENVIRONMENTAL MANAGEMENT ACCOUNTING

Success can be determined by how a country's PRTR meets its own stated goals and objectives (OECD 2001:9), but these data are also important to managers and others (OECD 1997b:3). Such data derives from an EMA system. A number of definitions of EMA have been proposed (Burritt 2004a), but their substance is captured in the following definition by the International Federation of Accountants (1998:1): EMA is "…the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices…[which] may include reporting and auditing in some companies" (IFAC 1998:1). Bennett and James (1997:34) identify six specific areas of EMA to include: identifying cost reductions and improvements; prioritizing environmental actions; guiding product pricing, mix and development decisions; enhancing customer value; future-proofing investment and other decisions with long-term consequences; and assessing the eco-efficiency and/or sustainability of a company's activities.

An important requirement of these areas is that they require information about monetary and non-monetary corporate environmental information to be gathered and communicated to management with links to reporting, both internal and external (Burritt et al. 2002). These are referred to as monetary EMA and physical EMA information (MEMA and PEMA). PRTR systems generate PEMA information. Managers in commercial and non-profit organisations focus on financial information as a basis for making short-term and long-term decisions. Physical information is a prerequisite for the calculation of the monetary consequences of actions taken by management. PRTR information may be of use to managers in a number of situations:

- Ongoing assessment of materials flows
- Environmental investment considerations
- Environmental risk management
- Links with external reporting of environmental information.

5.1 Materials Flow Accounting

Materials flow accounting is an important EMA tool. Collecting and reporting pollutant release and transfer data can assist firms to identify materials losses which equate to waste – or lost revenue. In turn, a PRTR can stimulate more efficient use of chemical substances, e.g. better use and/or recovery of materials and/or other feedstock for production. Increased efficiency means reduced releases and/or transfers over time, and this directly relates to increased profits (OECD 1997b:3).

Materials flow accounting and materials flow cost accounting (also termed substance flow analysis, or substance stream analysis) are specific EMA tools for recording substance flows linked with product and non-product (waste) output of organisations (Schaltegger and Burritt 2000:115, Schaltegger et al. 2002:109). PRTR data for the facility and for the company could be of direct use in materials flow cost accounting. The focus on waste reduction leads to eco-efficient solutions, a key concern of EMA.

Materials flow cost accounting has received growing attention as a tool for describing the route taken by substances from their extraction or production through all stages of manufacture to disposal, and holds potential benefits for recording PRTR data for corporate and government regulatory purposes. For example, Toyota in its Japanese environmental report provides the following PRTR materials flow data as shown in Table 17-14:

Amount handled = volume released to air
+ volume released to water
+ volume released to soil and landfill disposal
+ volume transferred
+ recycled volume
+ volume consumed
+ volume generated

5.2 Environmental Investment Considerations

A second focus of EMA is investments in environmental protection. Collection and collation of PRTR data provides a means for multi-facility operations to compare results among other facilities within an organisation and within the sector or manufacturing group, in order to identify data discrepancies and opportunities for cleaner production and green product investments (OECD 1997b:3). The PRTR data can be used to promote sound environmental management such as the prevention of pollution at source, for example by encouraging the implementation of cleaner technologies. PRTR data can be used in calculations of ecological payback periods (EPPs), ecological advantage ratios (EARs), and net present environmental impact added (NPEIA) (Schaltegger and Burritt 2000:307).

5.3 Environmental Risk Management

Environmental risk management is a third area of information support provided by EMA (Burritt 2004b). PRTR systems can provide data to support the identification and assessment of possible risks to humans and the environment by indicating sources and amounts of potentially harmful releases and transfers to all environmental media.

5.4 External Environmental Reporting

EMA provides information for management decision-making; however, it also forms the basis for disclosure of environmental information to stakeholders in the business. According to the OECD (1997b:3) many companies have confirmed that a PRTR can provide a template for environmental reporting under ISO 14000 and perhaps help to set the basic framework for integrated pollution reporting to external stakeholders. A PRTR offers commercial organisations the opportunity to lead by example – on the proviso that release and transfer information can change public image and response.

It allows for workers and the public to be informed about the pollutant releases and transfers in their local environment.

6. CONCLUSION AND FUTURE DIRECTIONS

Limited examination of PRTR data produced by a cohort of six countries and one motor vehicle multinational company reveals that poor-quality data still exist. It might be expected that, through the combined use of government agency PRTR data disclosure and separate corporate reporting about PRTR releases, a global picture of first, the total corporate emissions of a key range of substances across the globe and second, data related to global emission levels of specific substances, would be available. In the case examined, that of xylene emissions by Toyota, neither of these expectations were realized.

Further research is needed into four key related aspects of the data quality problems highlighted.

First, given the rapid growth of PRTRs in a growing number of countries, systematic research is needed into the need for and potential realisability of the standardized, comprehensive disclosure of a set of emissions of key substances by all country Registers for an agreed set of industries.

Second, given the proliferation of voluntary corporate environmental reports, especially by large multinational companies, systematic research is needed into the potential for environmental reporting standards and guidelines in the context of PRTR data and the perceived need for consistent, useful, reliable and comparable individual facility and consolidated (aggregated) data.

Third, the ongoing debate between academics about the relative efficacy of regulations and voluntary environmental disclosures (e.g. Frost 2001) could be directed towards PRTR data gathering and release which is guided by two sets of motivations, the perceived need for compliance with agency PRTR regulations and the perceived need for voluntary disclosure of PRTR information by companies. It appears that the present regulatory mix of dictated and voluntary data gathering is not effective.

Fourth, the gathering and dissemination of PRTR data is, potentially, a powerful tool for guiding corporate strategy towards emissions and transfers of substances, as well as communication of data to managers for action and to outside parties. Systematic academic research is needed into the ways in which high-quality PRTR data can be promoted and encouraged through EMA techniques used to present the data.

Providing a range of tools to communicate PRTR data will help a wide variety of audiences to comprehend better what the data mean. However, challenges remain in improving qualitative characteristics. The authors can only agree with the OECD that at this point PRTRs are still in the early stages of learning how best to use changing technology to disseminate and present data (OECD 2000a:40).

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Chapter 18

BENCHMARKING ENVIRONMENTAL PERFORMANCE IN THE ENGLISH UNIVERSITY SECTOR

The Experience of the Higher Education Environmental Performance Improvement (HEEPI) Project

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Abstract: The Higher Education and Funding Council for England and Wales (HEFCE) distributes public funds to the higher education sector and oversees quality assurance on behalf of the UK Government, and also sponsors a number of research projects to promote good management practice. This paper reports on a project to promote good environmental management in universities by researching into the use of environmental performance indicators through a series of benchmarking workshops. The project found that attempts to compare aggregate data at an organisational level between institutions without being able to control adequately for differences in structure and activities offered only limited potential for success, but that benchmarking at lower levels by focussing on defined specific types of buildings was more successful.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 409-430.

1. INTRODUCTION

1.1 Background and Structure of the Higher Education sector in the UK

The higher education (HE) sector in the UK is administered separately in each of England, Scotland, Wales and Northern Ireland. In England this consists of 94 universities (including 17 directly funded schools and institutes of the federal University of London) and 37 smaller higher education colleges (for simplicity, the term “university” is used exclusively in this paper).

The main source of income for most of these institutions is from public funds, provided by the UK government to support teaching and research, which are mainly channelled through four Funding Councils, of which the largest is the Higher Education Funding Council for England (HEFCE). HEFCE is responsible for overseeing quality assurance and promoting good management practice amongst English universities, supported by a number of research projects which are designed to investigate and disseminate best practice. This paper reports on one such project which aimed to promote good environmental management in universities by developing better environmental performance data and using this to drive improvement through benchmarking.

1.2 The UK Higher Education Sector’s Environmental Impacts

Although HE is a services activity and therefore does not have the obvious direct environmental impacts of many manufacturing sectors, it still has several significant environmental impacts, both direct and indirect. Indirect impacts include the potential for its educational and research outputs to influence environmental behaviour in other sectors through university graduates when they enter employment and through the dissemination of research, and the demand for transport stimulated both within Universities’ own operations and through commuting by staff and students.

As well as the consumption of such resources as paper, the main direct impacts of universities arise from the need for most institutions to maintain extensive estates of land and buildings. These are required not only for obvious uses such as teaching accommodation, laboratories, and offices, but frequently also for students’ halls of residence and catering facilities, and in some cases also sports fields, swimming pools and car parks (not only open-air but sometimes also multi-storey). These place significant demands on two environment-related resources in particular: energy (which can also be influenced by the need to run computers, printers and laboratory equipment), and water.

In 2002/03 the sector consumed over £200m. of energy, representing 4% of its total operating expenditures of £5.5 billion on items other than pay (Universities UK 2004). This is used mainly to heat, light, cool and ventilate buildings, and its importance is likely to increase in future as a result of several factors, including rising prices - in 2004 some universities and colleges renewing their energy supply contracts faced increases of up to 50% in prices, reflecting recent trends in international markets over the typical 2-3 years period of their contracts.

Revisions to the Building Regulations introduced in 2002 also require sufficient metering in new buildings (and, in practice, also in refurbished buildings) to enable at least 90% of the estimated annual energy consumption to be accounted for, as well as other stipulations which also require better information. The European Energy Performance of Buildings Directive also sets minimum requirements for the energy performance of all new and large renovated buildings and requires their certification, and in the case of public buildings, the display of accurate information on their energy consumption and carbon dioxide emissions.

The sector also pays water and sewerage bills of over £100m per annum. In some water-intensive institutions, water bills are almost as large as heating bills. Despite this, it is unusual for universities to manage their water consumption actively or to attempt conservation.

1.3 Previous Environmental Initiatives in Higher Education

There have been a number of past environmental initiatives in the sector, both international and specific to the UK. Internationally the Copernicus initiative (The Co-operation Programme in Europe for Research on Nature and Industry through Co-ordinated University Studies) was launched in 1988 by the European Universities Association (EUA), and in 1993 it published the Copernicus University Charter for Sustainable Development (Copernicus 1993). Today Copernicus is an independent organization with 319 member universities from 38 different European countries, which it aims to involve in a network to share their knowledge and expertise in the field of sustainable development. Its main emphasis is on teaching and pedagogy though it also supports projects related to university management, including on energy consumption.

The Talloires Declaration (Talloires 1990) was composed in 1990 at an international conference in France, and was the first official statement made by university administrators of a commitment to environmental sustainability in higher education. It is a ten-point action plan to incorporate environmental literacy and sustainability in teaching, research, operations and outreach at colleges and universities, and has been signed on behalf of over 300 universities in 40 countries.

Past environmental initiatives in the UK HE sector have taken two main forms: high-level actions by working groups and external organisations, and initiatives by HEFCE and other funding bodies. The 1993 Toyne Report (DoE et al. 1993) was one of the earliest sector-wide initiatives which attempted to focus attention on the link between HE and sustainable development (The Toyne Report also covered the further education sector, which relates primarily to the 16-18 age group.). This followed a recommendation by the UK Government's "This Common Inheritance" White Paper (HMG and DoE 1990) and represented the UK's response to the Talloires Declaration (1990). Following shortly after the 1992 Rio Earth Summit, the Toyne Report received widespread promotion and publicity. It made a series of recommendations, the most relevant for environmental performance being that 'after consultation with its staff and students, every HE and FE Institution should formally adopt and publicise by the beginning of 1994/5 a comprehensive environmental policy, together with an action plan for its implementation'.

However, a 1996 review of progress in both further and higher education (DoE et al. 1996) found that out of the 756 institutions studied, only 114 had or were implementing an Environmental Policy, and those that were making progress were driven mainly by their expectations of the potential financial savings. The review concluded that the majority of institutions and organisations that had participated in the 1993 report had subsequently demonstrated 'considerable indifference' to its recommendations.

Partly in response to these findings, Forum for the Future, a UK non-governmental organisation (NGO), received funding in 1997 for a project to identify good practise and demonstrate opportunities for progress in selected areas of sustainable development. This was followed up by the Higher Education Partnership for Sustainability, a collaboration between Forum and eighteen universities, which began in 2000 with a focus on implementation. For environmental performance, this has involved promoting good practice, providing tool kits, and publishing guidance on selected areas such as waste and procurement (Forum for the Future 2003), as well as providing guidance about including sustainability in the curriculum.

Whereas these external initiatives have been driven primarily by environmental and sustainability goals, HEFCE's environment-related activity has tended to be financially driven with a focus on identifying opportunities for increased efficiency in energy and water consumption. Simultaneously with the Toyne review, HEFCE initiated a major review of energy management in the HE sector which led to a series of publications and recommendations for more effective practices (Higher Education Funding Councils 1996). As an example, one recommendation arising from this was that each university should employ a full-time energy manager (or equivalent) for every £1 million of its expenditure on electricity and fuel. The review also published benchmarks for the energy performance of different types of buildings, distinguished between categories such as residential, teaching, research, and catering. The impact of this energy management work was reviewed in 2003 (UK Value for Money 2003).

Several studies, as well as much anecdotal evidence, suggest that the impact of these initiatives on environmental performance has been only patchy. Whilst some institutions have very good records on energy and water efficiency, many do not, and even fewer have addressed successfully the issues of transport or waste (Environmental Audit Committee 2003, UK Value for Money 2003). The most thorough review has been that conducted on HE energy performance by the Science Policy Review Unit (SPRU) of Sussex University as a part of a European research project which identified numerous barriers to improved energy efficiency and reduced wastage, including a lack of policies and resources to implement existing policies, and a lack of incentives (but the existence of several disincentives) to alter practices (Sorrell 2000).

Existing initiatives therefore have at best a mixed record of success in stimulating environmental improvement. Anecdotal evidence suggests that one reason for this has been their 'top-down' or 'externally-driven' nature, and that whilst these approaches can have the advantage of engaging senior management and of bringing new ideas into the sector, they can often appear as idealistic and impractical to those people (typically professionals in estates management and other operational functions in Universities) who are responsible for their implementation.

2. HEFCE'S ESTATES MANAGEMENT STATISTICS SERVICE

To support good estates management in the HE sector, in 1999 HEFCE set up an Estates Management Statistics (EMStats) database which has been found useful in supporting broad comparisons between universities in such areas as space utilisation and total estate management costs. The EMStats are collated annually in respect of each academic year, with the bulk of the data required being collected through a survey questionnaire which is sent to all UK universities in Excel spreadsheet format. This is also supplemented by further data which HEFCE already collects through its Higher Education Statistics Agency (HESA).

The survey questionnaire requests data on over 100 different aspects of estates management performance, several of which such as energy and water consumption have obvious environmental significance, and on parameters which can be used to normalise these, such as floor areas and student numbers. Although completion of this questionnaire is not strictly compulsory, the status of HEFCE as the dispenser of government funds as well as the value of the exercise itself means that the response rate has reached 97%, though for some universities this can represent only a partial response if they have not been able to provide complete data to the required definitions.

Each university completes the survey annually, which will usually require inputs from a number of its information systems, including financial, personnel (for numbers of staff), registry (for numbers of students), and estates management's own records of space utilisation, energy and water consumption, and specific projects. The scale and difficulty of this depends on the quality and comprehensiveness of each university's existing data and information systems but practitioners estimate that typically, completion of the survey may require around 15 staff-days to collect and collate the necessary data, over the eight-week period allowed for this by HEFCE.

The questionnaire requires each university to undertake some analysis of their raw data. For example, costs related to the use of buildings and the amount of space occupied have to be split between residential and non-residential, with the latter then further split between teaching, research and support activities. The buildings-related costs include maintenance, government property taxes, facilities management costs such as security and cleaning, and capital spending on buildings. However, these do not include equipment such as information systems infrastructure, so that some judgemental apportionment of total costs may be required when a new or refurbished building project includes features such as built-in cabling. Some judgement is usually also needed in providing data on floor areas, despite the detailed guidance which HEFCE provides – as one practitioner attending a HEEPI seminar observed, 'there will always be some grey areas with floor definitions'.

To some extent it may be necessary to make apportionments in order to analyse data into the required categories. For example, one university outsources its security and cleaning to outside providers, under a contract which covers all buildings on each campus without distinguishing between residential and non-residential buildings. However since the survey requires this distinction, the estates manager responding to the survey applies a notional apportionment (of 60% non-residential use, 40% residential) on the basis of his own judgement of the likely workload imposed by each type of building. In some universities a similar apportionment might also be needed for parameters such as electricity consumption, depending on the level of detail with which actual usage is directly measured by meters.

Practitioners report that when the EMStats were first introduced there were also some areas of ambiguity where they were unsure of precisely what data was being sought by the survey form and therefore had to make their own assumptions: for example, whether to categorise academics' office space as relating to teaching, research, or other uses. Practitioners' awareness of these ambiguities and the potential inconsistencies between different universities' responses meant that they were therefore naturally cautious of the reliability of the results, so they were less likely to attempt to use information from the EMStats in benchmarking. However the process has evolved over time, with HEFCE responding to the feedback and suggestions put to them by data-providers and having now developed and distributed detailed definitions of each data item. HEFCE has also run training workshops to help data-providers to understand what is required, though to date it has not attempted to offer any similar training to advise on the interpretation of the results, or to run any workshops or other processes to facilitate their use in benchmarking.

HEFCE carries out validation checks on the data it receives to identify any data which might have been returned incorrectly, by identifying any amounts which appear anomalous since it is substantially different from either the range for the sector as a whole or that university's data for the previous year, and for internal consistency, but do not attempt to carry out any more detailed audit. It then collates and processes the data and reports back the results around 8 – 9 months after the end of each academic year. Each university is sent a report on CD-Rom which lists over 200 different performance indicators, calculated from a combination of the estates management data collected through the questionnaire and the HESA data which HEFCE already has on hand, collected through other channels. For each of these indicators it reports the median and upper and lower quartiles for the sector as a whole, against which each university can compare its own data and assess its relative performance.

Since much estates management involves environmental resources and this is reflected in the EMStats, these can be seen as a combination of both monetary environmental management accounting (MEMA) and physical environmental management accounting (PEMA) data as defined by Burritt et al. (2002), with the main emphasis on PEMA since this reflects those factors which are most directly controllable by the primary audience for the EMStats, university estates managers. As later sections discuss, they also have the potential to drive eco-efficiency, which Schaltegger and Burritt (2000:24) define as "the efficiency with which ecological resources are used to meet established economic goals".

3. BENCHMARKING

The EMStats database is a deliberate attempt by HEFCE to encourage and facilitate comparisons of performance across the HE sector through benchmarking. Benchmarking has become topical in recent years, in line with increasing interest in methods of non-financial performance generally such as through balanced scorecard systems (Kaplan and Norton 1996, 2001, Figge et al. 2003), although there is no single universally accepted definition of its nature or primary purpose. Emphases differ, for example, between the relative importance of seeking only best-practice (or even "world-class") comparators rather than benchmarking against a comparable set of typical organisations, and whether benchmarking has to be a continuous ongoing process or benefits, even if more limited, can also be achieved from occasional or one-off exercises.

The World Business Council for Sustainable Development (WBCSD 1996) suggests that benchmarking between companies can be conducted either within a specific industry sector or between different sectors, with differing purposes. Benchmarking of similar processes against entities in otherwise quite dissimilar sectors may sometimes identify potentially radical changes in practice, but differences in performance revealed by comparisons within a sector are more likely to lead to smaller but more frequent incremental changes. Mayle et al. (2002:214) make a similar distinction between results benchmarking, in which the main activity is the collection of indicators and which they caricature as a "league table" mentality, and process benchmarking which is concerned with collecting ideas to guide improvement, i.e. a "creative swiping" (Peters 1989) mentality.

The common parameters in all benchmarking processes are the identification of appropriate performance indicators (or 'metrics') and relating these against valid comparators in order to identify gaps in comparative performance and thus identify potential areas for improvement. This can be at any of several levels, from strategic benchmarking at the level of the organisation as a whole to the level of individual processes and products. Some of the simplest and most inclusive definitions of benchmarking are offered by the European Benchmarking Code of Conduct ("simply about making comparisons with other organisations and then learning the lessons that those comparisons throw up"), the UK's National Audit Office ("the search to find and implement good practice through comparing the performance of an organisation with that of others"), and most concisely by the UK's Public Sector Benchmarking Service simply as "improving ourselves by learning from others" (PSBS 2004). These definitions encompass not only comparisons against best practice but more broadly against average and below-average performers.

Classification systems have been developed to distinguish between different types of benchmarking process in terms of their purposes and the intended recipients of the results. Bartolomeo ((1998) cited by Schaltegger and Burritt 2000) identifies five broad types of environmental benchmarking: internal (within a single organisation), best-in-class, competitive, sector, and eco-rating. Young and Welford (1999) define four categories: regulatory benchmarking by government agencies to assess conformance to legislation and regulations; public benchmarking in which companies are benchmarked against other companies and the information is made public, such as the annual UK Business in the Environment survey; market-sector benchmarking, where sector-specific indicators are used by companies (or other entities) in a sector to compare themselves against industry averages; and business service benchmarking in which a company can be confidentially benchmarked against other companies. The principle underlying the first two is external control and accountability, whereas for the latter two the aim is to provide companies' managements with information which has the potential to lead in due course to improvements in actual performance. Interpreted in these terms, the EMStats is an example of market-sector benchmarking within a sector, enabling comparisons against industry averages and lower and upper quartiles.

The opportunity for benchmarking environmental performance between companies and other entities has long been recognised, with exercises undertaken by a wide range of organisations (Bennett and James 1998a). However a chronic problem has been to ensure that the data which is used is adequately comparable. White and Zinkl (1999) noted the wide variety of environmental performance indicators used by companies in their external reporting, the limited extent of standardisation to date, and the resulting difficulties in trying to make comparisons, and argued the case for greater standardisation of indicators. This has subsequently been addressed by the Global Reporting Initiative (GRI 2002, Thurm 2005), but the problem of limited comparability applies also in internal benchmarking exercises, as Jasch (1999) recounts from her experience in managing an environmental benchmarking exercise in the Austrian food industry. This study has interesting similarities to the subsequent experience of the HEEPI project described below, since its first attempts to make comparisons at a high level struggled with the lack of comparability of data between companies and it was found necessary to go down to process level and to distinguish between the various different production lines.

Hopkinson and Whitaker's (1999) study of environmental performance data across the UK water industry is also instructive since the sector is similar to the HE sector in some fundamental characteristics, with several different organisations carrying out broadly similar activities in different locations and subject to a powerful external regulator which has a status equivalent to that of HEFCE in the HE sector. They found that although a large quantity of standardised data was available, since the regulator required that a wide range of standard performance indicators should be calculated, there was little evidence that this was actually being used. They concluded from this that "creation of standardised data in itself will not necessarily lead to improved comparability or better reporting" and that "the best way forward … in future may lie in strong external pressures driving sectoral initiatives by companies themselves".

4. HEEPI: BACKGROUND & STRUCTURE OF PROJECT

The Higher Education Environmental Performance Improvement (HEEPI) (see Internet URL <:http://www.heepi.org.uk> for further information) project was established in 2001 by HEFCE under its Good Management Practice initiative, in response to a proposal led by the University of Bradford (The Good Management Practice programme has now been superseded by the Leadership Governance and Management (LGM) programme.). It aims to overcome the barriers to implementation that were perceived in earlier 'top-down' projects by supporting more 'bottom-up' practitioner-led approaches, by developing more comparable data in order to stimulate environmental benchmarking, and by helping to develop the capacity of staff with environment-related responsibilities to achieve positive change within their institutions.

This paper reports on the results of the first stage of HEEPI, from September 2001 to August 2003. This involved a core partnership of Bradford as project managers, with three other Universities – Leeds Metropolitan University, the University of Gloucestershire and the University of Manchester Institute of Science and Technology (UMIST) – together with two sectoral bodies, the Joint Procurement Strategy Steering Group (JPSSG) and Yorkshire Universities, the regional HE association for Yorkshire and Humberside. The main emphasis during this stage was to undertake pilot initiatives within the four universities and other collaborators, and to disseminate the results through workshops, case studies and other means. HEEPI has also worked closely with, and built on the experiences of, networks of practitioners such as the AUDE, EAUC, and ShareFair (which is supported by the Building Research Establishment). In practice, HEEPI has represented a cooperation between academics and practitioners which is unusual in the sector, with academics contributing project leadership and co-ordination based upon the knowledge, experience and understanding contributed by practitioners.

From an early stage, the stakeholders of the HEEPI project expressed a desire to benchmark universities' energy and water efficiency. The following pages explain how this was approached and the results, and draw conclusions from this on sectoral benchmarking generally. The exercise developed in two distinct stages, the first being concerned with institutional-level comparisons and the second with building-level comparisons.

5. INSTITUTIONAL COMPARISONS

The original concept behind HEEPI was that its main activity would be to undertake a more detailed analysis of the environment-related data which was already available in the EMStats. It was anticipated that this would provide opportunities for universities to compare their figures and discuss the reasons for significant differences in performance, and to learn of potential methods of improvement, and to feed back advice to HEFCE if any potential improvements to the EMStats were identified.

A workshop was therefore organised with representatives from the estates management functions of a number of universities, and other invited experts, supported by a number of background papers which were circulated in advance discussing the factors which could influence performance. Although the EMStats data on its performance is confidential to each university, those represented at the workshop had given prior permission for their own data to be made accessible to other participants.

Participants were asked first to describe how they had used the information produced by the EMStats process, and to report whether this had led to any changes in practice. However it was quickly made apparent that although all participants reviewed this when it was published to see whether there was any suggestion that their own university's performance differed significantly from sector norms, in practice little use was actually being made to provide detailed support for operational environmental management. The only exception was provided by one university's estates director who had used the data to highlight what he felt to be his institution's wasteful management of space compared with other comparable universities, but there were no examples cited of the EMStats information having led to any improvements in environmental performance.

The reasons for this became apparent in the subsequent discussion, and can be summarised as firstly differences in data, and secondly differences in organisational structures. Despite HEFCE's attempts to standardise definitions, participants found that there still remained considerable variations in how the standard definitions of key environment-related data were interpreted by individual universities. For example, one parameter required by the questionnaire was floor space, which was then used in the analysis as a denominator to normalise the quantities of energy and water consumed. However whilst in most universities this was, as expected, represented by space inside offices, teaching buildings and laboratories, during the workshop it transpired that one university had also included in this a large multi-storey car park which was an integral part of the university's central buildings complex. Although this space clearly required some energy consumption through lighting, it was not heated and so this had the effect of biasing downwards the measure of that university's apparent overall energy consumption.

Participants at the workshop with experience of the EMStats process reported that over the six years since its first introduction this had evolved so that many of the data definitions had been tightened and clarified and the scope for these differences in interpretation had been reduced. However, it was clear that this still left sufficient ambiguity to undermine the credibility of the information as a basis for benchmarking. It was also found that differences between universities in their accounting systems, such as in how expenses codes were defined in each university's Chart of Accounts, could also make it difficult to be confident of consistency across the sector in the completion of the survey forms.

However, a detailed review by the workshop of the participating universities' data revealed that an even more fundamental problem was differences in their activities. Universities are large and complex entities comprising a wide variety of activities with widely differing demands for energy and water, which was reflected in the results from the original 1996 HEFCE energy management study (Higher Education Funding Councils 1996) cited above. Table 18-1 shows the differences in energy consumption by activity that this study reported, revealing that science-based activities consume electricity at over twice that of arts-based activities. Also, although all universities are involved in both teaching and research, the balance between these, and between different disciplines, can vary widely. *Ceteris paribus*, a university with higher-than-average research activity would normally be expected to have a significantly higher-than-average energy consumption, and laboratory-based research in science, medicine and engineering tends to have higher energy demands than does social science research. The university with the highest activity in these areas had also reported the highest levels for its indicators of energy and water consumption. This might superficially be interpreted as *prima facie* evidence of under-performance, but since it was not possible to identify how far this might be attributable to differences in activities it was not possible to draw even any tentative conclusions on relative operational performance which could identify areas for potential improvement.

Table 18-1. Energy management study in the UK Higher Education Sector (source: HEFCE Value for Money Initiative 1996).

	Benchmark Data per m^2 of Gross Internal Area (GIA)			
	Fossil Fuels		Electricity	
	Good Practice	Typical	Good Practice	Typical
• *Room Designation*				
Academic				
Science: experimental/laboratory-based	99	119	140	158
Science: other	99	119	102	116
Arts	90	108	60	68
• *Other*				
Catering, Fast Food	394	556	180	196
Catering, Bar/Restaurant	164	231	123	134
Residential, Halls of Residence	216	261	77	90
Residential, Self-Catering	180	216	41	49
Libraries, Air-Conditioned	156	221	263	364
Libraries, Naturally Ventilated	104	145	41	58
Students Union	119	178	119	178
Administration, Air-Conditioned	80	177	104	158
Administration, Naturally Ventilated	52	110	34	50
Recreation, Sports: Wet	238	356	158	217
Recreation, Sports: Dry	158	238	69	79

The following discussion revealed several further possible structural differences which might distort attempts to use the EMStats to compare underlying performances. Firstly, the ages of universities' buildings, and the relative proportions of older and newer buildings in a particular institution's buildings stock, varied considerably. Older buildings tend to be less energy-efficient than newer buildings, so that a university with a higher stock of old buildings – even if these were well managed – would usually tend to report apparently poorer performance than one with a higher proportion of modern buildings. Secondly, the prevailing climatic factors will have a strong influence on energy consumption, so that the location of a university within the UK and its local topography (since some universities' buildings may be dispersed across exposed hilly campuses, whilst others are more closely grouped together in dense urban areas) will affect comparisons. Universities also vary in their policies on opening hours and access to facilities, with a number offering 24/7 opening for some services but others being more restrictive, and some using buildings more intensively than others for teaching in evenings and at weekends with an obvious effect on total energy use.

Universities also vary in the extent to which they provide residential accommodation for students through halls of residence. A university with a higher proportion of residential students will, *ceteris paribus*, automatically incur higher environmental impacts through energy and water consumption and wastes generated for a given number of students, so that indicators of environmental impact per student would tend to show apparent under-performance. Questioning revealed that although it might be possible to separate the impacts arising from residential accommodation from those attributable to other activities if this were planned for in advance, such as by additional data capture through extra sub-metering, this could be expensive both to introduce and to monitor and would in any case be impractical to attempt to estimate retrospectively. Another potential factor was the provision of playing fields for students' sports which could require high water consumption, especially in periods of dry weather.

This means that unless the split of different activities at campus or building level is known, comparisons of relative performance may easily be misinterpreted and the underlying causes of differences impossible to identify with any confidence. Since the EMStats does not attempt to differentiate floor space by activity other than between residential and non-residential and between teaching, research and other uses, it was found insufficient to control for these potentially distorting factors, and did not allow data to be disaggregated down by activity-level or to building-level in order to enable more meaningful comparisons.

At the close of the workshop most participants considered that the process had been valuable, although not as had originally been anticipated. The original objective, of using EMStats data supplemented by the extra detailed data brought by each participant to identify genuine differences in operational performance from which participants could learn, was not achieved due to both doubts about the reliability of the data, and differences between universities. Most participants also considered that, even if the data had been considered reliable, its potential to drive improvement was limited because most opportunities exist only at micro-levels such as at the level of individual buildings. However, participants did value the discussions about management practices which the initial discussions around the data stimulated, and several identified ideas that they intended to implement in their own institutions. They also considered that benchmarking was potentially valuable and feasible, but only at the level of individual buildings, which led to a re-design of the project to introduce a series of buildings-level benchmarking workshops.

6. BUILDING-LEVEL BENCHMARKING

A series of three workshops were first held to define the categories of building which might be benchmarked, and the data which could be collected about them. This proved more problematic than anticipated, one reason being the complexity of higher education practices, with many buildings having multiple uses and occupancy hours which vary by the day, week, month and term, and another being a surprising lack of consensus on some of the issues.

A further issue on which opinions varied was the relative benefit of, on the one hand, simplicity of data collection, and on the other hand the need for sufficient detail to support effective analysis and interpretation. Several participants argued strongly for simplicity in general, although then frequently argued that more detailed data was essential for adequate understanding and management of those aspects in which they personally had a strong interest! This debate also stimulated discussion on the most appropriate methods of normalising data: whether through simple methods such as energy per square metre, or more complex methods which took into account further exogenous factors such as local climate and occupancy hours.

Another issue was the most appropriate method by which to group buildings into categories. Some participants considered this should be by academic department, as these underlay the functional and management structure of the university and therefore seemed obvious units to use; however others argued that many buildings might contain several departments, which could themselves vary in their research and teaching activities and rarely had responsibility for energy or water consumption. Their preferred alternative was to group buildings by activity, such as laboratories or research-intensive mixed-use buildings. Eventually, and in an atmosphere of some frustration, a decision was made to compromise and to accept building definitions that were generally considered to be satisfactory if not ideal, in order that some practical feedback could be generated. An Excel template with approximately 100 data fields was generated for this and was used by over 30 universities to provide data on over 300 buildings.

After this data had been collected, a series of four workshops were held to discuss the results with an average attendance of ten universities represented at each. Four of the most energy-intensive and water-intensive types of building were chosen for discussion: bio-science laboratories, engineering and physical science laboratories, halls of residence, and sports centres. Again, the detailed data for all the buildings in the database was circulated to participants before each workshop, which then began with an examination of the best and worst performers on a normalised basis (energy per square metre, adjusted for degree days) to identify the reasons for the ranking, before moving on to more general discussion on the data and the factors which had influenced it.

Interestingly, in all the workshops most of the data which had been laboriously defined and collected in earlier stages was ignored in the discussion, one reason being a feeling amongst participants of information overload – that they simply did not have the mental capacity to hold in their minds all the variables which were relevant when discussing a set of several buildings. Another was many participants' preferences for qualitative descriptions and discussions in order to obtain a holistic feel for a building and the factors which influence its consumption of energy and water. One area identified as crucial only during this series of workshops although it had not previously been considered important was air-change rates, which turned out to be perhaps the most important factor in explaining differences in energy consumption between similar types of building.

In all four workshops the consensus amongst participants on the value of their discussions was very positive for several reasons. One was that the process helped some individuals to identify anomalous data in specific buildings: subsequent investigation by one participant of one such building found that its excessive heating costs were due to the pre-set temperature controls having been manually over-ridden by an unauthorised person, and never subsequently corrected. Another participant had paid great attention to energy efficiency when her university had built a new sports centre and as a result, it had installed a pool cover to reduce evaporation and heat loss from the swimming pool when it was not in use. However, the centre did not outperform the other buildings in the sample to the degree expected. Subsequent investigations showed that, because the cover was manually operated, staff were reluctant to use it and there was no clear management responsibility for ensuring that they did so. The outcome was that the original manually-operated cover was replaced by a mechanical equivalent which staff could operate more easily and quickly, an investment which was quickly justified by the savings that it generated.

A more intangible benefit was a qualitative appreciation of general trends in buildings design generally. Several participants arrived with the preconception, although based only on casual observation and personal experience rather than on hard evidence, that newer laboratories are frequently much more energy-intensive than older ones (even though the buildings in which the laboratories are located themselves tend to be more energy-efficient than older buildings). This was strikingly confirmed by the workshops: of the eight bioscience laboratories which performed worst in terms of energy consumption, for example, five had been built within the last decade. The discussion identified that higher cooling and ventilation standards were the main reason for this. To some extent these were attributable to more stringent health and safety requirements and to higher expectations of comfort by users; but most participants also considered that over-specification by designers which had resulted in very high air-change rates was also a factor. The exercise also revealed vividly the importance of heat recovery in ventilated buildings. Other practical issues were also highlighted such as the tendency in several buildings for their heating and cooling systems to "fight each other", with over-cooling resulting in the heating system being activated, and vice versa.

This also provided an example of how dysfunctional financial management processes in design and decision-making could override the professional knowledge of the technical experts involved. High air-change rates have a particularly severe effect on energy consumption when there is no compensating heat recovery system in place. In two cases, heat recovery systems had originally been included in the design but were subsequently cancelled at a late stage in the design process. This was in response to pressure to reduce capital costs when it appeared that these might otherwise exceed the original budget, even though this had been recognised by those involved to be a false economy since the payback period for the energy savings to compensate for the extra initial cost is relatively short.

Discussion of how such apparent economically irrational decisions could be reached showed that the process of buildings design was often very fragmented with several different functions and professions involved, each with their own inputs into the design, including architects, surveyors, experts in heating and air conditioning, engineers, local government planning regulators, health and safety experts, and financiers. Each would have their own objectives and areas of concern, and a potential liability if the aspect for which they were responsible under-performed, so that there is an inherent motivation in the process for each participant to try to build in contingency provisions in order to avoid possible subsequent problems for which they might be blamed. The overall effect could be a substantial over-specification and consequently higher-than-needed subsequent running costs.

This irrationality was attributable not to those involved in the design process who were frequently well aware of these trade-offs, but to the financial systems within which they had to operate. Although the principle of life-cycle costing was well understood and the data needed to estimate life-cycle costs were available, and in fact these calculations were sometimes actually carried out, typically the budgets for capital costs and running costs respectively were set and administered entirely separately, with no opportunity to link them so that post-completion savings on running cost budgets could be used to offset higher initial spending on capital budgets. Capital budgets were invariably set in isolation, with a high importance attached to staying within pre-defined maxima, particularly since university managers were aware of the potential adverse external publicity that might result from apparent cost over-runs and the likely difficulty of trying to persuade a sceptical media and public that these would be justified by expected future savings that were as yet unrealised.

In some cases this was not entirely within the control of the university itself, since capital budgets for new buildings might be provided in part or whole by outside bodies which insisted on cost control at the building stage. These included HEFCE itself, which felt that it necessarily had to do this even if this meant higher future running costs and environmental impacts, since its own budgets from the Government were strictly defined and could not be exceeded. This budget pressure could often be further aggravated by pressure to meet deadlines for completion.

The workshops also provided an opportunity to debate and develop ideas that were as yet only partly formed. For example, universities seldom allocate energy or water costs between individual departments and budgets, and several participants speculated that this might be helpful in encouraging efficiency; however representatives from those universities where this had already been implemented reported that it tended to consume significant effort and time, and in the end had failed to obtain the co-operation which was needed from academics who typically considered that they had other, and higher, priorities. In some cases there was in any case little concern that spending might exceed budget, since on previous occasions when this had occurred the eventual outcome had been merely that the excesses were covered by the centre with no significant adverse consequences for those responsible. As a result there had been no discernable effect on consumption, so it was considered preferable instead to concentrate on educating laboratory administrators and strengthening energy management. However there was also some conflicting evidence where two universities had reported some modest success in pilot exercises, so it may be that the determinant of the success or otherwise of this approach may depend on how it is implemented.

7. CONCLUSIONS

The experience of the HEEPI project demonstrates both some of the difficulties and also the opportunities offered by sectoral benchmarking. Firstly, it shows clearly the inherent problem of attempting this on the basis of aggregate high-level performance data alone. However much attention is paid to issues of definition and collection, it is inherently difficult either to adjust for all anomalies or to ascertain the extent to which differences in the results reflect real differences in performance. This makes it easy for any apparent under-performers to blame their poor indicators on differences in either measurement methods or in organisational structures. Similar difficulties also applied to the micro-level data on buildings, where as well as problems of definition and collection, even experienced practitioners had difficulty in defining in advance the data that were likely to be most relevant to understanding the consumption (and therefore cost) drivers.

In practice however these limitations were not crucial since the main value of the exercise was found to derive from the process of the discussions between peers around the data. These were prompted in the first place only because this data was available, notwithstanding its generally recognised limitations, and could then be conducted at a more informed level than would have been possible in the absence of any data. It was found that discussion of this nature places the data in context, allows anomalies to be more readily understood, develops practitioners' understanding of their situation and opportunities, and encourages increased motivation and competence in order to achieve results.

The process of the workshops was also found valuable in bringing together universities' internal constituencies and breaking down barriers. In many universities there has been a traditional culture of separation between academics and non-academic staff, but the HEEPI project as well as other environmental initiatives has shown that a constructive dialogue is possible to which the practitioners bring their experience, detailed knowledge and robust scepticism about many externally generated ideas about improvement, and academics contribute by challenging assumptions, and designing and managing processes to maximise the learning from experience.

This still leaves open the question of whether any attempt to make macro-level comparisons between universities at the level of the institution as a whole is worthwhile. Although operational decisions are taken at lower levels, the organisational level is where policy is set and budgets are allocated; and both anecdotal evidence and intuition indicate that a perception by vice-chancellors that their institution is perceived by their peers to be under-performing relative to the sector can be a powerful motivator in helping to create the conditions in which proactive estates managers and environmental champions can be effective ("Vice-chancellor" is the title of the most senior individual in a full-time executive capacity in a UK university, i.e. its chief executive). A macro-level measure of performance is also consistent with the now well-established practice of drawing up ‘league tables’ which rank each university from the best-performer downwards and which are now an inescapable part of the environment of HE. Even if it may be argued that this approach is invalid and that any apparent differences are likely to be spurious (an argument which predictably is regularly made by those universities shown by the tables to be apparently under-performing), they are still generally if grudgingly recognised to be important in influencing the perceptions and decisions of key stakeholders, not least prospective future students.

It might be possible to develop such a macro-level indicator of overall environmental performance, but in order to have any credibility this would require some standardisation in order to eliminate the effect on the indicators of differences in structure and activities, and also of exogenous factors such as differences in local climates due to location, for example by adjusting on the basis of degree-days. It would also require a close standardisation of data definitions, collection and processing systems, which would necessitate significant changes in existing information systems and therefore additional costs. This could be achieved effectively only by an outside body with sufficient authority such as government, or by HEFCE as a condition of funding, though since this could be interpreted by universities as representing excessive external regulation of their internal management which could be politically controversial, this would need to be carefully managed.

In practice, there may also be a trade-off between benchmarking for objective comparisons between organisations with the purpose of assessing relative rankings, and benchmarking as a driver of improvement. One reason for the general perception of the success of the HEEPI workshops and of the value of the supporting data was that institutions were open with their data and were not unduly defensive about discussing its implications, since the exercise was intended not to create ‘league tables’ of relative performance which might foster rivalry and competitiveness but as a data-driven exploration of issues. Several participants remarked that if the aim had been to create league tables, they probably would not have participated. The implication of this is that not all kinds of benchmarking necessarily drive performance improvement, and that data itself is only one of the necessary inputs for effective benchmarking to occur.

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PART IV

NATIONAL EXPERIENCES AND DEVELOPMENTS IN ENVIRONMENTAL AND SUSTAINABILITY ACCOUNTING

Chapter 19

ENVIRONMENTAL MANAGEMENT ACCOUNTING IN CZECH COMPANIES THAT HAVE IMPLEMENTED ENVIRONMENTAL MANAGEMENT SYSTEMS

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Abstract: The first attempts to use of environmental management accounting (EMA) were taken in the Czech Republic in recognition of the need for a change in the approach of the enterprise sector to the protection of the environment. Implementation of environmental accounting in the practice of Czech companies during the late 1990s consisted, in particular, of tracking and evaluation of environmental costs. The need for management of environmental costs followed from an increase in the funds expended by companies on environmental protection or in connection with environmental damage. Systems of environmental cost accounting began to be employed, especially by companies that implemented environmental management systems (EMS). This paper deals first with an analysis of the current state of affairs in relation to the introduction of EMS in the Czech Republic. It concentrates on the reasons for implementation and the expected and actual benefits of EMS. It is also concerned with the current state of implementation of environmental cost accounting in companies that have implemented EMS. The paper also refers to anticipated developments in the use of EMA within the company sector in the Czech Republic.

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1. INTRODUCTION

The basic principle of the State Environmental Policy of the Czech Republic is the strategy of sustainable development. Suitable indicators based on information about the environment need to be established for the evaluation of the implementation of the above strategy and assessment of its effectiveness. One of the most important means for this evaluation and assessment is regular monitoring of environmental information, both in physical and in monetary units. Monitoring and related analysis of the data are implemented at various levels with respect to the entities using the information (the Government at the macro level, companies at the micro level). Specific activities and measures are related to their costs (cost-benefit analysis).

The information system in the area of the environment that is used in the Czech Republic provides adequate data and, together with the outputs of social and demographic statistics, is sufficient both for evaluation of the fulfilment of the objectives of the State Environmental Policy and for the provision of information for responding to European Union (EU) and Organisation for Economic Cooperation and Development (OECD) questionnaires. Nevertheless, it must be stated that the area of economic information is the least covered (Lacina et al. 2003). Data on environmental investment have been available for a long time. The first information on current environmental expenditures based on statistical surveys will be available for 2003. The most significant issue in this relation is connected with obtaining information from the business sector.

In order to ensure adequate economic information, for a number of years attention has been given to environmental accounting. It is employed both at the governmental level and at the company management level and it is an irreplaceable instrument in enforcing integration of economic aspects in environmental policies (Hájek 2002).

The first attempts to use environmental management accounting (EMA) were taken in Czech companies in relation to the need for a change in the approach to the protection of the environment. Stricter laws and the growing and very intensive pressures to internalize external costs in the microeconomic sphere, following from adoption of the State Environmental Policy of the Czech Republic, have resulted in major changes in environmental performance of economic entities (enterprises) at the beginning of the 1990s. During the transition to a market economy, the situation of the business sector became very difficult and complex. It was necessary to very quickly approximate the conduct of the enterprises and their approach to the environment to that of the developed countries; however, simultaneously with the above changes, fundamental macroeconomic and microeconomic issues had to be resolved. These facts caused a number of difficulties connected particularly with the higher rate of internalization of negative externalities in by companies. The companies have gradually changed their passive approach to the environment to a more active approach. Some representatives of the business sphere have even adopted a proactive approach where each company strives to actively use new technology in the area of environmental protection and creates prognoses of future trends as well as adapting its business strategy to these trends (Amudsen 1995).

2. IMPLEMENTATION OF EMA IN THE PRACTICE OF CZECH COMPANIES

In connection with stricter environmental laws, the companies in the Czech Republic were forced to implement a number of measures to mitigate their environmental impact. Implementation of these measures was often very demanding in financial terms. Companies began to acknowledge that their approach to the environment is important for the success of their business and that it could also be significant for the economic results and financial position of the company (Hyršlová and Sakál 2003).

Implementation of environmental accounting in the practice of Czech companies during late 1990s consisted mainly in tracking and evaluation of environmental costs. The need for tracking and management of environmental costs followed from an increase in the funds expended by the companies for environmental protection, or in connection with environmental damage (Hyršlová and Sakál 2003). For companies in a number of industrial sectors, environmental costs have become a very important element of cost. The reasons, why the company management pays increased attention to environmental performance and environmental costs can be summarized as follows:

- A number of environmental costs could be reduced or even eliminated on the basis of improved business decisions – in particular through investment in cleaner technologies or product designs that are friendlier to the environment; a number of environmental costs (e.g. for waste management) add no value whatsoever to processes or products
- Environmental costs could be compensated for by increased revenues (e.g. through sale of by-products, licenses for cleaner technologies, etc.)
- Improved environmental performance of the company can lead to cost savings; however, it has also other important benefits, e.g. for human health, such that an improved environmental performance of the company increases the success of business
- Understanding of environmental aspects and impacts of company activities and information on the environmental costs constitutes an important

factor facilitating management with respect to the processes, departments (centres) and products, and forms the basis for design of processes, products and services that are friendly to the environment
- Confirming the fact that company activities, products and services are friendly to the environment (i.e. that the company takes account of environmental impact of its activities, products and services, and attempts to improve its environmental performance), has a positive influence on the market position of the company

Information on environmental aspects and impacts and on environmental costs is used in the framework for decision-making processes. Achievement of objectives, such as cost reduction, increase in revenues and improvement in the company environmental performance requires that management pays attention to both the environmental approach and the current, future and potential environmental costs.

The companies created a detailed and dynamic system of keeping records and processing of data on environmental costs. The following findings (see Figures 19-1 and 19-2) arise from research, which was undertaken in the years 2001–2003 (Hyršlová et al. 2001, Hyršlová and Vaněček 2003, Vaněček and Hyršlová 2003). Companies that implemented a system of tracking and evaluation of environmental costs include e.g. České dráhy, Aliachem Praha, Vítkovice Ostrava, Třinecké železárny, etc. The systems usually include the following stages (see Figure 19-1):
1. Verification of the reasons for developing environmental costs
2. Conviction and commitment of top management
3. Creation of a methodology for tracking and evaluation of environmental costs
4. Collection of information on environmental costs
5. Tracking and quantification of elements of cost
6. Analytical evaluation of environmental costs
7. Proposals and implementation for remedial activities and measures

As seen in Figure 19-1, the first three activities are carried out only once and must be performed prior to commencement of work with environmental costs that follows from regular implementation of the four remaining stages. The companies track costs related to waste management, as well as costs flowing from non-compliance with the regulations for environmental protection and the provision of services connected with Environmental Management Systems (EMS) (see Figure 19-2).

However, it must be noted that tracking of environmental costs is not seen, in this phase of implementation of environmental accounting, as a part of an integrated system of tracking and evaluation of the material, energy and money flows in the company. Information on environmental costs is not connected to information on material and energy flows (e.g. through information on the sources and generation of waste in a broad sense – the volume and type of emissions discharged into the air or the amount and composition of waste water).

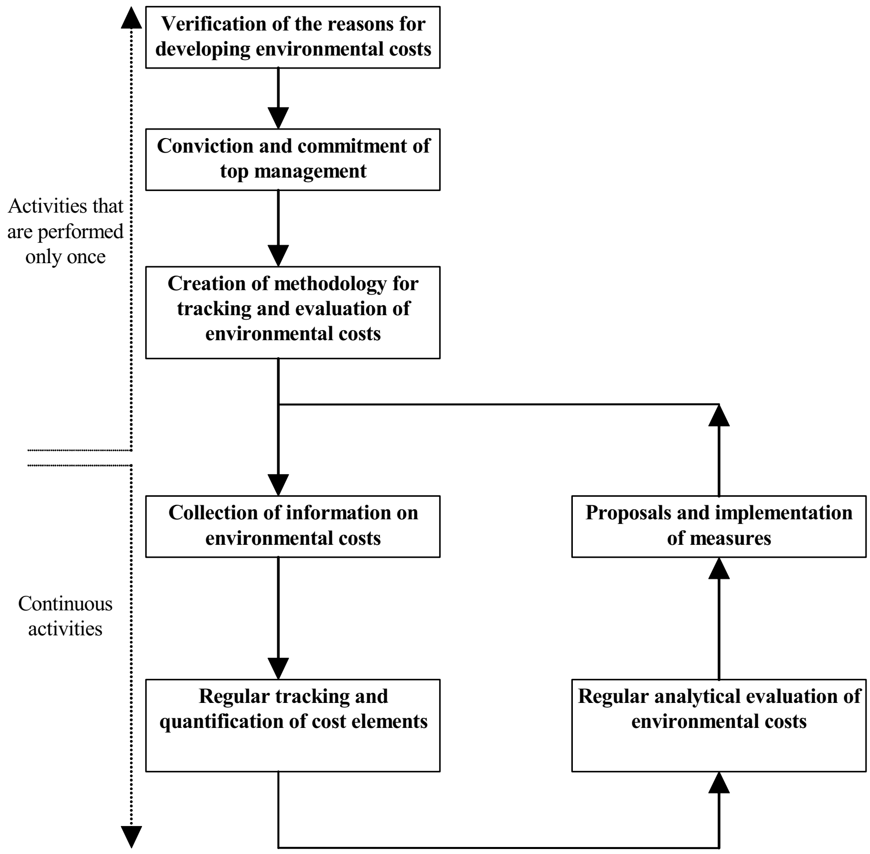

Figure 19-1. Stages of the system for tracking and evaluation of environmental costs in Czech companies.

The systems of tracking and evaluation of environmental costs began to be employed both by companies that have important environmental impacts (e.g. companies in chemical industry) and by those implementing environmental management systems.

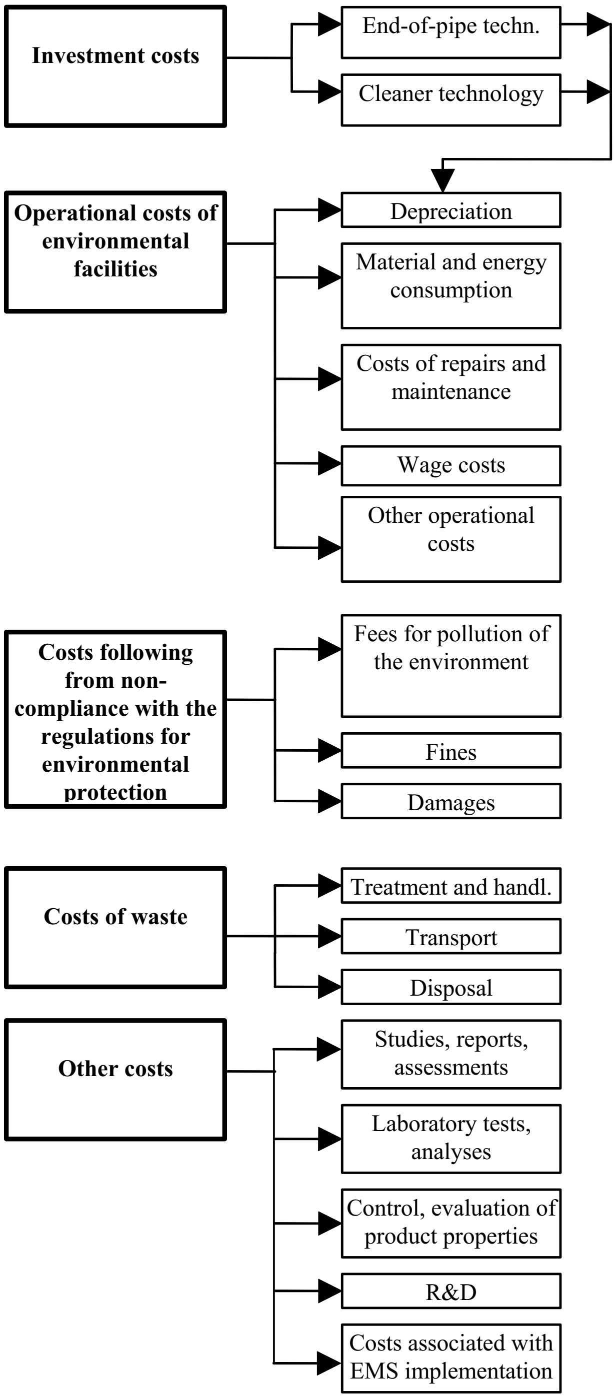

Figure 19-2. Classification of environmental costs in Czech companies.

Integration of these issues in management activities became a very important instrument for a change in the approach of the business sphere to the environment during late 1990s, when implementation of environmental management systems (EMS) became popular. EMSs are the most common form of voluntary activities aimed at environmental protection in the Czech Republic. Czech companies not only consider EMSs to be an important instrument to mitigate the environmental impact of their activities, but they are also well aware of the effects in the business area (Mikoláš and Moucha 2004). Ownership of an ISO 14001 certificate, or registration within the EMAS program, extends company potential in the export area, with respect to public procurement, and also in relation to acquiring subsidies for business activities. At the moment, in relation to implementation of EMSs, companies are beginning to note that environmental protection requires certain expenditures (Fedorová et al. 2002). On the other hand, it is also clear that disposal of waste and damage to the environment also result in costs and, furthermore, that these both lead to a negative response from company stakeholders.

With the implementation of an EMS activities are revealed which act negatively on the environment, and significant environmental aspects and impacts of entrepreneurial activities, products and services on the environment are discovered. In addition to information on environmental aspects and environmental impact of their activities, companies are also beginning to utilize information on material and energy flows and the associated costs. The following sections examine the implementation of environmental cost accounting in enterprises, which have introduced an EMS. First of all emphasis is given to the introduction of EMSs in the Czech Republic. Then attention is directed towards systems for tracking environmental costs, which these enterprises use to support decision processes.

3. IMPLEMENTATION OF EMS IN THE CZECH REPUBLIC

In mid 2003, the University of Pardubice and the EMAS Agency carried out research targeted at understanding the experience of companies with implementation and operation of an EMS in the Czech Republic. The research was concerned with the reasons for implementation, the anticipated and actual benefits, the duration of the process and the costs connected with implementation. Research data were gathered through a written questionnaire. Enquiries were made of 450 enterprises that had introduced EMS at the time of the survey. The research framework addressed all organisations listed on the EMAS register kept by the Czech Environmental Institute in Prague. The

EMAS register includes all companies with certified EMS – ISO 14001 or EMAS. Completed questionnaires were returned by 254 companies, i.e. 56.44%. Companies of various sizes in various branches were represented in the test sample. The respondents were environmental managers and top managers (see Figure 19-3). Results from the questionnaire answers were evaluated using common mathematical and statistical methods. The following text summarizes the selected results from this research.

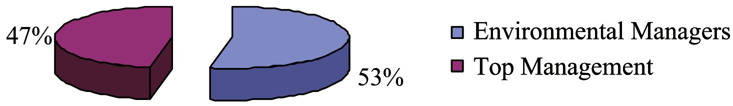

Figure 19-3. Structure of respondents to questionnaire (n = 254).

3.1 Which Companies Implement EMS?

Responses indicate that a clear majority of individual organizations use the environmental management ISO 14001 system compared with the EMAS system (441 organizations of the overall number of 450 enterprises have implemented this system). This is caused particularly by the international applicability of the ISO 14001 standard and the related requirements for competitiveness. Furthermore, when implementing EMS pursuant to ISO 14001, organizations use the findings and experience obtained from prior adoption of a quality management system based on ISO 9000. Although the Czech state supports EMAS, a system based on the EMAS Regulation has only been implemented to date by 9 organizations.

In the research framework, enterprises with a number of employees falling within the 0-49 interval were designated as small enterprises; enterprises with a number of employees in the 50 to 249 interval, as medium-sized enterprises; and enterprises with a number of employees equal to 250 or higher, as large enterprises. EMS is implemented primarily by large enterprises (44% of the overall number of enterprises that have implemented EMS). However, these systems can also be used in medium-sized and small enterprises where the system has been implemented by 153 medium-sized and 102 small enterprises (see Figure 19-4). From the sectoral perspective, the majority of enterprises were from the processing (63.56%) and the construction sectors (11.11%). The production of electrical and optical devices and production of metals and metalworking products sub-sectors had the largest share of applications in the processing industry.

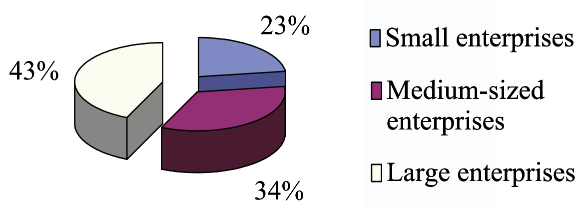

Figure 19-4. Enterprises with an EMS (segmentation according to the size of enterprises; n = 450).

3.2 Why do Companies Introduce EMS in the Czech Republic?

Respondents gave the following main reasons for implementing EMS:

- Permanent interest in protecting the environment (97.24% of respondents)
- Better image and trustworthiness of the enterprise (96.06% of respondents)
- Responsible behaviour and co-existence with the stakeholders (95.28% of respondents)
- Increased competitiveness (88.19% of respondents)
- Improvement of relations with the general public and governmental agencies (84.65% of respondents)

It clearly follows from the results that the enterprises are interested in environmental protection and are aware of the effect of their approach to the environment on relations with stakeholders (business partners, general public and governmental agencies). The enterprises also anticipate a favourable impact of a responsible approach to the environment on their competitiveness.

The research confirmed that the reasons for implementing EMS are the same irrespective of the size of the enterprise and the relevant sector. However, as enterprises grow in size, they experience increased pressure for the introduction of EMS in their business group and there is also an increase in the percentage of respondents for whom an important reason for implementation of EMS consists in cost reduction. Of the companies in the chemical and pharmaceutical industries 100% of respondents (17 enterprises) stated their permanent interest in environmental protection, responsible behaviour and improved image and trustworthiness of the company as the main reasons for implementing EMS.

3.3 What are the Benefits from the Introduction of EMS?

Analysis of results from the questionnaire survey indicated the benefits anticipated by respondents from introduction of an EMS and how their expectations were fulfilled (see Table 19-1).

The answers of respondents were influenced by further facts:

- Questions about expectations and perceptions of actual results were asked and answered at the same time
- Companies did not implement their EMSs at the same time. Some enterprises in the sample only recently implemented an EMS

Table 19-1 depicts the individual types of benefits and gives, for each benefit, the% of respondents who anticipated the given benefit and% of respondents who stated, based on the opinion of the respondents, that the given benefit was actually fulfilled. The fourth column of Table 19-1 provides the difference between perceptions of actual results and expectations. In the following only those contributions from EMS cited by more than 80% of respondents are discussed. Attention is given also to those contributions where the greatest difference between perceptions of actual results and expectations is revealed.

Over 90% of respondents anticipated that implementation of an EMS would ensure improved work in the area of environmental protection; create environmental awareness for employees; improve the organization's image; contribute to compliance with legislative regulations in the area of environmental protection; and improve environmental performance.

Over 80% of respondents also anticipated the following benefits from the introduction of an EMS:

- Better preparedness for accidents
- Better arrangement of operational documents
- Increased competitiveness
- Improved internal organization and management
- Improved working environment
- Improved communication with the general public and governmental agencies

According to the opinion of respondents, the anticipated benefits noted above were not fully achieved (except for being better prepared for accidents). Expectations were fulfilled the least in the area of improved competitiveness (nevertheless, 69% of respondents perceived a positive contribution of an EMS to improved competitiveness of the company).

Table 19-1. Anticipated and perceived benefits of introducing an EMS (n = 254).

Benefits	Expectations (%)	Perceptions of actual result (%)	Difference
Improvement of work in the area of environmental protection	98.03	94.09	–3.94
Creation of environmental awareness for all employees	97.64	92.13	–5.51
Improved image of the organisation	97.24	90.94	–6.30
Compliance with legislative regulations in the area of environmental protection	91.73	90.94	–0.79
Improvement of environmental performance (reduction of unfavourable environmental impact)	91.34	89.37	–1.97
Better preparedness for accidents	89.76	90.16	0.40
Better arrangement of operational documents	88.19	86.61	–1.58
Increased competitiveness	86.61	68.90	–17.71
Improved internal organisation and management	86.22	84.65	–1.57
Improved working environment	82.28	82.28	-
Improved communication with the general public and governmental agencies	80.31	72.05	–8.26
Improved supplier-customer relations	70.47	59.45	–11.02
Better negotiations with banks and insurance companies	50.39	39.37	–11.02
Reduction of cost of raw materials and energy	49.61	46.06	–3.55
Reduction of fees for environmental protection and fines for pollution	49.61	48.82	–0.79
Increased revenues	40.55	28.35	–12.2

Results of the research have shown that respondents consider acquisition of an ISO 14001 certificate or registration in the EMAS program as the significant tool for the strengthening of competitiveness. Respondents relate the implementation of an EMS with: the improvement of company image; increasing credibility for investors and creditors (and, because of this, with a better access to capital); widening possibilities in the export sphere; and in an area of public procurement. But it appears that in some areas contributions are not perceived as respondents expected (for example, some financial institutions in the Czech Republic do not put sufficient emphasis on company environmental performance).

Table 19-2. Anticipated and perceived benefits of introducing EMS–small enterprises (n = 41).

Benefits	Expectations (%)	Perceptions of actual result (%)	Difference
Compliance with legislative regulations in the area of environmental protection	97.56	85.37	–12.19
Improvement of work in the area of environmental protection	97.56	85.37	–12.19
Creation of environmental awareness for all employees	95.12	80.49	–14.63
Improvement of environmental performance (reduction of unfavourable environmental impact)	92.68	82.93	–9.75
Improved image of the organisation	92.68	85.37	–7.31
Better preparedness for accidents	90.24	82.93	–7.31
Better arrangement of operational documents	90.24	78.05	–12.19
Increased competitiveness	85.37	65.85	–19.52
Improved internal organisation and management	82.93	75.61	–7.32
Improved working environment	78.05	73.17	–4.88
Improved communication with the general public and governmental agencies	78.05	56.10	–21.95
Improved supplier-customer relations	70.73	56.10	–14.63
Increased revenues	51.22	31.71	–19.51
Better negotiations with banks and insurance companies	41.46	26.83	–14.63
Reduction of cost of raw materials and energy	36.59	21.95	–14.64
Reduction of fees for environmental protection and fines for pollution	31.71	31.71	-

The results of the research showed that the benefits from introducing an EMS increase as the size of the enterprise increases. Expected benefits were not achieved by small enterprises (see Table 19-2). According to the opinion of respondents, the following benefits were not achieved in particular: improved communication with the general public and governmental agencies; increased competitiveness; increased revenues; reduction of cost of raw materials and energy; improved supplier-customer relations; better negotiations with banks and insurance companies; creation of environmental awareness of all employees.

3.4 DOES THE IMPLEMENTATION OF AN EMS PLAY ANY ROLE IN THE SELECTION OF BUSINESS PARTNERS?

In this part of the research, the companies were asked whether they take the approach to the environment into consideration when selecting business partners (see Figure 19-5). Results confirmed that the vast majority of the respondents (94%) take the implementation of an EMS into consideration when selecting their business partners.

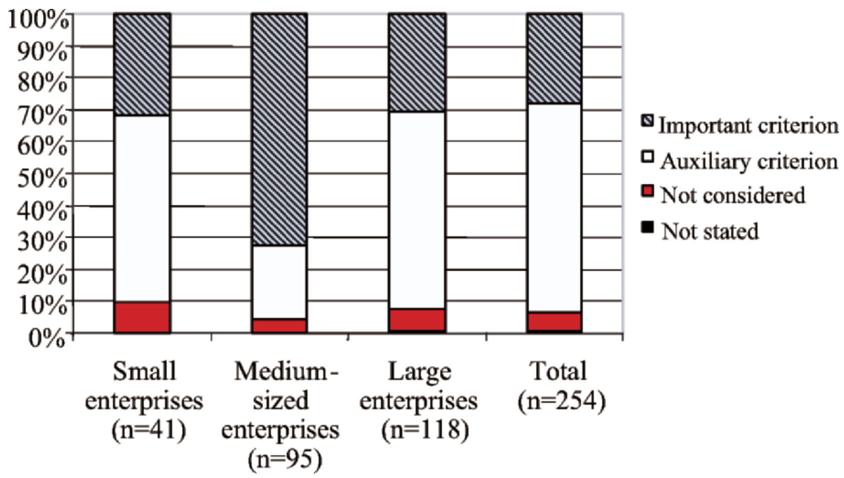

Figure 19-5. Implementation of an EMS as a criterion in the selection of business partners.

Incorporation of aspects of environmental protection in the overall management system can, thus, constitute a competitive advantage for the company. It followed from the results of research performed in 2000 and published in the Survey and Analytical Study on Introduction of EMAS/ISO 14001 in the Czech Republic (Czech Environmental Institute 2004b) that 80% of the entities that had introduced EMS required a sound environmental approach from their subcontractors. The above-mentioned research unambiguously confirmed the presence of increasing pressure on improving care for the environment in the business sphere.

The approach of business partners to environmental protection plays an important role for companies of all sizes. With respect to small and large enterprises, implementation of an EMS is used only as an auxiliary criterion in their business relations framework. For medium-sized companies a very important role in business relations is played by EMS implementation; thus, introduction of an EMS pursuant either to ISO 14001 or EMAS can be a considerable competitive advantage.

The sample companies consider the approach to environmental protection to be an important criterion in the selection of business partners especially in the following sectors: transportation, storage of goods, postal services and telecommunications (the sample contained 7 enterprises); other public, social and personal services (the sample contained 14 enterprises); and production and distribution of electricity, gas and water (the sample contained 10 enterprises). In other sectors, it is used only as an auxiliary criterion.

3.5 The Importance of an EMS for Environmental Protection in the Czech Republic

EMSs are the most common activity aimed at environmental protection in the Czech Republic. The number of companies using this voluntary instrument is constantly increasing. Figure 19-6 provides a survey of the trends in the number of enterprises that implemented an EMS from the date the standards were introduced to March 31, 2004.

The research unambiguously confirms that EMSs are regarded as a tool of environmental protection. 98% of all companies from the sample respondents would again introduce an EMS (see Figure 19-7). Among large companies, the response is absolutely unambiguous (over 99% of the respondents would implement an EMS again, for 79%, the answer was “certainly yes”). Positive responses were also predominant for small and medium-sized companies (an EMS would be implemented again by 95% of small and almost 98% of medium-sized companies). It can be concluded that, in a majority of companies, implementation of an EMS was associated with benefits that exceed the complications from introducing the system and also the total costs required by implementation of EMS.

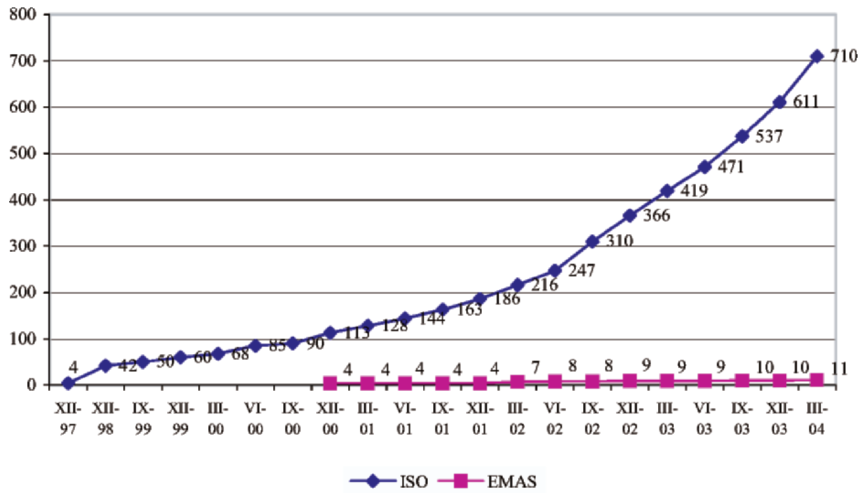

Figure 19-6. Number of companies with ISO 14001 or EMAS in the Czech Republic (source: Czech Environmental Institute 2004a).

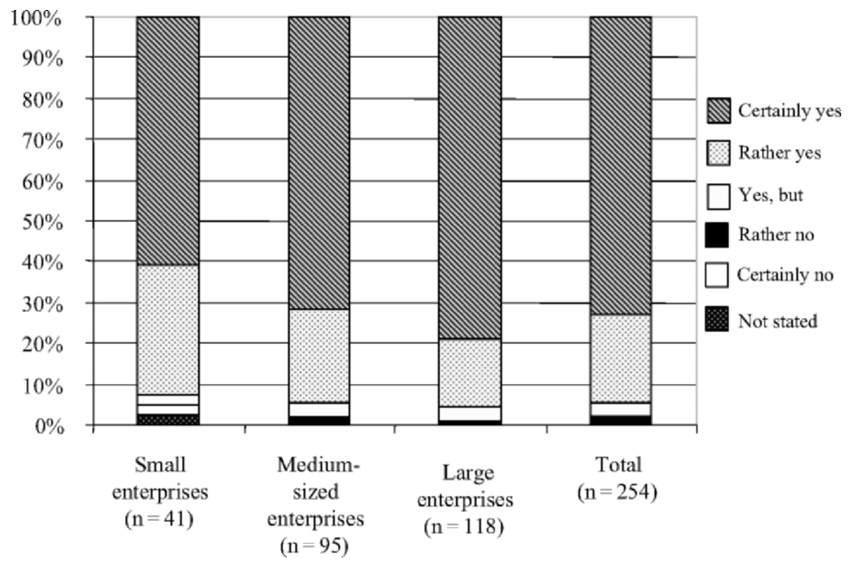

Figure 19-7. Re-implementation of an EMS .

Only 3% of the respondents refer to problems. These issues can be summarized as follows:

- Implementation of an EMS is a time-consuming process. Fulfilment of all requirements in the area of documentation was particularly difficult.

The respondents would welcome, in particular, substantial simplification in this area

- The respondents refer to considerable costs associated with actual certification, validation and recertification. They have considered the option of implementing EMS without certification/validation
- On the basis of their experience with EMS implementation, the respondents consider it purposeful to appoint a specific employee responsible for introducing and maintaining the system within the company
- The respondents also refer to the need for greater use of support from governmental bodies and agencies by companies when introducing an EMS. Czech companies can gain a subvention for the implementation and certification of their EMS, either from the State Environmental Fund of the Czech Republic and/or from the TRH Programme of the Czech-Moravian Guarantee and Development Bank. Companies do not make sufficient use of this financial support mainly because of high administrative requirements associated with completion of application forms. Enterprises also expect further types of support (e.g. inclusion of environmental requirements in the basic criteria for assessment of public procurement tenders)

Only 1.5% of the respondents would not implement an EMS again following on their earlier experiences. Among the main reasons for this decision, they state that the benefits from the system do not correspond to the efforts used, that the volume of administrative tasks has increased and that the costs of implementation are inappropriately high. They suggest that a sound approach to the environment can be implemented through other (more effective) measures.

4. ENVIRONMENTAL ACCOUNTING IN COMPANIES THAT HAVE IMPLEMENTED AN EMS

In 2002, in the framework for the grant project of the Grant Agency of the Czech Republic entitled “Information on environmental costs for environmental management” (registration number 402/02/0092), the University of Pardubice and Brno University of Technology carried out research on the current state of tracking of environmental costs in companies which have implemented an environmental management system (Fedorová et al. 2002). The research was performed by means of a questionnaire survey. Inquiries were made of 208 companies registered on the EMAS register at the time of the survey. 89 companies, i.e. 43%, returned a completed questionnaire.

Companies of various sizes in various branches were represented in the test sample. Respondents were representatives of company top management. The main research findings are provided below.

4.1 Tracking of Environmental Costs

Attention was concentrated during the research, not only on the question of whether companies track environmental costs, but also on the manner of their tracking (i.e. within or outside the general ledger system). In some companies environmental costs are tracked in the general ledger system (specific account codes have been dedicated to important environmental costs). In some companies reports of environmental costs are formed on the basis of data generated by a free standing system, which does not directly access data in the other systems, including non-automated, ad-hoc methods (i.e. environmental costs are tracked outside the general ledger system). The results of the research are apparent from Figure 19-8.

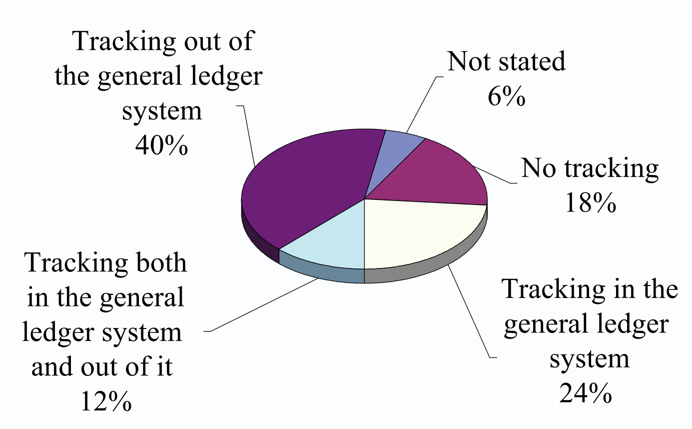

Figure 19-8. Tracking of environmental costs (n = 89).

Environmental costs are tracked in 76% of the respondent companies. Tracking of environmental costs outside the general ledger system is more frequent than tracking within. The results unambiguously show that the number of companies tracking environmental costs increases with company size (see Table 19-3). This is closely related to the fact that the complexity of accounting systems also increases with the size of the companies (the number of accounting transactions grows, transparency deteriorates, etc.). It is expected that important cost elements would be tracked and evaluated in order to support decision-making. In a number of companies, such environmental costs are thus tracked – either within or outside the general ledger system (Hyršlová and Sakál 2003).

Table 19-3. Tracking of environmental costs (with respect to the size of the company; n = 89).

Size of company / Tracking of environmental costs	Small companies		Medium-sized companies		Large companies		Total	
	abs. f.	rel. f.	abs. f.	rel. f.	abs. f.	rel. f.	abs. f.	rel. f.
Yes	2	29%	18	64%	48	89%	68	76%
No	5	71%	9	32%	2	4%	16	18%
Not stated	0	0%	1	4%	4	7%	5	6%
Total	7	100%	28	100%	54	100%	89	100%

The research was also concerned with the question whether tracking of environmental costs is affected by the ownership structure of the companies. It follows from the results that environmental costs are tracked both in companies that are owned by foreign and domestic entities and in companies owned by the state (see Table 19-4).

Table 19-4. Tracking of environmental costs (with respect to company ownership; n = 89).

Owners/Tracking of environmental costs	State institutions		Foreign owners		Domestic owners		Others	
	abs. f.	rel. f.	abs. f.	rel. f.	abs. f.	rel. f.	abs. f.	rel. f.
Yes	4	67%	28	78%	30	73%	6	100%
No	1	17%	5	14%	10	24%	0	0%
Not stated	1	16%	3	8%	1	3%	0	0%
Total	6	100%	36	100%	41	100%	6	100%

4.2 Tracking of Environmental Costs at Product, Department and Process Levels

This part of the research was concerned with the question whether companies track environmental costs, not only for the enterprise as a whole, but also from the viewpoint of products, departments (centres) and processes. 43% of enterprises provided a negative answer for all three views. Only two respondents stated that they tracked environmental costs both from the viewpoint of products and from the viewpoint of departments and processes.

Most companies (31%) stated that they tracked costs at the department level, 17% tracked these costs at the product level, while 15% of tracked the costs for processes. The number of companies that tracked their environmental costs at the product and process levels declined as company size increased.

On the other hand, the number of companies that tracked their environmental costs at the department level increased with the size of companies. The results of the research confirmed that the management accounting systems in companies are particularly concerned with management of departments (responsibility orientated) and product management. As the size of companies increases, it might be expected that greater attention should be paid to department (responsibility) management. However, on the other hand, complexity of accounting systems also grows as company size increases and, thus, in the majority of companies, environmental costs are tracked outside the general ledger system.

4.3 Structure of Environmental Costs

Identification of costs related to environmental protection and damage is very important from the standpoint of the need for environmentally orientated management as well as the need to seek environmentally favourable solutions that would be in accord with the economic objectives of the company and the principle of sustainability (Fedorová et al. 2002). In the research companies were asked whether they track operational costs of environmental protection (e.g. waste-water treatment plants, incinerators, etc.) for their facilities and what other elements of cost they consider as "environmental" costs.

The research results indicate that the following are usually considered to be "environmental" costs in companies:

- Costs associated with disposal of solid waste
- Costs for transport of waste
- Fees for protection of the environment
- Fines and penalties related to environmental damage
- Payments to external organizations for services connected with introduction, certification and recertification of an EMS
- Operational costs of end-of-pipe technologies, i.e. waste-water treatment plants, incinerators, etc.

It is clear from the above listing of individual elements that tracking is especially concerned with the costs associated with waste management, fees for environmental protection, penalties for environmental damage and provision of services related to the EMS.

This state of affairs in the tracking of environmental costs is characteristic not only of Czech companies. A survey of American companies showed that they, for example in the framework of decision-making on investments, take account of between 25% and 79% of total environmental costs (Total environmental costs = Environmental protection costs + Costs of wasted material + Costs of wasted capital and labour) (Jasch 2001). Most frequently, costs for treatment of waste water and hazardous waste, wage costs of "environmental" employees, fines for environmental pollution and costs incurred in relation to environmental reporting for external users (particularly governmental bodies) are included among environmental costs.

Research among selected Czech companies showed that part of the costs associated with environmental protection and environmental damage remain concealed within summary cost elements. Tracking of costs of wasted materials appears to be particularly inadequate. It is clear that costs for disposal of wastes are taken into consideration in decision-making; however, no account is taken of the purchase value of materials transferred to waste flows or of the costs of processing the non-product outputs. However, a survey of several company projects has shown that the costs of waste disposal usually equal 1% to 10% of total environmental costs, while the purchase value of the wasted materials represents 40 to 90% of environmental costs, depending on the sector analyzed (Jasch 2001).

4.4 Materials Resulting in Non-Product Outputs

Under the basic assumption that all purchased material must naturally leave the company either as a product or as waste, waste is, in fact, material that has not become part of a product intended for the market. Waste is thus an indicator of inefficient production. The costs of wasted materials (purchase value of materials that have left the company as a non-product output) should thus be taken into account in the company calculation of environmental costs (Jasch 2001, Schaltegger and Burritt 2000).

In the research conducted here, the sample companies were also asked what percentage of the value of input materials left the company as non-product output (waste). Their responses are shown in Figure 19-9 and Table 19-5.

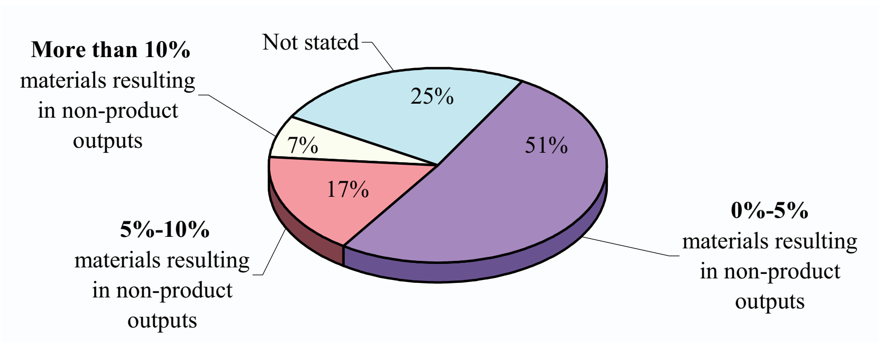

Figure 19-9. Materials resulting in non-product outputs (n = 89).

Table 19-5. Materials resulting in non-product outputs (with respect to the size of the company; n = 89).

Size of company / Wasted materials	Small companies		Medium-sized companies		Large companies		Total	
	abs. f.	rel. f.	abs. f.	rel. f.	abs. f.	rel. f.	abs. f.	rel. f.
0-5%	3	38%	13	48%	30	56%	46	51%
5-10	2	25%	6	22%	7	13%	15	17%
Over 10%	0	0%	1	4%	5	9%	6	7%
Not stated	3	37%	7	26%	12	22%	22	25%
Total	8	100%	27	100%	54	100%	89	100%

A total of 22 companies did not respond to this question. In the remaining cases (75% of respondents), the amount of this share was specified. Over half of respondents (51%) stated that up to 5% of the value of input materials leaves the production process in waste flows. 17% of respondents quantified this share between 5 and 10%. 6 companies (of which 5 are large) responded that the share of the value of input materials leaving the production process as wastes exceeds 10%.

For the group of large companies: 22% of these companies did not answer this question at all; 69% stated that up to 10% of the value of input materials leaves the company in waste flows and 9% believe that over 10% of the value of input materials is transferred to waste flows. The research confirms that, in a number of companies, the cost of wasted materials constitutes an important element that requires attention.

4.5 Importance of Information on Environmental Costs for Company Management

This research among Czech enterprises that have implemented an EMS showed that over three-quarters of companies separately track environmental costs. Tracking of environmental costs outside the general ledger system is more frequent. The research showed that tracking of environmental costs at the department, product and process levels is also important for decision-making processes in the company.

Companies consider information on environmental costs to be beneficial for decision-making processes within the company. Over 85% of respondents stated that information on environmental costs is beneficial for the management of the company. The importance of information grows with the size of companies (91% of large companies consider information on environmental costs to be beneficial for the management of the company). It is clear that environmental costs in large companies belong among the set of important cost elements that should be tracked and managed.

The results of the research also confirmed that companies that declare control of the environmental impact of their activities and that demonstrate their efforts to ensure a sound approach to the environment, including through the use of voluntary instruments for environmental protection, are aware of the effect of the environmental performance of the company on its financial position and financial performance. Therefore, they concentrate on the tracking of costs connected with environmental protection and environmental damage and use the information obtained to support decision-making processes within the company.

5. EXPECTED DEVELOPMENTS IN THE AREA OF EMA IMPLEMENTATION

Research performed by the University of Pardubice and the EMAS Agency in mid 2003 (see above) confirmed the increasing interest in EMA of the enterprises that have implemented an EMS (see Figure 19-10). 8% of respondents stated that they use EMA and another 15% of respondents were considering the implementation of EMA. There is a greater incidence of EMA use by larger companies. The research confirmed that companies that have implemented an EMS consider EMA to be an important instrument that facilitates their shift to sustainability.

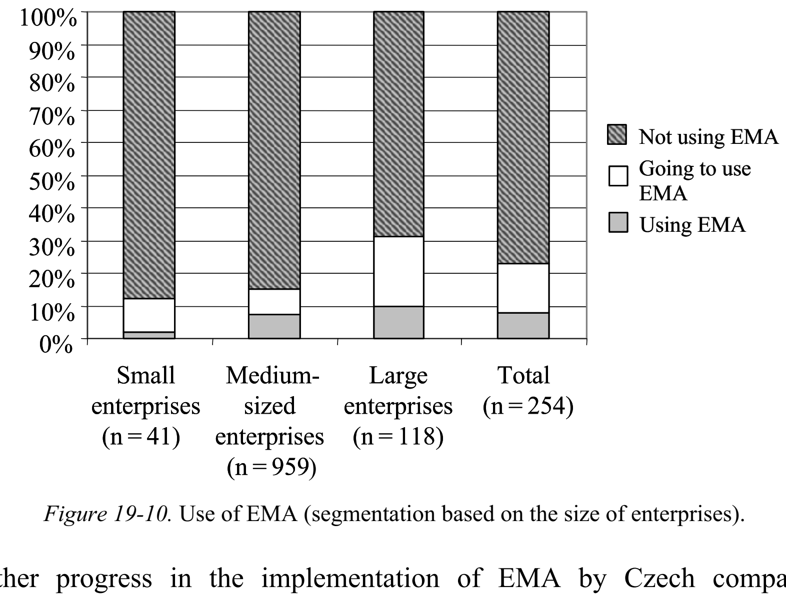

Figure 19-10. Use of EMA (segmentation based on the size of enterprises).

Further progress in the implementation of EMA by Czech companies should be facilitated through incorporation of the requirements for tracking economic impacts caused by the environmental effects of company activities via the EMAS program. If a company intends to obtain EMAS validation the system should also include the duty to "create and maintain procedures for tracking environmental financial flows, in order to introduce EMA" (Ministry of the Environment of the Czech Republic 2004b). The companies can use the method drawn up by the Ministry of the Environment of the Czech Republic. This method came into effect on January 1, 2003 under the name "Environmental Management Accounting Implementation Guideline" (Ministry of the Environment of the Czech Republic 2004a).

6. CONCLUSION

In the Czech Republic, the EMA system is used both at the government level (for drafting policies and concepts) and at the company level. Company management requires information on material and energy flows, as well as information on environmental costs, as the basis for decision-making that is in accord with company environmental and economic objectives. For companies, whose goal is to minimize the total costs or environmental costs and mitigate the environmental impact of their activities, products and services, EMA is an important instrument for fulfilment of these goals.

The companies that have implemented an EMS consider the potential for tracing, tracking, evaluating and controlling environmental costs to be an important benefit of EMA. The need for management of environmental costs followed from an increase in the funds expended by companies for environmental protection, or in connection with environmental damage. For companies in a number of industrial sectors, environmental costs have become a very important element of cost and these companies pay increased attention to such costs.

Results of the research confirmed that companies that have implemented an EMS are aware of the effect of company environmental performance on its financial position and financial performance. Therefore, they pay attention to tracking the costs connected with environmental protection and environmental damage, and use the information obtained to support decision-making processes.

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Chapter 20

CORPORATE ENVIRONMENTAL ACCOUNTING AND REPORTING IN CHINA

Current Status and the Future

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Abstract: Corporate environmental accounting and reporting has grown in importance in China along with the implementation of the national sustainable development strategy and introduction of new environmental laws and regulations. This chapter focuses on monetary issues and reflects the Chinese developments in corporate environmental accounting and reporting in general. It includes two parts. In the first part, the author reviews the current status of corporate environmental accounting and reporting research and practices in China on the basis of the published papers in China's journals over the period 1992-2003. In the second part, the author proposes some future steps to be taken to further develop corporate environmental accounting and reporting in China.

1. CURRENT STATUS OF ENVIRONMENTAL ACCOUNTING AND REPORTING RESEARCH

1.1 A New Accounting Discipline in China

Environmental accounting research, begun in 1992 by individual researchers, has gradually increased in popularity since then. Interest in environmental reporting research increased slowly in late 1990s. Table 20-1 shows that most researchers (about 98%) conducted environmental accounting and reporting research using the normative method and were more interested in environmental accounting than in environmental reporting. Empirical studies were only found in six papers, which represented less than 2% of the total published papers.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 457-471.

Table 20-1. Annual distribution of the published papers in Environmental Accounting and Reporting in China's journals in the period 1992 -2003.

Topics	Research Method	Year												Total
		92	*93*	*94*	*95*	*96*	*97*	*98*	*99*	*00*	*01*	*02*	*03*	
(1) Environmental Accounting	N*	1			2	2	7	8	20	33	50	66	55	244
	E**													
(2) Environmental Reporting	N								2	1	2	10	11	26
	E						1					1	1	3
Both (1) and (2)	N						5	3	4	7	5	7	17	48
	E							1				1	1	3
Total		1	0	0	2	2	13	12	26	41	58	84	85	324

* N represents Normative Method.
** E represents Empirical Method.

1.2 Normative Studies

A review of the published papers of environmental accounting in China's journals in the period 1992-2003 showed that the major topics were the introduction of environmental accounting and reporting in other countries and basic theoretical concepts of environmental accounting such as definition of environmental accounting, objectives of environmental accounting, basic assumptions and principles of environmental accounting, elements of environmental accounting, disclosures of environmental accounting information, types of environmental accounting, etc.. Disclosure of corporate environmental accounting information was the dominant topic in the published papers of environmental reporting in journals during this period. Table 20-2 outlines the general views contributed by the normative researchers about the basic theoretical concepts of environmental accounting and reporting in the published papers of environmental accounting and reporting in journals.

Table 20-2. General views about basic theoretical concepts of Environmental Accounting and Reporting in the published papers during the period 1992-2003.

Topics	Authors	General Views
1. Definition	Meng, Fangli (1997)	A new branch of corporate accounting which is designed to account for and control a company's environmental activities and economic activities related to the environment in multiple measurement units under the fundamental accounting principles and methods.
	Xu, Hong (1998)	A corporate accounting which is designed to account for a company's environmental items and report accounting information useful for a company's environmental management.
	Zhang, Bailin (2003)	An accounting discipline, which is designed to account for the interrelationship between economic activities and the environment about a particular entity mainly in monetary units.
2. Objectives	Meng, Fangli (1999) Xiao, Hua et al. (2002b)	To provide environmental accounting information which is useful for users' decision-making.
	An, Qingjiao (1999)	To pursue sustainable development.
	Li, Xiangyi (1998) Li, Hongying (1999)	To maintain the triple balance (e.g., economic efficiency, environmental efficiency, and social efficiency.
	Xiao, Xu et al. (2003)	Environmental financial accounting (i.e., environmental issues in financial accounting).
	Guo, Xiaomei (2002) Xiao, Xu et al. (2003)	Environmental cost and management accounting (i.e., environmental issues in cost and management accounting).
3. Types of environmental accounting	Xiao, Xu et al. (2003)	Environmental financial accounting (i.e., environmental issues in financial accounting).
	Guo, Xiaomei (2002) Xiao, Xu et al. (2003)	Environmental cost and management accounting (i.e., environmental issues in cost and management accounting).
4. Basic assumptions	Li, Xinghe (2002)	Basic assumptions underlying financial accounting (entity assumption, going-concern assumption, monetary unit assumption, periodicity assumption).
	Meng, Fangli (1999) Li, Xinghe et al. (2002)	Entity assumption, going concern assumption, periodicity assumption, multiple measurement units' assumption, sustainable development assumption, accountability assumption, environmental resources scarcity assumption.

continued on next page

Table 20-2. Continued.

Topics	Authors	General Views
5. Basic principles	Xiang, Guocuan (1997) Meng, Fangli (1999) Liu, Xiangyong (2001)	Basic principles underlying financial accounting (cost principle, objectivity principle, accrual basis assumption, revenue recognition principle, matching principle, full disclosure principle, cost-benefit principle, comparability principle, consistency principle, conservatism principle, social principle and flexibility principle).
6. Basic elements	Li, Xinghe (2002)	Environmental asset, environmental liability and environmental cost.
	Li, Xinghe (2002)	Environmental asset, environmental liability, environmental expenditure, environmental income.
	Lu, Yuming (1998)	Environmental asset, environmental liability, environmental equity, environmental revenue, environmental expense and environmental income.
7. Contents of environmental reporting	Meng, Fangli (1999)	Impacts of environmental issues on a company's financial position and operating results, and environmental performance.
8. Format of environmental reporting	Meng, Fangli (1999) Sun, Xinghua (2002) Xiao, Hua et al. (2002b)	Disclosure within the financial statements and non audited sections of the annual report.
	Meng, Fangli (1999) Xiao, Hua et al. (2002b)	Disclosure in a separate environmental report.
	Chu, Jiao et al. (2003)	Disclosure in environmental accounting statements such as environmental balance sheet, environmental income statement, environmental performance report, environmental pollution report, etc..
9. Verification of environmental reporting	Li, Xinghe (2002)	Environmental auditing can assure the quality of environmental reporting.
	Xing, Jingguo et al. (2002)	The third independent party should audit environmental report.

1.3 Environmental Accounting and Reporting Practice

1.3.1 Empirical Studies

Empirical studies on environmental accounting and reporting began in 1997 and have developed slowly since then. There were only six empirical papers published in journals over the period 1992-2003. These empirical papers are by: Wang et al. (1997, 1998), Xiao et al. (2002a), Geng et al. (2002), Sun et al. (2003) and Meng (2003).

Wang et al. (1997, 1998) presented the results of two mail surveys respectively in 1997 and 1998. The first survey was conducted to determine the attitudes of CEOs towards corporate environmental management by sending questionnaires to CEOs of 500 companies and the response rate was 14%. It was found that most companies had established a separate department or assigned specific personnel to deal with corporate environmental management issues, and provided annual mandatory environmental reports to related governmental agencies (e.g. local environmental protection administration and local Statistics Bureau). The second survey was conducted to investigate corporate environmental accounting practices by sending questionnaires to CFOs of 500 companies and the response rate was only 5%. The results of the second survey showed that most companies had incurred environmental expenditures and usually accounted for them as administration expenses or capital assets when they were incurred because there was no specific environmental accounting standard. The results also indicated that most respondents agreed that environmental indicators should be integrated with financial indicators and half of the respondents agreed that companies should report corporate environmental information to external parties. The authors suggested that separate environmental reports should be prepared as supplementary to corporate financial statements.

Xiao et al. (2002a) reported the results of a mail survey of 400 interested stakeholders (i.e., CFOs of 100 companies, CEOs of 100 investment companies, credit managers of 100 banks and CPAs of 100 accounting firms) in 2001 to determine the demand for corporate environmental information and the framework of corporate environmental reporting. The average response rate from the survey was 10%**.** The empirical findings included the following:

- Governmental environmental regulations had significant effects on the incurrence of environmental expenditures and environmental revenues
- Accounting treatments for environmental expenditures varied among companies because there was no specific environmental accounting standard
- Compliance with governmental environmental regulations and to present a greener corporate image to the outside world were the two major reasons for companies to provide environmental information
- Governmental administration agencies were the most important users of corporate environmental information and the public demand for corporate environmental information would increase

- Corporate environmental disclosures were not complete, comparable and fully-disclosed because there was no specific environmental reporting standard. The authors concluded that demand for corporate environmental information would increase as long as the public environmental awareness increased and proposed a framework of corporate environmental reporting in China.

Geng et al. (2002) studied the environmental disclosure of 30 listed companies in industries which were considered to have the greatest environmental impacts in order to investigate the changes in the level of corporate environmental disclosure over the period 1992-1999. The results showed that listed companies disclosed environmental information in the prospectus and 5 listed companies disclosed forecast environmental expenditures. Corporate environmental disclosures increased in contents. They were narrative in general and not comparable. The authors interpreted the results as showing that increases in environmental protection regulations and disclosure regulations and public demand for environmental information led to the changes in the level of environmental disclosures by listed companies, and lack of practical reporting guidance resulted in incomparability of environmental disclosures.

Sun et al. (2003) presented the results of a mail survey of corporate environmental accounting practice conducted by Environmental Accounting Committee (EAC) of the Accounting Society of China (ASC) in late 2002. The questionnaires were sent to CEOs and CFOs of 250 companies and the response rate was 7%. The results showed that environmental expenditures and environmental liabilities were accounted for as general administration expenses and environmental disclosures by listed companies were incomplete because there were no specific environmental accounting and reporting standards and the enforcement of environmental regulations and securities regulations was not satisfactory. The authors concluded that environmental accounting in China was underdeveloped because it was not considered in accounting law and environmental regulations. Environmental accounting information was not complete and comparable. Future steps the authors suggested included amendment of accounting law and environmental regulations and setting of environmental accounting standards.

Meng (2003) analyzed environmental disclosure practices of 58 listed companies in the building materials industry over the period of 1993-2002. The author found that 29 listed companies disclosed environmental information in their prospectus and 11 companies disclosed the forecast of environmental expenditures. Environmental disclosures by listed companies increased in total as a result of increases in and strict enforcement of environmental protection regulations and increase in the public environmental awareness. But environmental disclosure varied in content and form.

Table 20-3 summarizes the major findings of these empirical studies.

Table 20-3. Environmental accounting and reporting practice in China.

Topic	Author	Empirical Findings
Corporate attitudes towards environmental accounting and reporting	Wang, Liyan et al. (1997, 1998) Xiao, Hua et al. (2002a) Sun, Xinghua et al. (2003)	• Companies' environmental awareness was low • Environmental accounting would play a very important role in environmental protection and corporate environmental management • Environmental reporting is useful for stakeholders' decision-making and environmental performance evaluation • Environmental reporting is good for a company's green image • Listed companies should report environmental accounting information in the annual reports
Environmental accounting	Wang, Liyan et al. (1998) Xiao, Hua et al. (2002a) Sun, Xinghua et al. (2003)	Accounting for environmental expenditures • Recurring and regular environmental expenditures included emission fees, improvement and replacement of equipment required by environmental laws and regulations, investment in new equipment for environmental purposes and temporary environmental expenditure • In most cases, environmental expenditures were accounted for as general administration expenses when they are incurred • There was a positive relationship between environmental expenditures and environmental regulations.
	Sun, Xinghua et al. (2003)	Accounting for environmental liabilities • In most cases, environmental liabilities were accounted for as administrative expenses when they were actually incurred • Environmental liabilities did not represent a considerable financial burden to most of the respondents
	Xiao, Hua et al. (2002a)	Accounting for environmental revenues • Recurring environmental revenues were sales revenues from products made of recycling goods, tax reductions and tax exemptions on sales revenues of recycling goods, rewards for a company's good environmental performance, special funds to a company for the environmental conservation purpose. There was no specific accounting standard for environmental revenues • Environmental Revenues were included in a company's revenues account when they were incurred

continued on next page

Table 20-3. Continued.

Topic	Author	Empirical Findings
Environmental accounting	Wang, Liyan et al. (1998) Xiao, Hua et al. (2002a) Sun, Xinghua et al. (2003)	Environmental issues were not considered in an accounting standard
Environmental reporting	Wang, Liyan et al. (1998) Xiao, Hua et al. (2002a)	Reasons for corporate environmental reporting • Environmental reporting is a mandatory governmental requirement • Companies hoped to present a greener corporate image to the outside world
	Geng, Jianxing et al. (2002) Meng, Lili (2003)	Content of corporate environmental disclosures • Listed companies disclosed environmental information according to a disclosure regulation issued by the China securities regulatory commission, which included corporate environmental burden, environmental policy, environmental impacts on business operation, environmental risk and strategy, environmental improvement and investment, environmental quality certification, etc. • A few listed companies disclosed the forecast for cost of environmental measures Form of corporate environmental disclosures • Environmental disclosures were narrative in general, qualitative, physical and non-financial
Environmental reporting	Geng, Jianxing et al. (2002) Meng, Lili (2003)	Quality of corporate environmental disclosures • Environmental disclosures were not complete, comparable and consistent Location of environmental disclosures • Listed companies disclosed environmental information in the prospectus as specified by China securities regulatory commission • Voluntary environmental disclosures were not found in annual reports of listed companies There was a positive relationship between the level of environmental disclosures and environmental regulations and the public environmental awareness

1.3.2 Mandatory Environmental Reporting

Before 2004, companies were required to prepare one form of corporate environmental report (Format A) to local environmental protection administrations and local statistics bureau. Format A was mandatory and not public. Apart from Format A, one additional environmental report (Format B) is required to be prepared and published from 2004 by companies, which are identified as "dirty companies" by the China State Environmental Protection Administration. Companies, that are not "dirty companies", are encouraged to prepare and publish voluntary environmental reports on the Internet. A comparison of Format A with Format B is provided in Table 20-4.

Table 20-4. Mandatory environmental reports in China.

Topic	Mandatory and non public environmental reporting (Format A)	Mandatory and public environmental reporting (Format B)
Purpose	State environmental administration and conservation	To help the public supervise a company's environmental behaviour
User	Local or state governmental agencies	Local or state governmental agencies, the public
Prepare	Companies operating in China	"Dirty companies"*
Contents	Environmental impact and environmental performance measured in physical units	• Environmental policy • Total pollutant emissions • Environmental pollution prevention measures** • Environmental legal issues*** • Environmental management activities • Voluntary environmental information
Format	Uniform	Unspecified
Communication	Separate paper-based environmental reporting	Separate internet-based environmental reporting
Verification	Local environmental protection administration	Local environmental protection administration

*Companies whose total waste emissions exceed China's emission standards and are included in the list of "dirty companies".
**Including: major capital investment for environmental conservation purposes, compliance with the state or local Pollutant emission standards, utilization of units of solid waste disposal and units of safe disposal of hazardous waste, etc.
***Including: environmental law violation records, punishment documents issued by environmental administrations, environmental accidents and the losses resulted from those accidents, legal issues pending.

Table 20-4 shows that the predominant forms of corporate mandatory environmental reporting in China are qualitative, physical and non-financial. Format A reporting did not lead to an increase of environmental accounting since no financial information was required.

1.4 Environmental Accounting Education

Environmental education through environmental accounting education might increase the current and future environmental awareness of the accountancy profession and help its members understand the importance of corporate environmental accountability to society and their role in sustainable development and the integration of environmental considerations into accounting. However, an investigation of the teaching programs in China showed that only a few of the leading management schools planned to offer environmental accounting as an integrated part of accounting courses or as a selective course at the undergraduate or post-graduate levels in the coming years. Teaching materials included translated textbooks (e.g. Schaltegger and Burritt 2000, Gray and Bebbington 2001) and other textbooks written by some Chinese writers. In most cases, the textbook writers were instructors.

China BELL (Business-Environment Learning and Leadership) was a good example of an environmental education program. Launched in 2000, China BELL trained professors to integrate social and environmental curricula into traditional business tracks. China BELL published a series of seven course modules; and, in collaboration with the National MBA Education Supervisory Committee; China BELL released "Corporate Environmental Management," the first environment-business textbook for China. Two chapters of this textbook were devoted to corporate environmental accounting, environmental reporting and environmental performance auditing. China BELL professors were training thousands of MBA students to think critically about the role of corporations in solving environment and development challenges.

1.5 Government Initiatives

In 1994, sustainable development became the national strategy as specified in the "China 21st Century Agenda" by the State Council of China. Since 1994, new environmental laws and regulations were introduced, with significant implications for environmental accounting and reporting. Some laws and regulations increased companies' environmental compliance costs such as emission fees, fines for breaking environmental laws, pollution prevention cost, appropriation of retained earnings for pollution prevention funds, and environmental protection auditing. Others, which were set to enhance a company's 'green behaviour', reduced environmental compliance costs through, for example, tax reductions and tax exemptions on investments in more efficient pollution prevention and energy saving technologies and also focused on sales revenues from the recycling of goods. In 2000, the State Environmental Protection Administration (SEPA) and World Resource Institute launched the China BELL program to help Chinese business school professors with the tools to train the next generation of leaders in sustainable business practices. In 2003, SEPA issued a regulation, which required 'dirty companies' to publish their environmental reports (Format B) annually from 2004 on the specified websites or in the local newspapers. Since 1997, China Securities Regulatory Commission (CSRC) has addressed the importance of environmental protection and cooperated with SEPA. CSRC issued disclosure regulations respectively in 1997 and 1999 to require listed companies to have an annual environmental audit before IPO and to disclose environmental information in the prospectus, which included environmental risk resulting from probable new environmental protection requirements, financial effects of compliance/non-compliance with environmental protection laws and regulations on earnings and competitive position, companies' environmental standards and fines for breaking environmental laws and regulations in the past three years. Both SEPA and CSRC imposed high fines and penalties for non-compliance. In June 2001, the Accounting Society of China (ASC) formed an Environmental Accounting Committee (EAC) in order to motivate environmental accounting research in China. EAC organized the 1st environmental accounting conference in November 2001. More than 40 participants, mainly from universities, submitted 30 papers at the conference. In 2002, EAC conducted a mail survey of 250 companies in order to investigate environmental accounting and reporting practice in China.

1.6 Summary

In summary, environmental accounting and reporting was at the early stage of its development in research and practices over the period of 1992-2003. Governmental initiatives have greatly motivated environmental accounting and reporting researches and practices. The majority of contributions related to environmental accounting and reporting were normative and the empirical studies were mainly descriptive. Environmental issues were not considered in the accounting standards and corporate accounting systems. Mandatory environmental reporting did not include environmental accounting information and lacked high quality. Environmental accounting education programs did not receive a level of emphasis equivalent to that given to conventional corporate accounting and teaching materials were limited.

2. FUTURE STEPS

The author suggests that steps for the future development of environmental accounting and reporting in China could include the following:

2.1 In Respect of Environmental Accounting Research

Researchers need to:
- Agree on the basic concepts of environmental accounting
- Conduct international comparative studies on the theories and practice of environmental accounting and reporting
- Introduce to China advanced environmental accounting theories and practices from around the world
- Actively participate in international academic exchanges
- Establish collaboration with international organizations (such as the Environmental Management Accounting Network Europe (EMAN-EU), Asia Pacific Centre for Environmental Accountability (APCEA), Global Reporting Initiative (GRI), Féderation des Expertes Européens (FEE), United Nations Conference of Trade and Development (UNCTAD), International Accounting Standards Committee (IASC), World Business Council for Sustainability Development(WBCSD,) etc.)
- Extend research in corporate environmental accounting and reporting standards
- Link research with practices through the development of corporate environmental accounting information systems
- Conduct empirical studies or case studies to investigate effects of Format B environmental reporting on “dirty companies” and changes in corporate environmental disclosures practices after 2004
- Work with practising accountants in the development of environmental auditing
- Harmonize with international trends of environmental accounting and reporting research

2.2 In Respect of Environmental Accounting and Reporting Practice

Government can play an important role in improving environmental accounting and reporting practices. Future governmental initiatives may include:
- Integrating environmental considerations in accounting law and standards
- Setting specific accounting and reporting standards for recognition and measurement of environmental expenditures and liabilities

- Helping companies develop corporate environmental management accounting systems
- Rewarding corporate voluntary environmental disclosures
- Developing a qualitative conceptual framework to underpin corporate environmental reporting activity
- Improving the credibility of corporate environmental reporting activities by formalizing the external attestation process

2.3 In Respect of Environmental Accounting Education

Environmental accounting education programs might be a mechanism for developing environmental accounting and reporting in China. Future accounting professionals should be trained to think critically about their role in solving environment and development challenges. Environmental accounting education programs should receive a level of emphasis equivalent to that given to conventional corporate accounting. Environmental issues could be integrated into the core courses of the Chinese CPA accreditation examination. Curriculum development partnership with well-known international organizations could be formed to create pilot courses for undergraduate and post-graduate students of accounting. Teaching needs to be linked with research and practice through the development of the curriculum.

3. CONCLUSION

Sustainable development is the national strategy in China. When following this strategy, companies need to integrate environmental issues into the business agenda and discharge their environmental accountability. Environmental accounting and reporting should be further developed to contribute something to national sustainable development and corporate environmental agenda. Future development of environmental accounting and reporting in China needs cooperative efforts of and continuous contributions from academics, government and the accounting profession.

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APPENDIX

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Chapter 21

DEVELOPMENT OF CORPORATE ENVIRONMENTAL ACCOUNTING IN KOREA

Case Studies and Policy Implications

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Abstract: Since the 1990's, environmental accounting has been widely introduced and used as an effective tool for environmental management. Leading global companies, especially in Europe, North America and Japan, have applied environmental accounting to enhance their eco-efficiency and resource productivity. Since the mid-1990s, as a wide range of stakeholders have shown their interest in corporate environmental performance and its disclosure, some leading Korean companies have started to introduce environmental accounting. From the late 1990s, the Korean government has also made efforts to disseminate environmental accounting into the industrial sector in order to encourage sustainable development in Korea. The Korean Ministry of Environment (KMOE) published its "Environmental Accounting Guideline" in order to encourage the corporate disclosure of environmental accounting information, and the LG Environmental Strategy Institute (LGESI) has been carrying out an Environmental Management Accounting (EMA) project, funded by the Korean Ministry of Commerce, Industry and Energy (KMOCIE), to develop corporate EMA cases.

Based on the outcome of these projects, this paper introduces the Korean environmental accounting guideline, the corporate cases, and environmental accounting software. It also considers some key issues in successfully adopting environmental accounting into companies in Korea as well as developing countries.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 473-489.

1. INTRODUCTION

Since the 1990's, environmental accounting has been rapidly introduced and used as an effective tool for environmental management. Leading global companies, especially in Europe, North America and Japan, have applied environmental accounting in order to enhance their eco-efficiency and resource productivity. Also, recently increasing external pressure from many stakeholders such as financial institutions, socially responsible investors, government, and local communities have made companies take interest in environmental accounting.

In line with this trend, rapidly increasing environmental costs have now caused companies to begin to integrate environmental aspects into managerial decisions at all levels. However, measuring and reporting environmental monetary performance is still in its infant stage despite a number of methodologies and practices having been developed. In this context, environmental management accounting (EMA) has recently become considered to be an important tool in adopting successful environmental management. This reflects the fact that traditional accounting, which treats most environmental costs as overhead costs, is not appropriate to provide senior managers with proper information for their strategic decision-making.

In today's business paradigm, shifting from traditional profit-focused management to progressive environmental management, environmentally sound and sustainable development has become one of the key factors in strengthening corporate competitiveness. Leading global companies have come to recognise that environmental accounting can play an important role, not only to prevent and restrict negative environmental impacts but also to facilitate positive and proactive actions.

Comparing to advanced companies in developed countries, however, most companies in developing countries are still far behind in understanding and implementing environmental accounting. In this context, this paper reviews the overall status of environmental accounting in Korea; and presents the environmental accounting guideline, some cases on outstanding Korean companies, and software for environmental accounting. Through case studies, it diagnoses the current issues and discusses some problems to be solved for the development of corporate environmental accounting in Korea.

Because environmental costs are increasing rapidly as shown in Table 21-1, some Korean leading companies have begun to consider environmental costs at a managerial decision level.

In line with this trend, in 2002 the Korean Ministry of Environment (KMOE) published the environmental reporting guideline in order to encourage disclosure of corporate environmental performance. Further, in 2004 KMOE published an "Environmental Accounting Guideline" which had been prepared by the LG Environmental Strategy Institute (LGESI), and has been carrying out the process of obtaining feedback on the guideline from industry.

Table 21-1. Corporate pollution control expenditure in Korea (source: Bank of Korea 2004, Pollution Control Expenditure in Korea).

Year / Field	1993	1997	2003
Air	876	1,351	1,973
Water *and* Soil	856	1,094	2,595
Waste	782	1,105	1,681
Noise *and* Vibration	86	66	96
Others	92	105	711
By-product sales in waste treatment (-)	10	17	467
Total	**2,682 (100)**	**3,703 (138)**	**6,589 (246)**

Unit: US$ million
( ) This figure means the value compared to the total in the base year (1993)
NB: the Bank of Korea has annually surveyed environmental expenditure by sectors (government, industry, commercial and household). However this survey of industry was designed not to measure precise corporate environmental costs well but to track environmental investment by industry, so these figures represent the trends in environmental expenditure in Korea.

On the other hand, from October 2002 to September 2004 LGESI has, with financial support from the Korean Ministry of Commerce, Industry and Energy (KMOCIE), been carrying out a three-year EMA project in order to develop EMA cases and disseminate EMA into Korean industry. The project has been successfully implemented with participation by leading Korean companies such as POSCO (steel), LG Chemicals and Hanwha Chemicals (chemicals), Samsung Electronics and Hynix (electronics and semiconductors), Korea Gas (gas), Korea Water Resources (water), Yuhan-Kimberley (paper and healthcare), Korean Airline and Asiana Airline (airlines), SK (oil), Aekyung (homecare), and Hyndai Motors (auto). The project aimed to develop a useful methodology to measure and analyse corporate environmental costs more precisely and to disseminate best practices into Korean industry.

The basic approach of KMOE was therefore focused on how to identify environmental costs and disclose information to external stakeholders through environmental reports, whereas that of KMOCIE was to promote EMA for internal decision-makers and disseminate corporate cases into industry.

2. ENVIRONMENTAL ACCOUNTING GUIDELINES IN KOREA

2.1 Overview

The guideline was developed by the KMOE in 2004 to measure environmental costs and publicly disclose environmental accounting information for Korean companies.

The guideline is composed of five chapters as follows:

- Background and goal
- Basic guidance on measuring environmental costs
- Basic guidance on measuring environmental investments
- Basic guidance on measuring environmental benefits
- Guidance for information disclosure and utilisation

The quantitative management of environmental conservation activities is an effective way of achieving and maintaining sound business management. In other words, a company can accurately identify and measure investments and costs related to environmental conservation activity. In this regard, the guideline suggests an activity-based environmental costing approach for companies in which environmental costs are classified according to environmental activities.

The guideline defines environmental costs as resources consumed by each activity in order to minimise environmental impacts and to maximise eco-efficiency in a given time period. Four categories of environmental costs are defined: pollution treatment activity costs, pollution prevention activity costs, stakeholder activity costs, and environmental compliance and remediation activity costs. The guideline recommends that companies should disclose environmental costs as shown in Table 21-2.

2.2 Categorising Environmental Costs

2.2.1 Pollution Treatment Activity Costs

Pollution treatment costs are those costs which are related to spending on end-of-pipe solutions, facilities or equipment attached to the end of production facilities. This category includes costs incurred in order to maintain compliance with legal requirements. In other words, these costs are incurred mainly to comply with existing regulations:

- Costs for air/water/noise pollution treatment
- Depreciation costs for environmental facilities
- Costs for waste disposal

Table 21-2. Disclosure format of environmental costs.

Activity		Air	Water	Waste	Soil	Others	Total
1. Pollution Treatment Activity Costs							
1.1 Operation of pollution treatment facility	Operating cost of the facility						
	External contract						
	Others						
2. Pollution Prevention Activity Costs							
2.1 EMS implementation	EMS certification						
	Training						
	Monitoring						
	Others						
2.2 Resource saving and recycling	Operating cost of the facility						
	Energy savings and response to climate change						
	Progress of distribution channel						
	External contract						
	Others						
2.3 R&D	Process improvement						
	Eco-product						
2.4 Others	Afforestation						
3. Stakeholder Relation Activity Costs							
3.1 External relations	Donations and support						
	Partnership program (local community)						
3.2 Others	Environmental protection						
	Communication						
4. Legal Compliance and Remediation Activity Costs							
4.1 Legal compliance	Tax and charges						
	Penalty						
4.2 Pollution remediation	Remediation						
	Compensation						
	Others						
Total Environmental Costs							

Note: the KMOE guideline was prepared by LGESI.

- Costs for other type of pollution treatment
- Operational costs including labour, electric power, water system, fuel and electricity, as well as sewerage fees
- Costs of equipment and facilities used for waste treatment and environmental measurement costs, materials, repair costs, etc.

2.2.2 Pollution Prevention Activity Costs

Pollution prevention costs are related to the reduction of a production facility's environmental impacts. The type of costs for both cleaner production and environmentally friendly products can be called 'cleaner technology costs'. This sub-category includes costs related to climate change, costs for recycling facility and equipment, equipment leases, depreciation, operating and associated labour costs.

- Costs for climate change and energy saving
- Costs for establishing and implementing an Environmental Management System, as well as the cost of external certification of the management system
- Costs for the recycling, resale and proper disposal of used products
- Costs for saving materials, and water
- Costs for training employees on environmental issues
- Research and Development (R&D) costs incurred in order to develop eco-products which minimise environmental impacts
- R&D costs incurred in order to curtail environmental impacts at the manufacturing stage

2.2.3 Stakeholder Activity Costs

These costs are incurred in order to build up and maintain good relations with outside stakeholders such as investors, creditors, regulators, communities, consumers, and environmental activist groups. By maintaining good relations with these stakeholders, a company can avoid unnecessary conflicts and build up an image of a 'green' enterprise to promote its competitiveness in the market.

- Costs related to donations to, or the financial support of, environmental groups
- Costs of disclosing environmental information and environmental advertising
- Costs associated with various social activities, such as the financial support of a local community's environmental conservation activities

2.2.4 Environmental Compliance and Remediation Activity Costs

These costs include compliance costs and legal fees, fines and penalties. In other words, when waste materials are discharged into the environment without adequate prior treatment, they are likely to cause damage to nature or people. Environmental damages have to be restored, and any damage to health, life and property should be compensated.

- Fines and penalties for non-compliance with environmental regulations
- Compensation paid to third parties as a result of loss or injury caused by past environmental damages and pollution
- Environmental taxes or charges

3. CORPORATE EMA CASES IN KOREA

As mentioned above, Korean companies have a growing interest in environmental accounting and a few leading companies have actually introduced it. This chapter shows two cases, on POSCO and Hanwha Chemicals respectively. Both companies are participants in the EMA project and have produced relatively good information on environmental costs. (NB: the scope of the EMA project was only monetary aspects, and it excludes physical aspects).

3.1 POSCO

3.1.1 Profile of the Company

Founded in 1968 as a public corporation, Pohang Iron and Steel Corporation (POSCO) is one of the world's largest steel-makers with an annual production capacity of 28 million tons. It operates two steel works in Pohang and Kwangyang respectively, where it produces hot rolled sheet, cold rolled sheet, wire rods, electrical steel and stainless steel. The company recently recorded an annual turnover of over US$10 billion, with around 20,000 employees.

Since starting operations, POSCO has recognised that environmental preservation is one of the most important aspects of doing business. The company published the 'POSCO Environmental Policy' in 1995 and adopted its internal environmental management system, based on ISO 14001 standards, in 1996. Furthermore, POSCO is now initiating projects to achieve corporate sustainability in economic, environmental, and social performance. With these efforts, the company hopes to obtain stakeholders' respect and global leadership.

POSCO has recently switched its environmental policy from a conventional passive monitoring approach to a proactive strategy which aims to minimise environmental impacts and constantly enhance resource productivity. At POSCO, environmental investment has moved from the installation of pollution treatment by facilities to preventing pollution generation at source. Since its foundation, POSCO has spent 2.4 trillion Won in environmental investment, amounting to 9.1% of aggregate facility investment (US$1 = approximately 1,040 Won). In 2002, environmental facility investment was 176.7 billion Won, a 66.5 billion increase over the previous year, representing 11.7% of total facility investment in 2002.

As for environmental costs, including facility operating costs and depreciation, 518 billion Won was spent in 2002. Facility operating cost of air pollution prevention occupied the greatest portion of total environmental costs, at 34%. This covered electricity, material, wages, maintenance and repair, and depreciation of dust collectors. Facility operating costs for water pollution prevention mainly involved the maintenance and repair of wastewater treatment and recycling facilities, at 15%. By-product treatment, covering transporting, processing, and recycling, represented 26% of the total environmental cost.

3.1.2 Project Process and Result

POSCO has produced information on environmental costs since the early 1990s, though the information at the first stage was very limited and focussed on operating and maintenance costs related to 'end of pipe' pollution treatment. The company therefore participated in the EMA project in order to refine its standards of environmental accounting as well as to develop an environmental accounting system linked to its ABM (activity based management) System.

For the project, a task force team was organised with staff from the Environment and Energy Team, the ABM Team, and environmental accounting experts of LGESI. The project was implemented in the following five stages:

- First stage: defining the environmental activities within the business and identifying the resource drivers linked to environmental activities.
- Second stage: identifying the environmental costs hidden in overhead costs by the cost driver of the resource.
- Third stage: measuring environmental costs and using cost drivers to allocate them between each cost centre causing the costs.
- Fourth stage: establishing guidance on evaluating the environmental benefits which are related to environmental activities.

- Fifth stage: integrating environmental accounting information into various managerial decision-making processes such as performance evaluation.

In the first step, the company defined environmental costs as follows:

> *Environmental costs are direct or indirect costs related to activities to abate or prevent environmental impacts. Moreover, they include costs for disposing of or recycling resources and for other environmental activities related to stakeholders.*

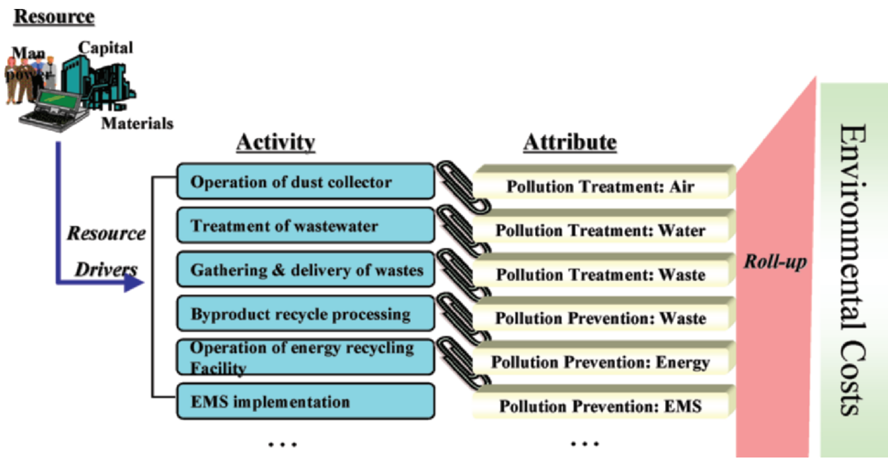

Figure 21-1. Basic structure of environmental costs in ABM system in POSCO.

The basic structure of the ABM system related to environmental accounting is shown in Figure 21-1. From the various activities of the manufacturing department and its staff, the task force team defined some to be environmental activities and then, based on guidance, rolled up these environmental activities and aggregated the environmental costs in terms of their cost drivers. At the same time, they reviewed the linkages between environmental activities and the cost items related to them. Table 21-3 shows the overall results of this review.

Environmental activities are divided in terms of two main dimensions: whether the activity is for pollution treatment or pollution prevention, and whether it is for an internal or external objective. These classifications are designed to harmonise with the KMOE guideline.

Table 21-3. Relationship of environmental activities and cost items at POSCO.

Category	Activities	Cost Items
Internal Pollution Treatment Activities	- Operation and maintenance of environ mental facilities related end of pipe - Waste collection, delivery and disposal	Depreciation, maintenance, labour, materials, external contracts, chemicals, etc.
External Pollution Treatment Activities	- Legal compliance - Environmental remediation and compensation	Environmental improvement charges, clean water charges Soil remediation, compensation for damage, etc.
Internal Pollution Prevention Activities	- By-product processing for recycling - Energy recovery (gas, heat, steam, hot water) - Water recycling - Implementation of EMS	Depreciation, maintenance, labour, materials, R&D External contracts, training audit, etc.
External Pollution Prevention Activities	- Nature conservation in surrounding vicinity - Disclosure of environmental information and advertising - Environmental donations and partnership with local communities	Publication of report, advertisement, partnership program, donation, etc.

In the course of the project, one of the most difficult tasks was to determine which facilities from the company's whole asset inventory should be defined as environmental. Since environmental costs are mostly incurred from the operation of environmental protection equipment or facilities, it is necessary to define the conceptual characteristics and scope of environmental assets before calculating environmental costs. It was, however, difficult to define the scope of the environmental assets since the facilities were complex. After several meetings to discuss this, POSCO decided on its definition of environmental assets and drew up detailed guidance. Its definition of environmental assets is:

> *Environmental assets are all equipment and facilities operated in order to abate and prevent environmental pollution.*

Under this definition, when certain equipment or facilities are purchased mainly for the purpose of environmental protection, the company recognises them to be environmental assets. In general, however, much equipment and facilities are operated with multiple purposes or functions so that it is difficult to decide whether or not the equipment is an environmental asset. On certain equipment or facilities being installed, if the main purpose (over 50%) of the installation is for environmental protection, the company determined that they should be recognised to be environmental assets. The rule of

50% is actually somewhat arbitrary, but can be a useful method for the sake of practical application.

After defining environmental assets, POSCO re-arranged the coding structure of the company's whole assets in order to recognise through its computerised costing process the environmental costs incurred by operating environmental assets.

At the fourth stage, POSCO are trying to set up the guideline for measuring environmental benefits from activities. They are also reviewing the process of using environmental accounting information through the ABM System, called "POSPIA". The company expects that "POSPIA" will measure environmental costs and benefits more accurately and effectively, and support efficient internal decision-making. POSPIA will be completed by the end of 2005, and POSCO has a plan to use environmental accounting information for the efficient reduction of waste and enhancement of resource productivity, and furthermore to link the information with environmental performance evaluation.

3.2 Hanwha Chemicals

3.2.1 Profile of the Company

Hanwha Chemicals is broadening its markets and targeting the whole world, including not only Korea but also Southwest Asia and Africa, by being the leading Korean producer of PVC, Polyethylene (LDPE, LLDPE) and Chlor-Alkali (CA). In 2002, Hanwha Chemicals recorded US$1,363 million of annual turnover, with around 1,800 employees in Korea.

Hanwha Chemicals had already predicted the importance of environmental management, and has carried out an ECO-2000 Environmental Preservation Campaign since 1991. At the same time it has raised the level of this campaign to an ECO-YHES management policy that integrates the responsibilities to be performed by corporate citizenship in the field of environment based on the leadership of the company's top management, and this has been well observed.

Hanwha Chemicals, a leader in the Korean petrochemical industry, has aimed to consolidate eco-friendly management and has published its "Sustainability Report 2003".

This case study centred on environmental costing at the Yeosu Plant in Korea, which was established in 1980 (Table 21-4). In 2002, the site recorded US$916 million of sales with around 780 employees.

Table 21-4. Environmental Costs of Hanwha Chemicals (by traditional classification).

Classification	1999	2000	2001	2002	2003
Amount invested	7,487	5,432	7,902	7,510	9,483
Operational costs	6,425	6,297	6,470	6,863	7,038
R&D costs	1,521	1,737	1,679	993	1,043
Total	15,433	13,466	16,051	15,366	17,564

Unit: US$ ’000

3.2.2 Project Process and Result

Scope and Target

The Project Team, composed of the Environmental Team, Technical Team, Accounting Team, Production Team and Hanwha Environment Research Center, first considered several different perspectives on accounting for environmental costs. After several meetings, they chose to trace environmental costs to products, in particular to EDC (ethylene dichloride) and VCM (vinyl chloride) at the Yeosu plant.

The Project Team decided the project’s targets as follows:

- Identifying the environmental costs hidden in overhead costs
- Measuring and allocating environmental costs
- Classifying environmental facilities

Definition of Environmental Costs

Environmental costs are direct or indirect costs incurred in order to prevent or reduce the environmental burden involved in the production of EDC/VCM. The classification of environmental costs is mainly based on the KMOE guideline.

Result of Collecting Environmental Costs

The environmental costs of EDC/VCM products are shown in Table 21-5. Pollution treatment costs turned out to be higher than other costs, which means that most of the environmental costs have up to now been spending on end-of-pipe treatment rather than on cleaner production.

Table 21-5. Environmental costs for EDC/VCM at Yeosu Plant.

Classification	Air	Water	Waste	Others	Total	Ratio
Pollution Treatment	982	1160	54	283	2,479	96.7%
Pollution Prevention	6	1	-	29	36	1.4%
Stakeholder	-	-	-	18	18	0.7%
Compliance/ Remediation	1	30	-	-	31	1.2%
Total	989	1,191	54	330	2,564	100%

Unit: US$ ’000

On the other hand, the ratio of environmental costs for EDC/VCM in comparison to total manufacturing costs is only 1.48% (Table 21-6). If the materials costs included in total manufacturing costs are excluded, however, the environmental costs become equivalent to 11% of the total.

Table 21-6. Ratio of environmental costs on manufacturing costs (EDC/VCM).

Products	Air	Water	Waste	Others	Total
EDC, VCM	0.57	0.69	0.03	0.19	1.48

Unit: %

3.2.3 Future Direction

At the current stage, the calculation of environmental costs has been done only at plant site level. Developing an environmental accounting system with an ESH (environment, safety and health) solution at the level of the company should be one of the most urgent issues to be pursued in the near future.

Secondly, the current calculation system at the Yeosu plant is not adequate to provide detailed information for the company's decision-making purposes. To meet the need for more detailed information, detailed guidelines for the calculation of environmental costs and effects must be developed at the company level, and the strategic importance of environmental cost information for the decision-making process should be emphasised and fully understood by the company's top management.

3.3 Environmental Accounting Software

During the EMA project, the research team has been developing 'EA Software' which can support the gathering and analysis of environmental costs in a company. The software is primarily designed to aggregate environmental costs and allocate them easily to each cost centre. In addition, the software is expected to provide companies with an effective tool to disclose environmental cost information to stakeholders, based on the KMOE guideline. Because it has been developed as a stand-alone program, however, cost data has to be input manually. The main structure and the display of software are shown in Figure 21-2 and Figure 21-3.

The function of the software is simply to provide the company with a basic tool to aggregate and allocate environmental costs. The software basically needs information on organisational structure, classification of environmental activities, and classification of environmental media. It can be used to edit organisational structure, environmental activity, and classification of costs by each company, so that environmental costs can be analysed in three dimensions.

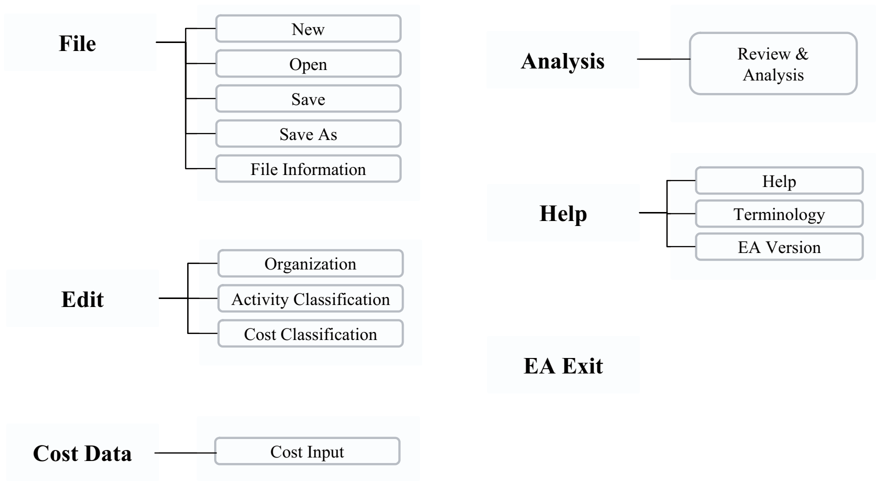

Figure 21-2. Basic Structure of EA Software.

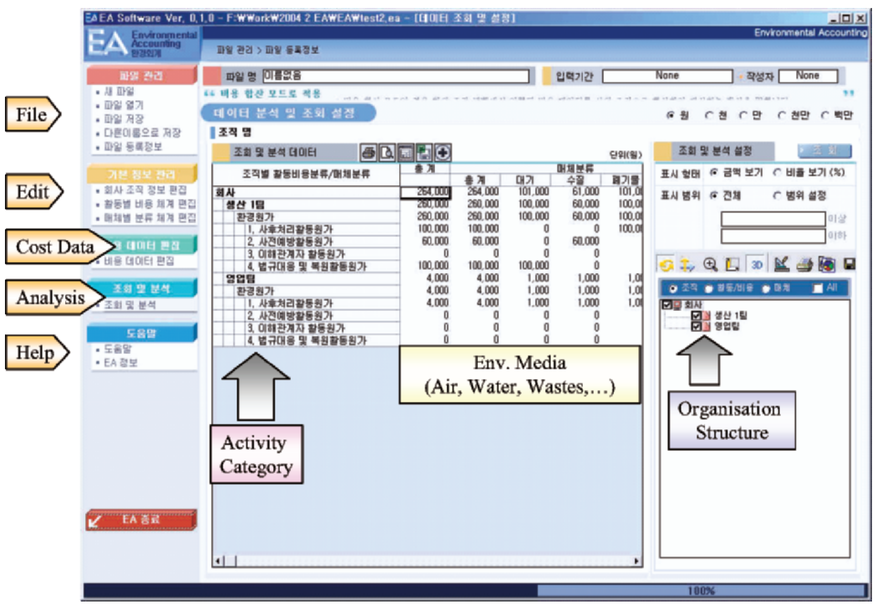

Figure 21-3. Display of the ‘EA Software’ (draft).

This software is still in its the first version and until now has been unable to provide various functions to corporate decision-makers, and has some weak points such as requiring manual operation. This means that further work is needed to upgrade the EA Software for more effective use in the process of corporate strategic decision-making.

4. IMPLICATIONS

The Korean companies which participated in the EMA project have introduced environmental accounting with the following common goals:

- To identify precisely the environmental costs hidden in indirect costs
- To evaluate the performance of their environmental management
- To review environmental investments more efficiently
- To communicate with external stakeholders

The companies mainly focussed on measuring environmental costs at first. Most managed the environmental costs which were related to pollution treatment, but did not cover costs for pollution prevention such as resource savings and recycling, cleaner production investment, fuel replacement, etc. After tracking their environmental costs, the companies have made plans to seek to evaluate the environmental benefits related to their environmental activities. They are also going to disclose environmental accounting information through their environmental reports or websites.

Through the EMA project, several key factors for introducing and implementing EMA have been discovered, as follows:

- **Senior Managers' Commitment**
  In carrying out the EMA project, the project team realised the importance of senior managers' commitment to the project. Without the interest and support of internal decision-makers, implementation of the EMA project would have faced substantial challenges and difficulties. In order to gather the necessary EMA information, the project required the participation of various departments. At an early stage in the project, accordingly, the project team had an opportunity to present an outline and stress the importance of EMA to senior managers, thereby enhancing their awareness. These efforts encouraged senior managers' interest and support.
- **Building Cooperation between Departments**
  Information on environmental costs has generally been produced only by environmental departments, which have no professional knowledge of accounting practices. Meanwhile, in Korea as in many other countries, accounting departments do not actually have a clear understanding of

environmental accounting, and accounting managers generally take a conservative attitude towards changing their practices.

To measure and allocate environmental costs effectively, however, it is necessary for the environmental department to cooperate closely with the accounting and production departments. The task force team also needs to encourage the accounting department to become positively involved in the EMA project.

- **Effective Constitution of Task Force Team and Sharing the Goal**
  It is usually crucial to organise a task force team with responsible members, leading to the better performance of the EMA project. In particular, frequent changes in its membership may give rise to serious trouble in implementing the project. It is important to keep a consistent task force team membership, and for all members to share the project goal. Ideally, a task force team should be made up from environment, accounting, and manufacturing departments all together.
- **Enhancing the Awareness of EMA and Diverse Utilisation**
  To use successfully the information on environmental costs which is produced, it is necessary for a company's management to have a common understanding on its importance and usefulness. At an early stage in projects, conducting training programs in EMA would be an effective way to develop a common awareness, and it is necessary to set up detailed plans on how to use EMA information.
- **Linkage of Environmental Accounting System and Existing Information System**
  Until now, most Korean companies have measured environmental costs not through a systemic process but through manual work by their environmental staff. Consequently, measuring and allocating environmental costs requires considerable time and is an extra burden for environmental staff. This problem arises annually during the reporting period. If at all possible, therefore, EMA information should be produced through the existing information system. It is crucial to harmonise with the existing accounting system and to minimise the inefficiency of carrying out this task manually.

5. CONCLUSION

As this paper has examined, Korean companies are at a very basic stage in EMA, but there is a great potential to establish and develop this. The efforts and policies of the Korean government can provide useful lessons for developing countries that try to promote EMA. Owing to external pressures from the government, international organisations, and NGOs, high demands are being placed on companies in developing countries to implement environmental accounting, now more than ever before. The corporate cases and issues suggested in this paper seem a good starting point to show an effective way to apply environmental accounting in developing countries.

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Chapter 22

UNDERSTANDING AND SUPPORTING MANAGEMENT DECISION-MAKING

South East Asian Case Studies on Environmental Management Accounting

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Abstract: Environmental Management Accounting (EMA) remains a relatively new decision-making initiative at the corporate level. This is particularly true when it comes to its adoption by small and medium-sized enterprises in developing and newly industrialised countries. This paper elaborates upon the concept of EMA for a research study which aims to understand the decision-making context of successful EMA application in small and medium-sized enterprises in the South-East Asian region. It describes the case study approach chosen for implementing the EMA framework established by Burritt et al. (2002) and provides initial results from the analysis. The research study is part of the international capacity development and research project addressing 'Environmental Management Accounting for small and medium-sized enterprises in South-East Asia' (EMA-SEA). More information on the EMA-SEA project is available: ema-sea@uni-lueneburg.de, www.environmental-accounting.org.

1. INTRODUCTION

Environmental Management Accounting (EMA) is designed to locate and make transparent to management positive benefits related to joint economic and environmental effects of corporate activities (Burritt et al. 2002, Schaltegger and Burritt 2000). Two contextual considerations are important

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 491-507.

when accounting for corporate environmental issues. First, smaller organisations face greater difficulties than larger organisations for a number of reasons including being time-poor and being short of appropriate specialised human resources (Hillary 1997:352). Second, developing countries face greater difficulties than developed countries because they usually do not have the institutional capacity in place to promote environmental protection, or to encourage the inclusion of environmental costs in decision-making (Davy 1997:179). Hence, implementation of EMA in small and medium-sized enterprises operating in developing countries represents a dual challenge.

This paper outlines an approach for addressing the challenge that is being adopted by the international capacity development and research project referred to as 'Environmental Management Accounting for small and medium-sized enterprises in South-East Asia' (EMA-SEA). This large scale project, funded by InWEnt gGmbH (Capacity Building International, Cologne, Germany), aims at providing practice-oriented foundations for training as well as training of trainers for implementation of EMA by South-East Asian managers, engineers, consultants, and other representatives related to small and medium-sized enterprises. As part of this project, EMA researchers from the Centre for Sustainability Management, University of Lueneburg, Germany, and The Australian National University, Canberra, Australia, are conducting 16 in depth company case studies in Indonesia, the Philippines, Thailand, and Vietnam. The studies are specifically designed to provide a basis for the development of EMA training materials and to serve as a reference point for development of good practice. The purpose of the case studies, however, goes far beyond the provision of examples where EMA has been applied. They are designed to fill in pieces of a conceptual puzzle which, when complete, will result in a research study that reveals and analyses the full picture of specific decision-making situations relating to EMA implementation in South-East Asian businesses.

This paper elaborates upon a suitable design for the research study on EMA (Section 2) by identifying the research purpose (Section 2.1), linking the study with the conceptual EMA framework (Section 2.2), and analysing relevant preconditions of small and medium-sized enterprises in a South-East Asian context (Section 2.3). It places special emphasis on the case study approach (Section 3), a well established research approach with a long history, particularly applied in sociology and psychology. Based on these preceding considerations, the paper describes the actual design of the research study and initial experiences (Section 4) before it draws provisional conclusions (Section 5).

2. SETTING UP THE RESEARCH STUDY ON EMA

2.1 Purpose of the Study

The main question of the projected research study is: What are the links between EMA tools and different types of managers within particular decision-making contexts? The study aims to explore different decision-making contexts in small and medium-sized enterprises in the South-East Asian region that are related to environmental issues, in order to understand ways in which managers from different departments and organisational levels use EMA information. It seeks to analyse the links between decision characteristics of EMA tools and different decision-makers and types of information. Dependent upon the particular decision-making contexts, generic patterns of EMA tools can be elaborated that facilitate the integration of environmental considerations into management decision-making.

To date, the majority of case studies on EMA have focussed on the application of a single tool (or, in a few cases, a combination of two or more tools). The goal of these case studies is to show thatan EMA tool such as material and energy flow accounting or environmental cost accounting, for instance, can be applied in different companies in an industry or country, how internal implementation of a particular corporate EMA tool can be undertaken, or what the costs and benefits of its application are.

In contrast, the purpose of this study is to examine different decision-making contexts in small and medium-sized enterprises in the South-East Asian region that are related to environmental issues. Furthermore, the study intends to elaborate factors which influence the application of specific EMA tools that are used to provide "required information". Thus, the study underlies a broader perspective. At the centre of the study is the exploration of different decision situations which depend on management levels and company contexts and the way these particular decisions and internal accountability processes are linked with EMA information, in particular through the use of monetary and physical measures.

2.2 EMA Conceptual Framework

The term environmental management accounting (EMA) is an umbrella term for a large set of different tools for information management. The framework used in this study to classify the variety of EMA tools serving different management purposes was developed by Burritt et al. (2002). It systematically integrates two major components of EMA: monetary environmental management accounting (MEMA) that addresses environmental aspects of corporate activities expressed in monetary units, and physical environmental management accounting (PEMA) that analyses and measures a company's impact on the natural environment, expressed in terms of physical units (Figure 22-1). In order to understand and assess the links between EMA tools and different business actors and decision-making contexts, the framework highlights the past/future and short/long-term time dimensions of the different tools as well as the regularity of information generation (see details in Burritt et al. 2002).

		Environmental Management Accounting (EMA)			
		Monetary Environmental Management Accounting (MEMA)		Physical Environmental Management Accounting (PEMA)	
		Short Term Focus	**Long Term Focus**	**Short Term Focus**	**Long Term Focus**
Past Oriented	Routinely generated information	Environmental cost accounting (e.g. variable costing, absorption costing, and activity based costing)	Environmentally induced capital expenditure and revenues	Material and energy flow accounting (short term impacts on the environment – product, site, division and company levels)	Environmental (or natural) capital impact accounting
Past Oriented	Ad hoc information	Ex post assessment of relevant environmental costing decisions	Environmental life cycle (and target) costing Post investment assessment of individual projects	Ex post assessment of short term environmental impacts (e.g. of a site or product)	Life cycle inventories Post investment assessment of physical environ-mental investment appraisal
Future Oriented	Routinely generated information	Monetary environmental operational budgeting (flows) Monetary environmental capital budgeting (stocks)	Environmental long term financial planning	Physical environmental budgeting (flows and stocks) (e.g. material and energy flow activity based budgeting)	Long term physical environmental planning
Future Oriented	Ad hoc information	Relevant environmental costing (e.g. special orders, product mix with capacity constraint)	Monetary environmental project investment appraisal Environmental life cycle budgeting and target pricing	Relevant environmental impacts (e.g. given short run constraints on activities)	Physical environmental investment appraisal Life cycle analysis of specific project

Figure 22-1. Framework of Environmental Management Accounting (source: Burritt et al. 2002).

The framework not only serves for conceptual classification purposes but also provides a pragmatic structure to identify the appropriate EMA tool for any given corporate decision setting. Furthermore, it provides a basis for managers and staff to reflect upon whether an EMA tool already in use is the most appropriate for the intended decision purposes.

2.3 Background to the Research Study

This study seeks to give a holistic perspective on the large range of tools which can be used for management decision-making and accountability by different groups of management, and in different organisations. It analyses the concept and applicability of EMA and related tools depending on the decision-making context within the company. The study focuses on small and medium-sized enterprises in South-East Asia.

2.3.1 Economic and Environmental Importance of the Region and Specific Role of Small and Medium-Sized Enterprises

A growing part of global industrial production takes place in South East Asia (see Enkama 2004 for South-East Asian countries' statistics). This is particularly true for, amongst others, globally traded goods such as textiles, electronic goods, and plastics. With the accompanying growth of production of food, paper, and mobility for domestic consumption, the South-East Asian region is characterised both by rapid economic growth and increasing environmental problems. Despite the Asian financial crisis in 1997, countries in the region have shown significant annual gross domestic product growth rates in recent years. Economic growth has boosted spending power and consumption. At the same time, energy consumption, volume of traffic, disposal of waste, and other environmentally relevant issues have significantly increased (Enkama 2004). Decoupling environmental impacts from economic growth, a prerequisite for sustainable development (Weizsäcker et al. 1997), seems to be a distant prospect as "…incremental improvements in environmental regulatory policy typically have been over-ridden by the scale effects of increased production, consumption and resource use" (Angel and Rock 2003:4).

In developing and industrializing countries, small and medium-sized enterprises make an important and dynamic contribution to economic development and lead to environmental degradation. For specific environmental impacts, their cumulative contributions may even exceed those of multinational enterprises because of relatively inefficient production techniques and operations. Substantial environmental impacts of small and medium-sized enterprises occur in industries such as metal finishing, textile manufacture, electroplating and food processing (Hobbs 2000, Scott 2000). Hence, movement towards sustainability as a whole will not succeed without sustainable development of small and medium-sized enterprises in the South-East Asian region and elsewhere. This development, however, is not just a replication of the path taken by larger enterprises towards sustainability because "Where larger firms have been developing the capabilities needed to achieve the triple bottom line over the last decade, small and medium-sized enterprises often lack the skills, knowledge and expertise, funds and time to make the desired changes" (Bruijn and Hofman 2002:195).

2.3.2 Barriers for Small and Medium-Sized Enterprises and EMA Assistance

Research into the application of environmental measures by small and medium-sized enterprises has revealed key obstacles and distinctive features (see details in Viere et al. 2004). In particular, scarce resources (time, personnel, and finance), low tolerance for failure (Herzig and Schaltegger 2004) and attitude to risk and risk management (Burritt 2005) have to be given thorough consideration. Unlike large companies, small and medium-sized enterprises cannot afford to employ additional specialist staff for managing sustainability issues. Usually existing staff complete this task in addition to their other duties. Furthermore, financial resources for external environmental training and expert help (outsourcing) are also limited. Hence, small and medium-sized enterprises often lack an awareness of the environmental impacts of the business and of the financial importance of environmental issues. A specific reason is the lack of information and appropriate tools to identify, analyse, measure and assess the links between environmental issues and financial performance. Another necessary consideration is that top managers need to rethink their attitude towards environmental issues. This will happen if the obstacles mentioned above are overcome, and if top management incentive packages include rewards based on acceptance of responsibility for corporate environmental impacts and encourage the ability to change (Burritt et al. 2003). Otherwise top management's resistance to this kind of "cultural change" remains a main obstacle on the path towards sustainable business development (Altham 2003).

The obstacles described above constitute the so-called 'integration challenge' that derives from two main concerns (according to Schaltegger et al. 2002, Schaltegger and Burritt 2005):

- *Contextual integration* – combining and simultaneously improving ecological effectiveness and ecological efficiency (and social issues) with economic aspects.
- *Instrumental integration* – integrating the management of environmental (and social) issues with conventional economic management.

From an organisational and methodological point of view environmental aspects are at present very often dealt with in parallel organisational structures and departments separate from conventional business management. This placing of environmental responsibilities in separate organisational 'silos' can produce inadequate attention to the identification of complementarities and conflicts with other parts of the organisation. It usually leads to a total or partial failure to address environmental issues. The instrumental integration of environmental management, with its concepts and tools, into conventional business management is of particular interest to small and medium-sized enterprises because of their scarce resources and lower tolerance for failure compared with larger firms. EMA provides a good starting point for a successful approach to the integration challenge. EMA tools, as mentioned before, offer the opportunity to analyse the environmental impacts of the company on the natural environment, and address the environmentally-driven monetary impacts on the company. Through the linking of environmental issues with conventional management tools EMA avoids the establishment of environmental management systems and tools which are rarely connected with day-to-day business and run parallel to other management systems of a company that already exist (Schaltegger et al. 2002). In other words: EMA supports methodological and instrumental integration of effective environmental management (substantially reducing environmental impacts) and efficiency-orientated management (considering the economic effects of environmental management) with conventional economic management.

2.3.3 EMA Application in the South-East Asian Region

The research study conducted seeks not only to use a broader perspective on the EMA implementation process than has been used in previous case studies, but also focuses on small and medium-sized enterprises in 'developing' countries, an issue that has hitherto been treated as subordinate in case study research on EMA (Burritt 2004). EMA application in the South-East Asian region is in its early stages, although the Philippines constitute an exception in this regard. Mainly driven by the country's organization of accountants, the Philippines Institute of Certified Public Accountants (PICPA), some aspects of EMA have been integrated into undergraduate accountancy education and continuing professional development (Reyes 2001, 2002). Furthermore, a Philippine guidebook on environmental management has been published recently including a chapter on environmental cost accounting (EMB 2003). Some company projects on environmental cost accounting have also been conducted in Philippine industries. However, in only a few cases are documentation and reports dealing with the application of EMA available, and these case studies have mostly been carried out in cooperation with large and multinational companies. In comparison with the Philippines, the dissemination of EMA in the other three case study target countries (Indonesia, Thailand, and Vietnam) is less advanced. In these countries institutionalisation has not taken place and only a few large companies have begun to apply EMA in recent years, for example in the Thai electronics industry.

3. THE CASE STUDY APPROACH

3.1 Purpose and Characteristics of Research Case Studies

Besides their widespread application for teaching purposes, case studies have become quite common in management accounting research in general (Ryan et al. 2002), and in EMA research (e.g. Burritt 2004, Ditz et al. 1995) and related approaches such as eco-control (e.g. Schaltegger and Sturm 1998), Sustainability Balanced Scorecard (e.g. Schaltegger and Dyllick 2002), etc. in particular in recent years. In the literature, however, there is still no precision in the terminology associated with case studies. In some situations they are recognized as a research method (e.g. Ryan et al. 2002) while others emphasize that case studies are not a specific and isolated method of empirical sociological research (e.g. Hartfiel 1982, Lamnek 1995, Witzel 1982). From their perspective a case study includes, in principle, the whole spectrum of sociological research methods, i.e. a case study is a manifold methodical approach (Hartfiel 1982, Witzel 1982) that brings the theoretical specification of a methodology into practical action without in itself being a research method (Lamnek 1995). Therefore, case studies are seen as being located between an actual research method and a methodological paradigm. However, it is commonly understood that case studies are not a methodology. Rather, they can be used for research and teaching in combination with different methodological approaches (Ryan et al. 2002).

Following Yin (2003), case studies are defined here as research strategies comprising the logic of design, data collection techniques, and specific approaches to data analysis. Yin (2003:13) defines the case study as "…an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident".

3.2 Why Case Studies?

Case studies can be seen as a guide to establish a frame for data collection in a particular piece of research, seeking to cover contextual conditions which might be relevant for the phenomenon being studied. Case studies are particularly suitable for research areas where there are few prior theoretical pieces of literature or empirical research work (Eisenhardt 1989) and the most appropriate research questions are those asking 'how' and 'why' (Yin 2003) rather than those requiring broad statistical analysis. Kloot (1997) observes that there have been numerous calls for case studies to be undertaken to study accounting in practice as well as to gain rich descriptions of actual situations (e.g. Kaplan 1986, Scapens 1990) and a fuller understanding of the context and factors which shape contemporary management practices (e.g. Parker 1994). The present study seeks to illuminate different decision-making contexts in South-East Asian companies which are related to environmental issues, and to analyse ways in which managers in different industries and from different departments and levels depend on EMA information. Thus case studies are used here as a research strategy to analyse decision-making and internal accountability processes, how environmental information influence these processes and with what results. An obvious advantage of case studies is that, by limiting the study to relatively few research objects, the researcher can deal intensively with data collected in order to gain more comprehensive, 'rich' in-depth and complex results. The selected unit for analysis is not considered as being an interchangeable, unimportant part of a sample population, but is seen as being the relevant object of investigation for the interpretation of everyday life (Lamnek 1995). In order to derive results that can be transferred, or partially or broadly generalized, project case studies should reflect holistic and realistic pictures of EMA-related decision-making contexts including all relevant dimensions of the object of interest.

By making a research study of each individual case, the aim of every EMA case study is to analyse the concurrence of factors related to the application and implementation of an EMA tool while focussing on the identification of characteristic processes in small and medium-sized enterprises in South-East Asia. Accordingly, the units of analysis are the company's decision situations. These can differ substantially, depending on the management level (top management, middle management, etc.), the department in charge (accounting, finance, production, environment, etc.), the type of management activity (investment, operational production activity, ex post assessment of a project, etc.), the time frame, and the risk attitude.

In spite of the observation that almost every country appears to be a kind of 'developing' country from the perspective of the state of EMA application and tool development, so-called developing and newly industrialized countries in particular lack good quantitative data related to the generation and utilization of environment-related information. With little systematic prior work available, case studies are especially useful for examining EMA in the four target countries in this research project. Moreover, the choice of case studies as the approach to research in this target area can be seen as a suitable way of examining complex social phenomena in such countries. Additional advantages of the case study approach are the triangulation of data collection over time, space and people, investigator triangulation using multiple observers, the multiple analysis method, and the opportunity to obtain a picture of the nature of practice in the field (Yin 2003).

Several arguments against the use of case studies relate to problems with qualitative research in general, such as, for example, the presence of subjective preconceptions. Moreover, case studies are sometimes considered to produce theories that are too complex because of the variety of data collected for analysis (Eisenhardt 1989). One of the most important limitations of the case study approach is the expected or actual limitation for the generalisation of research findings (e.g. McClintock et al. 1979). Case studies do not produce empirical data about a sample that can be generalised to other populations (such as, for instance, surveys using statistical generalisation). However, they rely on analytical generalisations through replications and verifications of certain findings in a second or more cases (Yin 2003), i.e. the projected case studies may allow the generalisation of a particular set of results to some broader theory.

3.3 Types of Case Studies

Among a number of classification schemes, some important types of case studies are explained in order to classify the projected case studies on EMA in South-East Asia. These types are often used in case study research (e.g. Stake 2000, Yin 2003).

Case studies can be *classified basically* into (Stake 2000):

- Intrinsic case studies
- Instrumental case studies
- Collective case studies

Intrinsic case studies are interesting in their own right, i.e. the specific case itself is of interest. The researcher wants to examine, for instance, an unusual case because of its value as such, instead of studying a case that provides insights into a more general problem or phenomenon. In contrast with intrinsic case studies, the purpose of an *instrumental* case study is to constitute examples of a general phenomenon and to build and develop a theory. It is based on a case that is selected in order to guide the researcher exploring how the phenomenon of interest exists within a particular case. A study that tries to illuminate a phenomenon and refine a theory by analysing several cases which provide insight into an issue is called a *collective* case study (or multiple instrumental case studies).

A second classification distinguishes cases on the basis of the *kind of research question* behind the case study, between (e.g. Yin 2003):

- Descriptive
- Explanatory
- Exploratory

A *descriptive* case study provides detailed information of an object of interest in its context. While descriptive case studies present a comprehensive account of the phenomenon under study without exploring it in relation to existing theoretical formulations, *explanatory* case studies go beyond a narrative or description of the phenomenon within its context. They aim to explain how events occurred and, based on cause-effect relationships, use explanatory concepts in order to understand the observed practices. This case study research tries to generate theories which enable researchers to provide convincing explanations of the phenomenon under study (Ryan et al. 2002). *Exploratory* case studies, however, aim to discover characteristics of the phenomenon, explore reasons for particular practices, and stimulate the researcher's sensitivity for asking questions and generating hypotheses about the background of the phenomenon of interest. The objective of this open and hardly standardised research procedure is a narrow analysis of the case in order to get a better understanding of the relevant dimensions of the research object. This classification is sometimes expanded through further types of case studies such as, for instance, illustrative or experimental case studies (e.g. Ryan et al. 2002).

Each type of case study described can be further differentiated in relation to the *number of observed cases* (similar to the distinction between single instrumental and multiple instrumental case studies in the first classification) and the *units of analysis* chosen by the researcher (Yin 2003). Trying to analyse an object of interest with two or more cases within the same study classifies this study as a multiple case study, while a single case study focuses only on a single case that may be unique or extreme or that serves as a test to verify or falsify a theory. A *multiple* case study either includes cases that attempt to gain similar results (literal replication), or it consists of cases that are deliberately *selected to produce contrasting results* in ways that are believed to be theoretically important (theoretical replication). Both types of case studies can be further distinguished between those (Yin 2003):

- With one unit of analysis that is the selected resource to be examined in the study (single/multiple case holistic design)

- With two or more units or analysis (single/multiple case embedded design)

Holistic approaches are based on a single unit of analysis and do not differentiate between any relevant subdivisions of the case, while embedded approaches underlie internal divisions and enable researchers to switch between different levels and embedded units of analysis.

Case studies can also be conducted for comparisons of complex issues (such as a decision situation). Such *comparative case studies* can be further distinguished between:

- The case-orientated comparative approach
- The variable-orientated approach

While the *variable-orientated* approach aims to test a general theory by conducting the largest number of case studies possible (hypothesis testing), the *case-orientated comparative* approach focuses on a few case studies which are described in detail and which build ideal or idealised types of decision situations explaining how the results of social processes are influenced by different contexts (Bradshaw and Wallace 1991).

In the following section, the case study approach used for the projected case studies on EMA in South-East Asia will be explained.

4. SOUTH-EAST ASIAN CASE STUDIES ON EMA IN DIFFERENT DECISION-MAKING CONTEXTS

The research design of this study is a *comparative* case study as a *distinctive form of multiple or collective case* studies (Yin 2003), comprising 16 *exploratory* case studies of small and medium-sized enterprises in Indonesia, Philippines, Thailand, and Vietnam. This specific research design has been chosen because, across cases, the studies aim to understand complex decision-making contexts and demonstrate why certain circumstances and incentives lead to certain results, whereas other cases create contrasting results. This case-orientated comparative approach tries to identify and highlight similarities and differences between the processes by which a decision was, or a set of decisions were, made (considering different sectors, organisational structures, management levels, etc.). It analyses the different types of environmental data that managers of different business functions may need when making decisions, depending on the decision-making context (Burritt et al. 2002). In order to identify generic sets of EMA tools and methods that may provide this specific information, the research design includes a set of multiple case studies for the purpose of cross-unit comparison. Results of the analysis of case studies will confirm or refute the usefulness of the framework adopted (Yin 2003). Final conclusions from cross-case comparisons will be derived when the researchers meet, present and examine the sixteen individual case reports (see also Larrinaga-Gonzalez et al. 2001).

Based on the EMA framework (Burritt et al. 2002) the specific decision-making context of a company and its sub-units is analysed in order to choose the most suitable EMA tool(s). Instead of elaborating the usefulness of specific EMA methods for various businesses, it thus approaches EMA from a different perspective by focusing on the needs and the specific decision situation of the company managers. This approach attempts to observe present practice, increase the benefit of EMA to management and meet the reality of management accounting, where internal decisions about varied and rather different issues have to be prepared, assessed, and made independent of predefined systems or standardised tools.

Interested companies were asked to apply for a case study by answering questions on their environmental situation and environmental management as well as their accounting system. Based on this information the project partners chose several companies from different representative sectors (e.g. food, textiles, electroplating). The question of possible selection bias does not arise because the multiple cases are chosen to provide insight into specific EMA issues identified by the researchers and linked with the conceptual framework for EMA.

In order to cover a wide range of phenomena and to use the sources of data for cross-validation, several sources of evidence are required (data triangulation). The study draws from multiple data sources including:

- A large spectrum of contact persons (environmental, production, and financial managers, accountants, representatives from environmental and industry associations such as, for instance, chambers of commerce)
- A variety of research methods (direct observation, documentation, archival records, interviews, and questionnaires)
- Different groupings of researchers (interviewing and observing in pairs)
- Different cases within and between sectors (e.g. electroplating, food, paper and pulp, etc.)

The case studies are conducted by analysing the data collected and developing conclusions and implications. In order to promote EMA in the South-East Asian region, so-called “local resource persons” are involved in conducting the case studies. These are mainly environmental management and engineering consultants and trainers who are both expected and able to multiply the EMA knowledge and experience they gain during the case studies.

5. CONCLUSION

The projected 16 case studies have already provided and are expected to provide further valuable business-relevant insights into various EMA related decision-making contexts in South-East Asian small and medium-sized enterprises. The variety of company situations and information needs faced by different managers in each company help with the understanding of how specific sets of EMA tools can better facilitate particular decision and internal accountability processes (including the relevance of monetary and physical measures).

Local and international EMA researchers started to conduct case studies in the autumn of 2004. Most results are, of course, preliminary at this point. However, some initial insights can already be summarized:

- The EMA approach founded on the comprehensive framework provides a good basis for bringing together an interdisciplinary team of representatives from different disciplines (business administration, engineering, environmental scientists, etc.) and departments (accounting, environmental planning, process engineers, production managers, finance, etc.), because it is appealing to business managers as well as to environmental managers and production managers.
- Materials and energy flows (measured in physical units) and related cost calculations can be helpful to identify the relevant decision situation, the necessary EMA tool(s), and the potential savings in economic and environmental terms.
- The potential for improvements in environmental as well as financial performance is high. On the one hand, simple technical modifications, such as insulation of heating or cooling systems, the use of heat exchangers, low-end solar panels, simple metric devices, and so on, in many cases reduce the environmental impact of corporate activities and at the same time save a significant amount of money. On the other hand, simple environmental management accounting improvements also produce significant environmental and financial benefits.
- The spheres of influence and societal context in which EMA is introduced (Schaltegger et al. 2003) in small and medium-sized enterprises in SEA is a critical success factor.
- As societal issues sometimes play an important role within the decision-making contexts being investigated, a few case studies will require environmental information as well as social information and thus could

contribute to the development of sustainability-orientated company case studies on EMA.

A provisional implication of the case studies is that the basic framework could usefully be adjusted and extended to include further decision dimensions in order to better reflect the various decision-making contexts. In particular consideration needs to be given to the specific identification of financial and environmental risk issues. Also, full cost accounting, addressing evident social aspects associated with corporate environmental impacts, could broaden the relevance of the EMA framework and touch upon sustainability accounting issues where externalities are a concern to the corporation.

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PART V

NEW DEVELOPMENTS AND NATIONAL EXPERIENCES IN SUSTAINABILITY REPORTING

Chapter 23

JUST A PAPER TIGER?

Exploration of Sustainability Reporting as a Corporate Communication Instrument

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Abstract: Sustainability reporting is an increasingly popular corporate communication instrument. The advantages and possibilities of communicating through a sustainability report (SR) are often discussed from a theoretical perspective, but some empirical analyses are now also being conducted. This paper concentrates on an empirical analysis of the communication process between companies and their stakeholders with the help of SR. The emerging questions are: Who reads sustainability reports? Can sustainability reporting be an all-purpose tool to attract and manage the interests of various stakeholder groups? Or is it just a trend to produce sustainability reports rather than using them in order to achieve corporate goals? Two case studies (Deutsche Telecom AG, Weleda AG) were conducted by interviewing managers and stakeholders of two companies during September 2003 and January 2004 to produce a cross-case view. The results show that both firms understand SR as an important and valuable tool to inform internal and external stakeholders about the company and its sustainability performance, but that they aim at addressing different stakeholder groups. Whilst Weleda addresses stakeholders who are primarily engaged with product quality and performance (employees, customers, suppliers, and advisory board), Deutsche Telekom addresses stakeholders who are engaged with the international finance sector (the financial community, including their own employees). Against this background, it is interesting to see the differences in reaching the relevant stakeholders in each case: Whilst a high rate of Weleda stakeholders felt addressed by the SR, a lower proportion of the Deutsche Telekom stakeholders reported this. In summary, the results of the research show that communication with a SR can be useful, not only by producing a detailed, clear and structured report, but also most importantly by improving stakeholders' engagement with the SR.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 511-531.

1. INTRODUCTION

Since the Rio Conference in 1992, corporations have been increasingly challenged to deal constructively with and contribute to the vision of sustainability. Apart from the rather theoretical debate on corporate ethics in the fields of social science, business administration and management theory (among others, see Beschorner et al. 2004, Leisinger 1997), several practical approaches to management have also been discussed. For example, comprehensive international and policy-oriented approaches which concentrate on the relationship between the company and society are of growing importance. The Global Compact was established as the first global forum to address critical issues (e.g. principles of human rights, labour standards and the environment) related to globalisation (Global Compact Office 2001). Approaches based on the ideas of Corporate Governance (e.g. Theisen 2003, Witt 2000), Corporate Social Responsibility (CSR) (Commission of the European Communities 2001, 2002, Theisen 2003, Witt 2000) and Corporate Citizenship (Schrader 2003) are often discussed separately, but appear to have common origins, at least when discussing the relationship between the company and society (Pfriem 2004). In all concepts the company plays a central role in civil society: It has rights which it can claim, but it must also fulfil its obligations so that a wider community may function (Schrader 2003:9ff, Matten and Crane 2004). Herewith, the company has its part in social control; an approach that goes beyond the classical micro-economic schemes "in which product efficiency dominated and communication intelligence was of peripheral importance" (Pfriem 2004).

Based on analysis of the theoretical and practical discussions of different approaches to corporate sustainability management, it may be concluded that both of the two essential features, the company's sustainability management system and its sustainability communication system, are becoming more important. However, to summarise the above examples, it appears that communication, both within a company and between that company and society, is being recognised as increasingly important as a modern management task. In this regard, a sustainability report (SR), which nowadays is considered to be a special corporate communication instrument, plays a very important role in presenting a clear picture of corporate values, principles, and performances in all aspects of sustainability, as requested by the stakeholders, and is a significant part of a company's relationship with its internal and external stakeholders (Bruhn 2003, Dozier et al. 1995, Eberhardt 1998, GRI 2002, Kim 2003, Klaffke and Krick 2002, Merten 1994, WBCSD 2002).

Against this background, it is not surprising that the number of registered sustainability reports is increasing worldwide from year to year. Whereas in 2000 there were only 29 sustainability reports registered, by 2002 this had increased to 98 (CorporateRegister 2004a, 2004b). In addition, stakeholders' demands for transparent information about the company in economic, environmental and social dimensions appears to be increasing (imug 2003).

The advantages and possibilities of communicating through an SR are often discussed from a theoretical perspective, but a few empirical analyses are now also being conducted. This paper concentrates on the issue of the communication process between companies and their stakeholders through a sustainability report. This urgent matter needs to be explored first before one can speak about the real advantages or disadvantages of sustainability reporting. The objectives of this paper are to learn about stakeholders' acceptance of the SR, and also their perception and behaviour towards the company after having read its sustainability report. This is illustrated in this paper on the basis of interviews with stakeholders of two German enterprises. In addition, the reason for using two different business cases is to enable a search for differences in communication strategies and their implications. The questions that emerge in this regard are: Who reads sustainability reports? Can sustainability reporting be an all-purpose tool in the effort to attract and manage the interests of various stakeholder groups? Or is it more or less a "paper tiger", and just a matter of joining the trend by producing sustainability reports rather than finally using them to achieve corporate goals?

This study focuses on corporate communication and adopts an explorative research approach based on empirical analyses. As a methodological approach, a heuristic communication framework that represents the research method in Section 2 as well as the method of the empirical analysis is utilised. Section 3 presents the different views of the communication process through sustainability reporting which are based on the communication scheme which was developed and which is featured in Section 2. Some recommendations of the findings from the empirical research are discussed in Section 4.

2. RESEARCH APPROACH AND METHOD

2.1 Communication Approach as Heuristic Framework

This study focuses on the communication process between companies and their stakeholders via SR (re stakeholder theory see e.g. Chuang 2004, Freeman 1984, Gummesson 1996, 1997, Hunt and Morgan 1994, re enviromental management issues see Achleitner 1985, Dyllick 1990, Dyllick et al. 1997, Schaltegger and Sturm 1992). To consider this, there are a variety of communication theories and definitions which have been developed by different authors (among others Bruhn 2003, Maletzke 1963, Zerfaß 1996) that can be traced back to research about communication in various scientific disciplines (Kirchner 2001:79). Each discipline claims that several aspects of communication are part of its field, and creates its own definition of communication. As a consequence, a jumble of definitions and approaches have emerged which often contradict each other (Merten 1977:9).

Basically, there are two models that can be considered: one-sided, purposeful communication (asymmetric) and two-sided or reciprocal communication (symmetric) (Kotler and Bliemel 1995, Krippendorff 1994, Maser 1971:9ff., Merten 1977, Naschold 1973). This differentiation refers to both the activities of the sender and receiver and to the goal of the communication – whether this is seen as only a process to transmit information, or also as a sense-producing process (Merten 1977:40).

In contrast to the one-sided communication model, the so-called two-sided/reciprocal communication model depicts the actual process of understanding between dialogue partners. According to Schulz von Thun (1994), two-sided communication involves concurring cognition in a sense of knowledge, experience or valuation between the communication participants (sender and receiver), which enables the signal transmission to take place. In addition, in his definition of a two-sided communication, both communication participants play an active role. The dominance of the sender is replaced by symmetry, involving both participants equally (Schulz von Thun 1994: 140). Using the illustration of a communication model by Linke et al. (1996), the two-sided communication process can be seen in Figure 23-1.

This communication model from Linke et al. is adapted and utilised in this research as a heuristic framework to explore the communication process with an SR. In this model, sender 1 (Corporation) and sender 2 (Stakeholder) have a partly concurring knowledge of their social environment (i.e. cultural and ethical background) and a comprehensive, corresponding knowledge of language. The physical, social and psychological dimensions of the joint communication situation are individually processed and evaluated. Therefore, both speakers interpret the situation differently (but some interpretations also correspond). Statements are formulated or understood on the basis of the speakers' intentions and interests and of their interpretation of the situation. As soon as it is formulated, each statement is part of the joint situation, which is itself altered by this statement (this is indicated by the arrow that interconnects 'statement/message' and 'situation' in Figure 23-1) at the same time so that communication can be understood as a reciprocal preparation of such statements or signals. The communicating partners will perceive this communication differently, based on their respective knowledge of the social environment, their individual competences, and their own interests and ideals. These are mostly accentuated with different meanings so that they will process information differently.

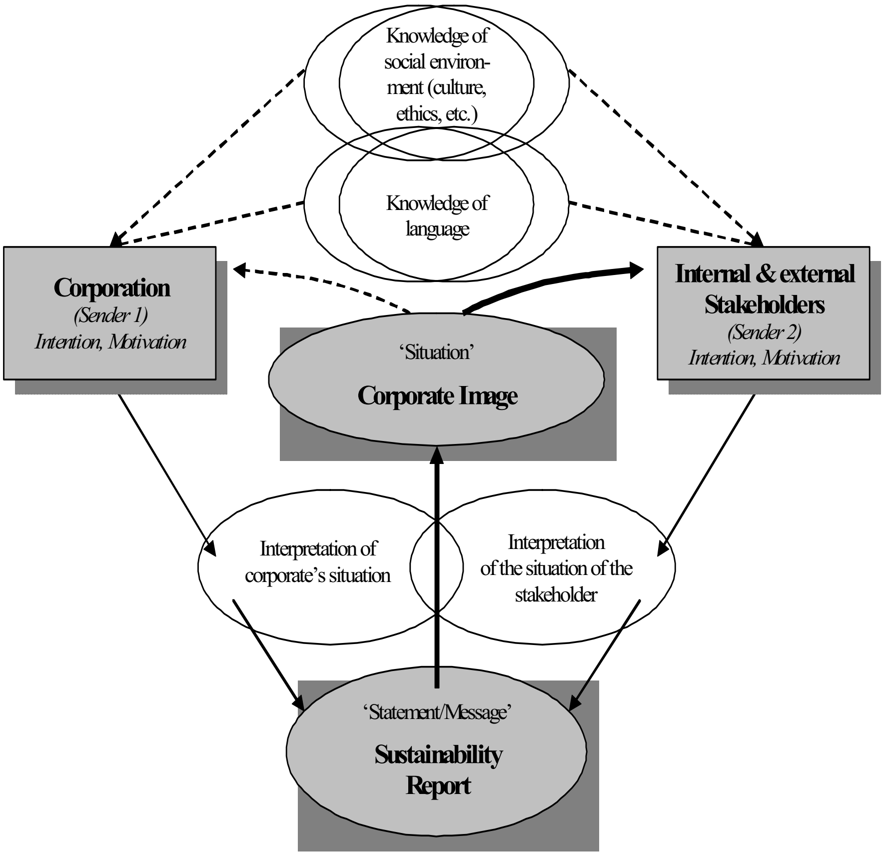

Figure 23-1. Communication scheme with a sustainability report (source: adapted from Linke et al. 1996, see also Prakke 1968).

In comparison with other communication models, at least three aspects of communication via SR are displayed which go beyond a simple cause-and-effect relationship of the communication process. The communication is seen as a reciprocal bargaining process, in which the meaning of the communication content is actively created. The model also considers the individuality and the cognitive background between sender 1 (Corporation) and sender 2 (Stakeholder) in a communication process. The cognitive background is essentially based on prior knowledge, interests, values, beliefs, etc., and substantially determines how information is perceived and interpreted.

Communication processes usually go through different phases (Kim 2003, Luhmann 1971, Maletzke 1963). In order to be able to portray the communication process between a corporation and its stakeholders, the static communication model which is presented above will be implemented in this study based on three communication phases (Kim 2003:15, Maletzke 1963:147): the pre-communicative phase, the communicative phase and the post-communicative phase (see Section 3).

In their interviews with the companies' managers, the researchers aimed to gather information about the companies' understanding of sustainability reports in general, and the companies' stakeholders (pre-communicative phase). The motives and goals of sustainability reporting and the development process of the report are explored (communicative phase). The interviews with stakeholders are aimed at gathering data about the stakeholders' view of the sustainability report and the company (pre-communicative phase), their acceptance of the contents of the report and, lastly, their perception of the corporate image (post-communicative phase).

2.2 Methodological Approach

2.2.1 Choosing the Cases: Deutsche Telekom AG and Weleda AG

The research is based on explorative studies of two selected German companies. This is because both German industry and government put great emphasis on sustainable development, in which sustainability reporting is considered to be an important part of the implementation of the vision of sustainable development, and German companies were third to UK and USA companies in submitting reports (CorporateRegister 2004c).

In choosing the enterprises, accessibility was an important factor. Several corporations listed in "best of class" rankings (Clausen et al. 2001, SustainAbility/UNEP 2003) were contacted in order to find out if they were willing to be part of this research. This approach to sampling reflects the fact that sustainability reporting is not an instant process, but rather the result of years of a company's experiences and activities in sustainable development. For this reason, two experienced companies out of these rankings seemed to bring the best insights to the research question. Another factor in choosing the enterprises was that both should represent different markets and, if possible, differing consumer sensibilities in regard to their products.

For these reasons, Weleda AG was chosen as an example of an enterprise that operates successfully in an international niche market, identified by a high potential consumer acceptance and sensibility which finally leads to a high level of trustworthiness of the company. It was established in 1920 and is headquartered in Dornach/Switzerland, with its German headquarters in Schwäbisch Gmünd. It is part of a a group which operates Europe-wide in the health care sector, basing its activities on anthroposophy and developing and selling medicine, dietetic and personal hygiene products (Weleda 2004). In Schwäbisch Gmünd alone, Weleda employs 632 employees and in 2002 had a turnover of 88 million Euros (Weleda 2003). In product testing, Weleda received many appraisals, e.g. by German consumer protection agencies "Öko-Test" and "Stiftung Warentest". According to a consumer interview from Reader's Digest regarding "European Trusted Brands 2002", it is one of the top three skin care brands which German consumers trust. Weleda is very concerned with nature protection, and has since 1996 operated an environmental management system which meets the requirements of the EU Eco-Audit regulation and the international environmental management standard ISO 14001.

The other company studied in this research is Deutsche Telekom AG, which was chosen as an example of a large company that operates successfully in an international and highly competitive, technology-driven market. Deutsche Telekom AG is one of the world's leading telecommunications and information technology service providers, and is headquartered in Bonn, Germany. The corporation is represented in 65 countries around the globe (Deutsche Telekom 2004a) and employs approximately 249,000 employees worldwide, and in 2003 its turnover was 55.8 billion Euros (Deutsche Telekom 2004b). It is committed to the principles of sustainability and uses economic, social and ecological criteria as the basis for its actions. Telekom's vision is to network society for a better future as a telecommunications and information technology corporation, and to serve customers with top quality, efficiency and innovation in every respect (Deutsche Telekom 2004c).

2.2.2 Sampling of Interviewees

Principally, the sampling of interviewees (managers and stakeholders) was conducted by a mixture of non-random and random methods. To identify the relevant stakeholder groups, both companies were asked for a list of stakeholders that they considered should be the addressees of their sustainability reporting, distinguishing between the various stakeholder groups which were identified. Regarding the relevant managers, Deutsche Telekom and Weleda both stated that there was only a small population of managers (5 managers at Deutsche Telekom and 8 managers at Weleda) who were actively involved in producing the company's sustainability report.

This method of determining the population of the company stakeholders as data sources made it possible to test whether the stakeholders actually understood themselves to be part of the correct sustainability report target group. At the end of August 2003, both companies provided stakeholder lists with some information about the stakeholders. Deutsche Telekom listed 88 stakeholders who could serve as data sources, divided into 11 important groups, and Weleda named 152 stakeholders, divided into 13 important groups. The aim was to interview a couple of stakeholders from each group and from each company. Considering also time and budgetary constraints, it was estimated that 50 interviewees per company would allow an average of approximately 4 representatives in each group. These representatives were selected randomly, and ultimately 44 Telekom stakeholders (Table 23-1) and 48 Weleda stakeholders (Table 23-2) were selected and interviewed.

Table 23-1. Stakeholders interviewed in Deutsche Telekom-Case.

• Employee (6)	• Press agency (4)
• Financial service provider (6)	• Industrial consultant (5)
• NGO-Customer protection (1)	• University/Research institute (4)
• Authority (3)	• Rating agency (5)
• NGO-Union (2)	
• NGO-Environmental group (4)	
• NGO-Politics/Agenda 21 (4)	

Table 23-2. Stakeholders interviewed in Weleda-Case.

• Employee (4)	• Press agency (4)
• Financial service provider (4)	• Industrial consultant (4)
• Customer (4)	• University/Research institute (4)
• Authority (4)	• Health insurance company (1)
• NGO-Union (4)	• Supplier (5)
• NGO-Environmental group (4)	• Advisory Board (4)
• NGO-Politics/Agenda 21 (2)	

Note: 'NGO' refers to non-governmental organisations

In the next step, a fully structured interview was chosen as a means of data collection. It consisted on the one hand of closed questions, to enable an analysis and comparison of the statements of the various stakeholder groups statistically, and on the other hand of open-ended questions in order to provide some detailed qualitative data that would help to explore the recipients' understanding and collect their suggestions for improving the report. This questionnaire had been tested at the Institute of Forest Economics in Freiburg in August 2003.

Before the interviews were conducted, an invitation letter together with the sustainability report of the respective company was sent to each external stakeholder of the two companies, following which appointments for interviews were arranged. 49 Telekom respondents (5 managers and 44 stakeholders) and 56 Weleda respondents (8 managers and 48 stakeholders) were interviewed by telephone between the end of September 2003 and mid-January 2004.

The data gained from the interviews was analysed using content analysis and quantified with frequency distribution and contingency coefficient.

3. RESULTS

3.1 Pre-Communication Phase: Prior Attitudes towards the Issue of Sustainability and the SR

Main Results

The senders of the SRs (company managers) primarily mentioned the obligation on each company to publish an SR as evidence of its sustainable management approach which could be verified. The criterion of transparency in particular was repeatedly emphasised as a commitment of the managers towards their stakeholders, though the possible marketing character of the SR was pointed out only occasionally. This is rather surprising in view of the considerable amount of resources dedicated to the compilation and production of an SR. Nevertheless, the majority of managers stated that the main goals of the report are to improve stakeholders' attitudes towards the company's image, so that identifiable and positive marketing effects were stated as expectations of the effectiveness of the SR. The hope was frequently mentioned that the effect of reading the SR might go beyond changing perceptions of image, and actually lead to real changes in stakeholders' behaviours.

The stakeholders generally had a positive attitude towards the SR, with more than 85% stating that they were either 'interested' or even 'very interested' in it. However, inquiries about concrete expectations associated with the reading of the SR did not yield any specific results. A broad and rather unspecific answer was that an SR should provide "information about the sustainable management and/or production of the company". Very rarely was a lack of interest in the SR explained with a reference to the currently fashionable buzz word "sustainability", or the claim that companies use it as an alibi to legitimise their traditional management and resource use practices.

In the vast majority of cases, the opposite effect could be observed: the current huge interest in sustainability was the reason that stakeholders devoted their attention to SRs, in which they generally had a great deal of trust. Although there were several Telekom respondents who mentioned that they considered that the information in Telekom's SR was 'not trustworthy', most of both Telekom's and Weleda's stakeholders felt that they could trust the information in the companies' SRs. For Telekom, 71.4% out of 28 respondents stated that the information in their SR was 'trustworthy' and 14.3% said 'more or less trustworthy', whereas only 14.3% considered that the information in the report was either 'not always trustworthy' or even 'absolutely untrustworthy'. For Weleda, almost all of the respondents (96.7% from 30 stakeholders) considered that the information in their SR was ‘trustworthy’ with only 3.3% considering that it was only ‘more or less trustworthy’.

When asked whether they considered themselves to be addressees of the report, 59.4% of Telekom’s 32 stakeholders felt that they were, with 31.2% feeling only neutral in their position towards the company and the other 9.4% stating that they did not feel like stakeholders or addressees of the report. For Weleda, 80% out of 30 stakeholders felt themselves to be addressees of its SR, with 16.7% feeling only neutral and the other 3.3% stating that they did not feel like either stakeholders or addressees of the report. The rates of over 40% for Telekom and 20% for Weleda were somewhat surprising (particularly the former) since the whole sample of interviewees had been provided by the companies as indicating those whom they perceived to be their stakeholders. Those figures are even more significant if one also takes into account that hardly any interviewee had read the SR prior to contact, but instead had looked at it only because of the agreed upcoming interview.

Case-Specific Conclusion

Despite a rather low willingness to engage with the content and the arguments of the SR (see above, see below), the large majority of the stakeholders saw themselves as addressees of the reports and emphasised their importance. The basic preconditions for a successful and effective communication via SR with most stakeholders are therefore rather good. Not feeling addressed by the report has severe consequences for the effectiveness of communication, which might then be either far more difficult or not even take place at all.

In this respect, it is interesting to observe the huge discrepancy between very high and optimistic expectations of managers for the publication of an SR on the one hand, and the rather low and unspecific expectations of the SR on the part of the addressees. The latter often neither have any understanding of what an SR should comprise, nor can they state what the main goal or intention of the report has been, but just position it vaguely as being somewhere between a collection of reports/data and a mere advertising brochure of the company.

General Conclusion

It can be reasoned that the unclear expectations of the readership towards an SR – which could alternatively be interpreted as reflecting the unclear vision of the senders, which could result from their own unfamiliarity with this tool – has led to a rather cautious and careful approach to it. This certainly reduces the effectiveness of the communication process: in most cases the report is not read. The research shows that many stakeholders have a clear and pronounced interest in the topic of sustainability and sustainability reporting, which could be seen as optimal preconditions for the communication process. Nevertheless, the reports were either only quickly browsed, or consulted only because of the upcoming interview. It has to be said that hardly any of the interviewees had read the SR before they were contacted, and most stakeholders used the announced interview about the SR as their only reason to read it. For both companies, some potential interviewees refused to read the report at all. Despite this, there were many vague statements made by stakeholders which underlined their interest in SR and its positive contribution towards the image of the company, which could lead to an overestimation by the sender of the possible effects of such a report.

3.2 Factors Determining the Interest of the Stakeholders in the Particular SR Prior to Communication

Main Results

Various factors influence stakeholders' willingness to engage with the report. The research took a closer look at the variables "interest in SR", "trust in the company" and "feeling of being an addressee of the report" and looked at how far these variables were correlated to the "percentage read of the report".

In the case of Telekom, the values of the contingency coefficient for the variable "interest in SR", "trust in the company", and "feeling of being as addressee of the report" to the variable "percentage read of the report" were 0.83, 0.77, and 0.61, respectively. In Weleda`s case meanwhile, the values of those variables were 0.67, 0.52, and 0.47, respectively.

The variable "stakeholders' trust in the company" together with the other variables of SR in the pre-communicative phase, such as "interest in SR" and "feeling of being an addressee of the company's SR", have a large influence on the willingness of stakeholders to read an SR, which in this case is represented by the variable "percentage read of the report" (variable of the communicative phase). This indicates that there are several factors outside the matter of creating and publishing SRs that make stakeholders want to read the report, which it is essential that companies consider, otherwise the SR will be useless because it will not be read by the stakeholders.

Case-Specific Conclusion

The findings show that the company's self-perception and the stakeholder perception of the company correspond to one another, especially at Weleda, which is characterised by a close customer loyalty. However, a slight tendency to over-estimate their own image reveals itself in the managers, who do not go into potential image problems – this also reflects itself in the SRs, where potentially critical attitudes towards their own company are hardly ever dealt with pro-actively.

General Conclusion

The image of the sender, especially their credibility and trustworthiness, is one of the central factors that determine the comprehension and finally also the effectiveness of SR. Where there is a prior negative attitude towards the company, the role that an SR can play in correcting this attitude is naturally restricted: it will hardly be possible to dispel any prejudice. At most, one might successfully discover such preconceived notions and contend with them pro-actively. This means being sensitive to and identifying the recipients' negative judgment and thereby entering into an anticipated dialogue, and thus possibly creating the willingness for the recipient to deal with the company anew and to be more open-minded.

Conversely, it holds that the better (meaning the tighter) is the bond of the stakeholders to the company, the more favourable will be their prior attitude towards the SR, but on the other hand there is less scope to improve the image of the company to them as a result of reading the SR. However this research generated a remarkably different result from this expectation, since it was those stakeholders who were already positively disposed who noted that the SR had contributed to a further strong improvement in the view that they held of the company.

Further inquiries showed that the interest in details apparently increases again at a certain level of close bonding to the company – and that a preoccupation with the SR contributes to a deepened knowledge of the company.

3.3 Contents of the SR

Main Results

There was a wide diversity in the results produced when surveying the managers concerning the information which was to be published within the scope of an SR – apparently, no clear perceptions or schemes exist amongst this group on which central issues should be mediated to the stakeholders.

Independently of this, the majority of managers who were surveyed believed that the information published in the sustainability report reached the target groups, and consequently that the selection of the presented information corresponded with the information demands of the stakeholders. The SRs thereby conveyed the impression of a broad and very comprehensive offer of information to the recipients.

The stakeholders in turn reported upon inquiry that "their" issues are generally included in the SR, but that they each also wanted more specific information or more comprehensive data based on their personal focus.

In Telekom's case, even though the stakeholders admitted that they had found in the reports information on the issues relating to environmental, social and economic dimensions of sustainability which they had expected beforehand, in their opinions there were still many such issues which were not covered in the report. They also mentioned that they considered that some issues were not well presented in the report. Meanwhile, in Weleda's case, the stakeholders also admitted that they found the issues in the environmental, social and economic dimensions which they had expected beforehand, but there were still some critics amongst them who considered that some of these issues were not well presented in the report.

The contents of the SR from both companies regarding the environmental, social and economic issues which were presented could not completely meet the stakeholders' information needs. However, the information presented in Weleda's SR could satisfy the stakeholders better than that in Telekom's SR. In Telekom's case, 26 respondents showed their interest in environmental themes by dealing with and providing their comments on the environmental issues which were presented. Meanwhile, it turned out that 27 respondents dealt with the social themes and gave their comments on the presented social issues, whereas only 17 respondents stated their enthusiasm for economic issues. In Weleda's case, the amount of the stakeholders who showed their interest by giving their comments for the presented environmental, social and economic issues were 26, 22, and 17 respondents, respectively. These results show that the social dimension of the company's activities received the most attention from Telekom's stakeholders, more than the environmental and economic dimension. The first three social issues, which are mostly expected by the stakeholders, are staff development (education, training, etc.), social standards and policy, and matters relating to staff lay-off (retirement, old age provision, etc.).

The dimension of the company's activities which received the most attention by Weleda stakeholders was the environmental dimension. The first three environmental issues which were mostly expected by the stakeholders were energy management/consumption, transport management (i.e. commuter traffic), and raw materials management/consumption.

Interestingly, the choice of topic plays a central role for the question of "reading enjoyment", which means that there are topic complexes that are considered to be particularly interesting from the perspective of the recipients which make the SR attractive: In the case of Telekom, the comparison of the value of contingency coefficient between the variables of SR in the communicative phase, such as "language style", "structure of the report", "font type and size", "design and colour", "found economic issues", "found environmental issues", and "found social issues", with the variable "reading enjoyment", shows that the social issues which were expected and found by their stakeholders play the most important role, together with the variable “structure of the report”, in affecting the “reading enjoyment” of the stakeholders. In Weleda’s case, the environmental issues which were expected and found by their stakeholders played the most important role in influencing the variable “reading enjoyment” of the stakeholders.

Case-Specific Conclusion

On average, the stakeholders’ information demands were well satisfied by each SR, although as well as a general interest about the facets of sustainability that was encountered universally, each reader approached the material with a specific interest.

General Conclusion

The deepened and specific individual interest of each stakeholder in the SR can generally not be met if it is to be kept within a reasonable scope (the text should not exceed a certain length, see below). Therefore, the demand for information of each stakeholder cannot be met by a standardised SR.

3.3.1 Layout/Understandability

Main Results

The conclusions concerning layout and understandability are based primarily on the theory of the ‘Hamburger Verständlichkeitskonzept’ (Hamburg Concept of Understandability) which is supported by considerable empirical evidence. This identifies four criteria by which to assess a text’s understandability: ‘readability’, ‘structure’, ‘brevity-conciseness’ and ‘additional stimulants’.

In general, it can be concluded that Telekom’s and Weleda’s sustainability reports matched the criteria to be ‘easy to read’. It can be assumed that the editors succeeded in adapting the language of the report to the communication abilities of their target groups.

Regarding the SR’s structure and the readability of the report, 54.8% of 31 Telekom stakeholders stated that the structure of the SR helped them to understand the contents of the report, although 29% said that they found the structure to be only ‘somewhat helpful’ and the remaining 16.2% thought that it was ‘not helpful’ or even ‘confusing’. Weleda seems to have performed much better in clearly structuring its SR: 92.6% of their 27 stakeholders stated that the structure of the SR was ‘helpful’ in understanding the contents of the report and only 7.4% considered that it was merely ‘somewhat helpful’.

The results for brevity/conciseness are somewhat contradictory. In order to determine the conciseness of the SRs, two of the interview questions dealt with the 'length of the report' and the 'preferred amount of pages'. On the one hand, the majority of Telekom stakeholders stated that the length of the report is not appropriate; but when asked about the optimal length of such a report, most preferred exactly the number of pages which the report actually had (90-130 pages). This contradiction in data simply reflects the contradicting demands on such a report. Conciseness is requested, but at the same time there is a huge interest in the issues of sustainability, and detailed information about particular aspects is therefore also demanded. This dilemma cannot be solved easily by those producing sustainability reports.

General Conclusion

Particularly for Telekom, various interviewees criticised the structure. However, as the example of Weleda shows, using a stringent structure following the well-known and almost 'conventional' structure of the three aspects of sustainability leads to a high degree of satisfaction. In relation to conciseness, the editor must deal with the aforementioned dilemma, for which no overall solution is available. Various stakeholder profiles may require different solutions to tackle this dilemma. One could think of using more elements to structure the text (see above), clearly indicating concise and detailed sections. Many recipients did not know the aim of the report and had no specific expectations, so that it may be beneficial to provide inform about its aim at the beginning.

There could be a precise and short executive summary on the first pages of the report. Another alternative would be to publish a concise print version which includes links to an extended online version that is well structured, and which presents all the necessary detailed information that stakeholders such as financial advisers, for example, may need at a later stage (regarding the relationship between printed reports and the Internet see e.g. CorporateRegister 2004d, Isenmann 2004). The main aim of this concise print version would be to convince those stakeholder groups which are in need of more detailed information that the company is transparent and trustworthy, with all information needs being fulfilled in a far more accessible format by means of the extended internet version.

3.3.2 Style and Communication Method

Main Results

It is difficult to interpret the data concerning the various communication methods and styles since very few precise comments were made and little critique was voiced. However, some elements were judged positively, particularly in Weleda's report. The following three elements were mentioned particularly often:

- Presentation of concrete and real examples of the company's sustainability management and production, which illustrate the company's approach to sustainability in a vivid way. Sustainability as a concept is rather abstract, and practical examples therefore make it more tangible.
- Humanising is another important factor for getting attention. Those parts of the text which relate to people usually attract more attention than do abstract figures and data. Obviously, people can identify themselves better with other humans. This may possibly explain the high interest in the social dimension of sustainability.
- Interviews make the report appear more personal and provide the reader with first-hand information which can be directly attributed to a particular person. The reader feels directly addressed by the information and messages in the text and therefore approaches the text more openly.

Case-Specific Conclusion

An unexpected, unconventional and lively style and presentation format, which differs from the traditional report/data collection style, usually leads to positive responses from stakeholders and increases their willingness to read the report. The unconventional elements of the reports were remembered and were mentioned when interviewees were asked about the qualities of the report.

General Conclusion

In general, it can be concluded that vividness and liveliness are of particular importance to the SR. This also includes allowing a certain degree of cotroersy. Various interviewees mentioned that the inclusion of differing voices and views particularly attracted their attention. Arguing in favour of vividness and liveliness should not be misunderstood as a statement in favour of high gloss with colours and pictures. The huge differences in style of the two reports, and the relatively positive responses to both of them, clearly show that there is no single recipe for producing the ideal SR.

The more vivid the report is, the further it distinguishes itself from mere advertising. The more that unexpected unconventional styles are used, the greater is the willingness to read the report and to remember its contents, and the higher is the probability that even those stakeholders with negative perceptions will appreciate it. In short, the effectiveness of the communication process is greater. The interviewees showed a clear preference for a colourful mixture of styles: abstract reporting, magazine-style presentations of cases, portraits or interviews instead of pure data. There are therefore no strict limits on what is allowed and what is not within an SR. Weleda applied such a vivid mixture of styles, which may possibly explain the slightly better rating of its report by the stakeholders.

4. SUMMARY AND RECOMMENDATIONS

The base of this empirical analysis, on two case studies, is not particularly large. Nevertheless, considering the significant amount of resources which the companies spend on producing their sustainability reports, the results listed above are not satisfying for them. A "cross-case view" to examine how both SRs address relevant stakeholders shows that both firms see their SR as an important and valuable tool with which to inform internal and external stakeholders about the company and its performance. However, they aim to address different stakeholder groups. While Weleda addresses stakeholders that are more engaged with product quality and performance (employees, customers, suppliers, and advisory board), Deutsche Telekom addresses stakeholders that are more engaged with the international finance sector (financial community, also including their own employees). Against this background, it is interesting to find out whether both firms reached their intended stakeholders. The research results show differences between both cases: while a high proportion of Weleda stakeholders felt that the SR was addressing them, a lower proportion of those Deutsche Telekom stakeholders who were interviewed confirmed this. The interview results offer various possible explanations for these numbers.

One possible reason is that the appearance and ease of reading of Weleda's SR addresses a wider range of stakeholder groups than does Deutsche Telekom's SR. On the other hand, Deutsche Telekom has chosen a broader content approach, with which it focuses on all sustainability aspects. By contrast, Weleda has picked a narrow theme spectrum, in which it mainly highlights the environmental and social topics. One could have expected that the wider theme spectrum which is covered in Deutsche Telekom's SR would have lead to a higher degree of feeling addressed by the stakeholders, but the results did not confirm this (see above). Another explanation could possibly have been an active involvement of stakeholders during the report-making process. However, neither company actively involved its external stakeholders in the report-making process.

An additional reason could possibly be found in the trust of the stakeholders in the companies. The trust of the interviewed Weleda stakeholders in the company is definitely stronger than in the case of Telekom. This may be a prejudice by the stakeholders that is also conferred to the SR.

This could be connected to the finding that many stakeholders were indifferent to the SR and browsed through it only because of the announced interview. The efficiency of this means of communication is rather low. The reason for this lack of interest cannot be a lack of interest in sustainability itself, as the interviewed stakeholders made it known that they are interested in issues of sustainability. Therefore, it is crucial for the SR producer to make the pursued goal clear and transparent for the stakeholder. If the stakeholder cannot get clarity and has to assume that the particular SR is either a pure advertising sheet or just "another boring collection of data", then there is the potential risk that even those persons who are interested in sustainability issues will not approach the report with the necessary openness and interest.

In addition, different stakeholder groups do prefer different styles of SRs. If, for example, a stakeholder approaches a report with a rather professional and analytical attitude, they are likely to accept or even prefer reports which are loaded with information and analytical data, similar to an annual or financial report. Nevertheless, it can be concluded that most recipients generally preferred those parts of the text which clearly differed from the classic report, which aims to provide transparency and as much data and abstract information as possible. Lively reports and mixed genres are often seen as more relevant for the current situations in corporations.

However, the recommendations concerning the design of an SR do not deal with the major problem, which is related not to the actual SR itself but to its effectiveness as a communications tool. Those who finally read or browsed through the reports did not express major criticism, and most recipients judged their quality positively. The key problem refers to the phase before reading the report: if stakeholders are not even willing to take a minute to browse through the report, it does not matter how good the report is, it simply cannot have any effect. The key issue, therefore, must be to provoke the interest and the engagement of the stakeholders with the SR by any means. Expectations need to be created that the report might contain something new - central information for the stakeholder - otherwise the report will be lost in a flood of other information sources with which the stakeholder is inundated daily.

The above-mentioned problem certainly shows the area in which there is the most urgent need for further research and investigation into sustainability reporting, if the aim is to use an SR as an effective communication tool.

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Chapter 24

INTERACTIVE SUSTAINABILITY REPORTING

Developing Clear Target Group Tailoring and Stimulating Stakeholder Dialogue

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Abstract: Providing greater interactivity is a step forward in sustainability reporting. Interactivity includes mechanisms to involve key target groups and give feedback, facilities for user control, and opportunities to select report contents and design. These features determine users' satisfaction, value, and overall attitude towards sustainability reporting, whether users actually pay attention to sustainability reports, how readers assess reliability and value of these documents, and the extent to which stakeholders are willing to make use of such communication vehicles for decision making. Today, one-way-communication on sustainability issues through 'one size fits all' hard copies or simple electronic duplicates without any added value, hardly fulfils stakeholder expectations and reporting requirements. In contrast to the importance of these issues of communication in codes of conducts, standards, guidelines, and other recommendations, however, current reporting practice has significant room for improvement. Hence, a framework is proposed and examples of current practice are presented showing how a more interactive sustainability reporting approach could be shaped and implemented.

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1. INTRODUCTION TO SUSTAINABILITY REPORTING

In the 10 years since sustainability reporting first became a topic of broader interest in academia, business, and government, it has rapidly grown to become a field of research with increasing relevance to companies (Kolk 2004) and capital markets (Flatz 2003), including through the eyes of investors (Australian Government 2003, EEA 2001). At present, sustainability reporting seems to become part of companies' daily affairs, and is entering mainstream business. Hence, for a growing number, not just for some pioneering companies, it is now a question of *how to report* on sustainability issues, and no longer a question of whether to report at all (Marshall and Brown 2003).

While the field is still evolving, as sustainability reporting matures and practice develops into a more sophisticated stage, issues of *communication* become of greater importance (ACCA 2003, 2004, Hund et al. 2004). In particular, interactivity (Teo et al. 2003), target group tailoring (Isenmann and Marx Gómez 2004), and stakeholder dialogue (WBCSD 1999, 2002) are of increasing relevance. Closely linked with cross media availability and other innovative opportunities offered by the internet and its associated technologies and services (Isenmann 2004, 2005), companies are in a phase of transition, entering a new stage of reporting (Clarke 2001, SustainAbility and UNEP 1996, Wheeler and Elkington 2001).

The way companies are communicating sustainability issues determines users' perceived satisfaction, value, and overall attitude towards sustainability reporting, whether users actually pay attention to sustainability reports, how readers assess reliability and value of these documents, and the extent to which stakeholders are willing to make use of such communication vehicles for decision making. Further, companies' communication style may have an impact on users' media preferences, e.g. whether they tend primarily to favour hard copies or computer-based reports. Employees and customers, and also suppliers and investors, usually have different information needs (Azzone et al. 1997). Hence, they want fine tuned information and expect tailor-made reports exactly meeting their specific needs in content, form, media, and information supply. Reporting merely through one size fits all hard copies or simple electronic duplicates without any added value hardly fulfils emerging requirements and future expectations (Isenmann et al. 2002).

In contrast to the widely accepted importance of how to communicate in codes of conducts (Højensgard and Wahlberg 2004), standards (ISO 2003), guidelines (Clausen et al. 2001, GRI 2002, WBCSD 2003) and other recommendations (EEA 2001, FEE 2002, Hund et al. 2004), and report current practice shows significant *room for improvement*, even for the best reporters. Hence, an outline is given of how to develop from early stages of sustainability reporting towards a more sophisticated approach, with special emphasis on interactivity, target group tailoring, and stakeholder dialogue, while fully exploiting the benefits of the internet:

- First, a framework of interactive sustainability reporting is proposed (Section 2)
- Second, examples of current practice are presented (Section 3)

The framework and illustrations reveal that companies are in a phase of transition, intensively experimenting with new reporting methods and using several instruments. Despite various developments, there is clearly a converging trend towards an interactive reporting approach, paying more attention to target groups' different information needs, and offering various opportunities for stakeholder dialogue.

2. INTERACTIVE SUSTAINABILITY REPORTING

Based on current trends and analysis of literature in the field, a framework of interactive sustainability reporting is introduced in two parts: Stakeholder reporting and internet-based reporting are examined as a proper conceptual basis for interactive sustainability reporting (Section 2.1). Then, characteristics and benefits of these conceptual elements are brought out (Section 2.2).

2.1 Concept of Interactive Sustainability Reporting

Among other components, the concept of interactive sustainability reporting should make use of three intellectual resources (Figure 24-1). In general, interactive sustainability reporting should rest on *corporate communication* in which interactivity and communicating sustainability issues play a key role. Based on corporate communication, *stakeholder reporting* and *internet-based reporting* should be taken into consideration as conceptual core elements.

2.1.1 Conceptual Baseline: Corporate Communication

Corporate communication is the overarching umbrella that summarises the company's activities, methods, and strategies to exchange information or any other intangible resources with its stakeholders, inside and outside the company. As corporate communication represents the conceptual baseline for any specific aspect of communication and reporting, it is clear that interactive sustainability reporting must be *incorporated in* and *consistent with* common corporate communication if interactivity is to make any difference in the way companies are reporting. This is especially true for the company's guiding communication principles, underlying values, and valuations, e.g. the public's right to know, disclosure about corporate performance in terms of sustainability, added value creating nature of stakeholder relationships, and belief in two-way communication.

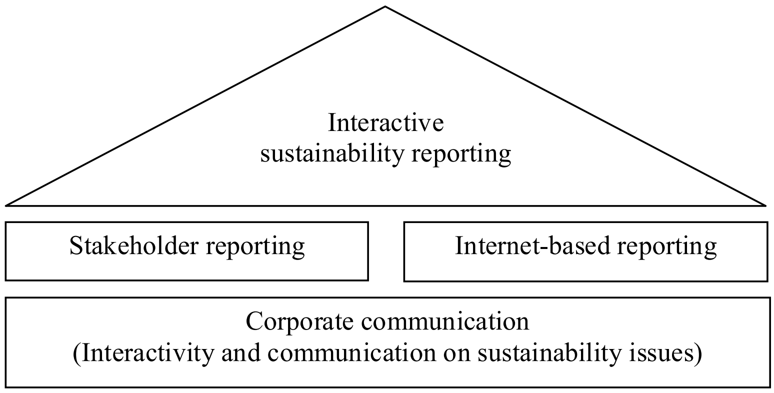

Figure 24-1. Concept of interactive sustainability reporting.

One prerequisite is that communicating sustainability issues needs to be considered as an *integral part* of corporate communication, but not as a fashionable extra or merely an exercise in public relations. The rationale why emphasis is put on interactivity and its core elements is that companies applying such an approach are convinced that engagement with stakeholders can be beneficial for the company itself and create stakeholder value (Figge and Schaltegger 2000). Further, incorporation into corporate communications illustrates that all these features are useful elements of sustainability management, and hold an important promise to meet some of the complex challenges that companies are facing today. Finally, interactive sustainability reporting, based in corporate communication, is seen not just being valuable but as a necessity.

2.1.2 Opening the Window of Reporting: Stakeholder Reporting

Based on corporate communication, stakeholder reporting is an approach of value-based management characterised by ongoing dialogue with the company's stakeholders. It aims to build and manage effective *relationships with a number of key target groups*, in which two-way communication, possibilities of choosing issues, and expressing personal preferences are the norm, but not the exception (Ernst & Young et al. 1999). As such it is a core building block in implementing continual exchange of ideas with various stakeholders. This stakeholder input should be directly linked to the management through continuous feedback into the company's strategy. These feedback loops and other mechanisms for learning ensure that stakeholder reporting is truly embedded in the company, and that issues, concerns, and expectations of key target groups are actually reflected in the company's underlying understanding of itself. Hence, stakeholder reporting is not only *for* or *about* stakeholders but rather *with* and *by* stakeholders themselves (OECD 1999).

Stakeholder reporting has its intellectual roots in the stakeholder approach. This approach of understanding the business environment takes into account a wider range of groups and individuals other than shareholders that can affect, or are affected by the company (Freeman 1984). This new perspective indicates a milestone in current strategic thinking: Companies can no longer be managed in isolation even when trying to achieve their economic objectives. To simply view a company as the private property of a small group of owners – shareholders – does not seem to be appropriate in a world of complex networks. In contrast, what is the characteristic of most companies is that they have become "quasi-public institutions", creating an arena of interests and concerns, be they conflicting, complementary, or unclear.

Stakeholder reporting only becomes a valuable and effective enterprise if companies create a fine tuned strategy for all parties identified as key target groups. Hence, companies have to develop expertise in new socio-political arenas to deal with emerging special interest groups and different non-governmental institutions, as well as with customers, suppliers, and other business partners as a task of market communications. In particular, critical stakeholders must be identified and *tailored reporting efforts* have to be taken to ensure that they are willing to contribute to the company's long term success. The role of critical stakeholders is crucial because these groups provide resources that either are difficult to substitute or would be rather costly to replace, be they capital resources, goodwill, or information and knowledge (Figge and Schaltegger 2000). Currently, there are some initiatives to develop information and communication technology (ICT) applications and software tools that may help support stakeholder relationship management (Stößlein and Mertens 2001).

2.1.3 Using Technical Support: Internet-Based Reporting

Next to stakeholder reporting, interactive sustainability reporting makes use of internet-based reporting. The idea behind reporting supported by the internet is that this computer-based method provides an array of media-specific capabilities and technical benefits (Isenmann 2004, 2005). Compared with orthodox methods, internet-based reporting overcomes the limitations of paper-based communication through one size fits all reports, hard copies, print media fixation, and one-way-communication. In contrast, a fully ICT-supported approach offers a number of features to improve sustainability communication. It elevates the field to a more sophisticated stage by adding value for reporters and report users.

In particular, internet-based reporting embraces a broader range of *beneficial characteristics* to enrich the way of communicating sustainability issues, such as combining text, still and moving images, sound, feedback, interaction, dialogue, and integration of different contents (Isenmann and Lenz 2002, Jones and Walton 1999). Because of its overall *added value creating opportunities*, the internet is already used by some reporting companies and target groups as the *pivotal platform* to provide or to access information on environmental, social, and economic performance or other related issues of sustainability (Rikhardsson et al. 2002). As Alan Benjamin, chairman of QSP Holdings plc, argues: (1998:13): "The Web site will be the prime communications vehicle of the 21st century – largely interactive. It will host a permanent dialogue as the gateway to the company."

2.1.4 New Perspectives through Interactive, Tailored and Dialogue-Oriented Sustainability Reporting

Interactive sustainability reporting is not a 'passing fashion', but rather a shift in the way forward-looking companies are going to report on sustainability issues. In that sense, the issues highlighted here are likely to become crucial reporting requirements in the near future. The transition phase may be described as a process that moves reporting away *from a "managerial closed shop procedure" towards a "quasi public effort"* of engaging and involving stakeholder (Spencer-Cooke 1995). Information supply evolves from a strict monologue and one-way company controlled exercise towards a more interactive and tailored reporting approach, while communicating with a wider audience and making more use of the internet, trying to get feedback and stakeholder commentary from a number of target groups, or even to engage interested parties to provide a "challenger report" (IfEU et al. 2001). Such a transition calls also for online communication to actually facilitate engagement, involvement, and other mechanisms of learning. Companies realise that they cannot act alone to achieve their sustainability reporting objectives.

The issues of policy and practice and their mutual interrelations, which underlie the "triple bottom line" (Clarke 2001), are too complex and usually divisive. They require involvement of different interests and continuous exchange of knowledge, from inside and outside the companies. Hence, companies face development *from strict confrontation to stakeholder engagement*. For example, pressure groups or other critical stakeholders which have primarily been seen as watchdogs could also be considered from a more open-minded perspective perhaps valued as potentially constructive partners. Some partnerships with former critics have proved to present tremendous opportunities to open new lines of communication, e.g.: Nature Conservancy–International Paper, or Conservation International–Starbucks Coffee. Non-governmental institutions could do more than engage in strong activism; they could actually co-operate and even collaborate with the company.

From a co-operative perspective, interactive reporters can make use of the stakeholders' existing expertise and profound knowledge. A prominent example was the co-operation between Hoechst AG – since 2004 incorporated into the Sanofi Aventis Group – and the Institute for Applied Ecology (Ewen et al. 1997). In a fruitful process of learning, they both developed a "Product Sustainability Assessment" tool and implemented this instrument into Hoechst sustainability management. Such successful examples illustrate: interactive, target group tailored and dialogue-orientated sustainability reporting is more than just temporary 'hype'. In contrast, it may create real value and, when incorporated into the organisation, its structures and processes, it even becomes a necessity and thus a part of the company's daily affairs. Further, when sustainability reporting is supported by an underlying ICT-infrastructure and also implemented into information management systems, the outcomes and results can improve operating practices and certainly enhance ongoing decision-making.

The *internal and external value* that companies are expecting to gain through stronger stakeholder relationships and tailored, dialogue-oriented reporting may be summarised through four advantages (Ernst & Young et al. 1999, Hund et al. 2004, Stratos 2003):

- The first benefit is to prevent and avoid shareholder risk. Such risk may occur if a company fails to establish or does not take enough care of stakeholder relationships. Ignoring real stakes, emerging concerns or reasonable interests seems to be a risky communication strategy, for example see the case of Brent Spar.
- Another benefit that companies could exploit is inspiration for innovation. Strong relationships with employees, along supply chains, and within other business networks are a fertile ground providing far more than a prerequisite to create innovative products, or to improve efficiency of processes.
- Closely related, a third benefit lies in the pool of ideas, knowledge, and other resources available in a network of relationships. Such a network provides valuable resources and crucial information necessary for the development of new markets and other business opportunities.
- As reputation is based on stakeholders' perceptions, good relationships are a vital source of intangible assets such as superior reputation and

enhanced brand value, both of which generate a number of competitive advantages.

Generally, companies are recommended to see sustainability reporting and progression in communication no longer as an extra cost or burden on hard-pressed management, but from a long-term perspective the attainable benefits may far exceed their costs. Hence, it is argued here that companies *weigh the costs and benefits* of such advanced reporting against the target groups' information needs and the companies' resource capabilities to satisfy them.

2.2 Core Elements of Interactive Sustainability Reporting

Following the concept of interactive sustainability reporting (see Figure 24-1), the three issues of communication highlighted are arranged in a system with target group tailoring and stakeholder dialogue as its core elements (Table 24-1).

Table 24-1. Elements, characteristics, and benefits of interactive sustainability reporting.

Core element	Key characteristics	Benefits
Target group tailoring	• Customisation of content, form, media, distribution channel, information supply, etc. • Cross-media-availability • Fine tuned reports (stereotyped, individualised, personalised) • Reporting on demand	• Identifying relevant target groups and crucial stakeholders • Drawing target groups' attention to the company • Encouraging target groups to participate in communication • Meeting users' different needs • Fulfilling various reporting requirements
Stakeholder dialogue	• Active, engaging, two-way communication • Conversation prior to reporting • Various opportunities for feedback and criticism • Stakeholder consultation	• Continually exchanging ideas, information, and knowledge • Taking stakeholder concerns into account for decision making • Valuing stakeholder relations • Involving stakeholders in participation, co-operation, or even partnerships • Installing learning mechanisms • Demonstrating openness and honesty in reporting

2.2.1 Customizing Reports: Target Group Tailoring

Target group tailoring is based on the fact that stakeholders interested in sustainability issues usually have heterogeneous needs and preferences. More recently, it is observed that stakeholders are more critical in the company's business (Ahmed and Hardaker 1999). Therefore, it is evident that attention must be paid to the production of reports meeting various and perhaps conflicting needs through a clearly customised reporting approach (Lenz 2003). By doing so, users certainly realise that their concerns are truly taken into account. Nevertheless, companies have difficulty in identifying relevant target groups and discovering their needs. Axelrod (1998:12) pointed out: The "dilemma facing environmental reporting since its inception – how to cater to the varied interests of different target groups – still remains today".

Target group tailoring opens a window to improve sustainability communication, because tailored reports prevent information overload. Such a tailored approach is likely to result in ongoing communication, constructive dialogue, and further steps of engagement. The internet is an excellent instrument for approaching target group tailoring and providing fine tuned reports. Otherwise it would be very laborious and probably expensive as well to produce a great number of tailored reports on print media through orthodox practice. In a more detailed fashion, target group tailoring based on the internet could be implemented through three different methods (Lenz 2003), perhaps starting with stereotyping and then developing to individualisation and personalisation (Brosowski and Lenz 2004, Isenmann and Marx Gómez 2004):

- The first approach is called *stereotyping*, a basic method employing standard user-profiles. These profiles record information needs that are thought of as characteristic for a specific group of users. Stereotypes are usually based on an analysis of empirical studies and then refined for a certain company via questionnaires and interviews with its key target groups. Using stereotypes, a tailored reporting approach provides different, but frequently static views of a report, perhaps dependent on a certain target group that users are assigned to. For example, employees have a different view of a report from customers, and thus a company may prepare a set of tailored reports. This is the way a number of users may prefer: They are provided with a pre-selected report, probably meeting their needs and likely to suit their preferences.
- The second method of target group tailoring is described as *individualisation*. Through this more sophisticated method, users are able to create their own reports. They are becoming "reporters" themselves, just selecting the information they need, either according to their current preferences, or in line with certain guidelines. Individualisation offers more

interactivity. Tailored reports that users request, however, have to be produced dynamically through a content management system. In order to manage its administration well, it is helpful to employ user-profiles. These profiles record users' preferences perhaps regarding their target groups, density, media, breadth, depth, time and the form in which the report is to be prepared.

- The third method through which target group tailoring can be accomplished is *personalisation*. Personalisation is seen as the most sophisticated approach because it records personal data in addition to users' preferences. However, recording personal data, e.g. such as name and address, is a sensitive issue that needs to be treated very carefully to prevent misuse. For that reason, any procedure for recording personal data should be voluntary, reversible, and made transparent to the user. Furthermore, its employment should be strictly limited to fine tuning communication vehicles. Implementing personalisation mirrors an insight stated early on (CICA 1994:40): "The choice of audience will directly affect the presentation of information, its tone, sophistication, emphasis, etc."

2.2.2 Involving Interested Parties: Stakeholder Dialogue

Corresponding to target group tailoring, the second core element emphasised here is stakeholder dialogue. When providing stakeholder dialogue, companies can demonstrate openness and honesty in reporting, especially if communication with participating parties is meaningful, open, and fair. Such communication makes clear that reporters take users' needs and preferences into account, e.g. through feedback loops or other mechanisms for learning, finally linking to management as an important input for reflection.

Following the guidebook on sustainability communication and stakeholder involvement (Hund et al. 2004, WBCSD 2002), stakeholder dialogues can take the form of a continuum, from passive and non-participatory to active and fully participatory. Put in business terms, the spectrum includes: information, consultation, involvement, collaboration, and empowerment. Emphasising the vital importance of stakeholder dialogue as a critical issue for reporting, Hund et al. (2004) describe different types in a five-stage model, relating to the degree of information exchange and degree of stakeholder involvement (Figure 24-2): ad hoc communication, one-way communication, two-way communication, stakeholder engagement, and partnership, understood as participatory fashion of decision making.

While the early stages have been focused primarily on ad hoc and one-way communication, sustainability reporting striving for interactivity is also about using the more sophisticated types of communication. Support by the internet offers a number of opportunities to make such an approach work., Interactive sustainability reporting could make *good business sense*, for at least two main reasons: First, sustainability reporting is becoming increasingly relevant for professional users in the financial community and decision making (Flatz 2003); and second, multiple inquiries companies are receiving from ranking and rating institutions are a really time-consuming and costly exercise (Axelrod 2000). Rather than endure these procedures, companies are recognising the value in having a readily available tool for providing the information needed.

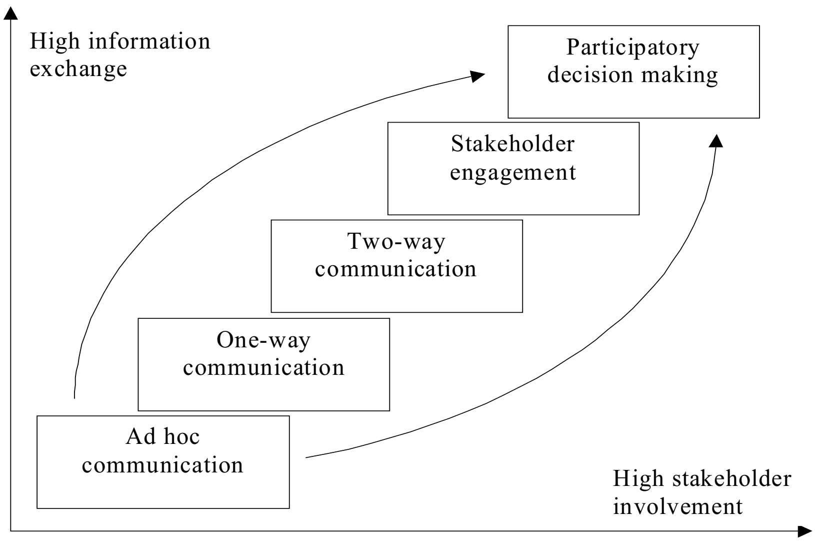

Figure 24-2. Types of communication that can be adopted for stakeholder dialogue (source: Hund et al. 2004:xi).

Based on the development model described above, Hund et al. (2004) further illustrate how to use these tools and point out the vehicles available. This catalogue of communication vehicles includes a number of written and verbal tools. Many of the following reporting instruments could be made available on the WWW, or at least benefit from internet support: Reports, brochures, leaflets, newsletters, press releases, slides, presentations, audio sequences, and video clips accessible via download and/or online, prepared for being available on demand or automatically disseminated via email or other current push technologies (Isenmann and Lenz 2001).

Stakeholder dialogue can be a *fruitful method* to be used at all phases of sustainability reporting:

- At the beginning of a reporting cycle, perhaps to draw stakeholders' attention to reports, or invite target groups to articulate what they need and expect to read
- Along the reporting processes, e.g. to provide opportunities for feedback, or criticism of reports
- Subsequent to publication and release, e.g. through stakeholder consultation as an input for forthcoming efforts and the next reporting cycle

Using the internet helps to break down barriers of information between companies and stakeholders. The bridge of this reporting medium without boundaries however has positive and negative impacts on companies. On the one hand, growing sensitivity in the public for sustainability issues linked with increasing demand for corporate transparency and credibility could influence companies to think hard about their way of doing business and thus to provide more interactivity. On the other hand, more and more critical customers tend to give feedback when they miss companies' commitment for environmental and social responsibility. In this respect, interactive sustainability online reporting could also be a reasonable defensive action companies may take against being stigmatised as insensitive to rising environmental and social issues.

Moreover, online communities will play an increasing role in forcing companies to become more sensitive to sustainability issues. Here, the internet helps bringing this about primarily by facilitating more effective and transparent communication (Ahmed and Hardaker 1999). While the focus of target group tailoring is more on information supply and of particular relevance when reports are to be published, stakeholder dialogue is understood as an element throughout the whole reporting processes. Nevertheless, the two core elements of interactive sustainability reporting are complements. For that reason, stakeholders' heterogeneous needs could be best analysed through ongoing stakeholder dialogues.

3. EXAMPLES OF CURRENT PRACTICE

Next to the conceptual considerations described above, examples of current practice are presented. The purpose of this snapshot is to illustrate that companies are in a phase of transition while intensively experimenting with new reporting methods, media and instruments (ACCA 2001, 2003, 2004, MacDonald and Peters 2003, Stratos 2004, SustainAbility 2002).

The first example given is of *target group tailoring*. Indeed, this core element of interactivity seems to be very useful, for reporting companies and for the target groups addressed. From the company's perspective, target group tailoring provides an opportunity to extend reporting success and multiply the number of users actually reached; from the stakeholders' point of view, target group tailoring is a requirement for truly meeting their needs and thus for tracking company performance over time. One approach of tailored reporting worth emulating is *BP's data desk* (Figure 24-3).

Figure 24-3. BP's data desk as an example of target group tailoring (individualisation on the left in 2003; stereotyping on the right in 2004).

Following the classification above (Section 2.2.1), the data desk in its former fashion (BP 2003) could be classified as individualisation. Meanwhile access has been changed into a stereotyped approach (BP 2004). This pre-selected approach is fine tuned to the specific needs of socially responsible investors, perhaps due to the result of a detailed stakeholder analysis. Anyway, the data desk offers various ways to tailored access and fine tuned environmental information, also linked with financial and social issues within BP's websites. Users can take a specific view and create their website meeting their specific needs.

The next example illustrates *stakeholder involvement*, which is understood as a certain method of stakeholder dialogue (see the classification in Section 2.2.2). Risk & Policy Analysts Ltd. (RPA) (2004) has launched a simple software programme on its website to involve stakeholders in their sustainability reporting (Figure 24-4). RPA is a UK-based consultancy, providing expertise in environmental management both in the public and private sector, especially regarding health and safety issues. RPA's 2001 sustainability report, which was the first, has been commended by The Association of Chartered Certified Accountants (ACCA) in its sustainability reporting awards. RPA was the only small business short-listed alongside a number of well-known companies such as Shell International, the Co-operative Bank, and BT Group plc.

Figure 24-4. RPA's download page as an example of stakeholder involvement (2004).

The ACCA found the first report 'trailblazing' and its successor in 2002 should take this one step further, while directly reflecting the views of stakeholders in terms of RPA's business and sustainability issues. In order to record these different views and to gather as many opinions as possible from the largest range of people, RPA developed a *software-based questionnaire* called "Vox Populi '02". This programme gives stakeholders a chance to communicate their views on a catalogue of topics. This catalogue was tailored to some categories of sustainability identified by the former reporting cycle.

The software "Vox Populi '02" is based on Microsoft Excel. Stakeholders are invited through promotion e.g. using push-techniques like email, and encouraged to visit RPA's website where the programme could be downloaded. The simple programme allows interested users to show where they think are RPA's greatest impacts and where the company should concentrate resources for future improvement. The catalogue compares categories like "impact on global warming", "waste to landfill", and "public access to information". The outcome has influenced the 2002 sustainability report and subsequent actions to be taken. Data collection will be continued so that benchmarks or targets RPA has defined could be tracked from a long term perspective.

The third example given by Henkel (2003) demonstrates how various vehicles and instruments could be arranged in a *sustainability communication and reporting system*. Such a comprehensive system uses various media and different distribution channels (Figure 24-5). It is built using topicality and information and includes a number of communication vehicles and reporting instruments, e.g. special interest articles, CD-ROM, site reports, open house events, sustainability ratings, reports, direct dialogue, internet platform, consumer information, press releases and other tools prepared for certain communication types or a specific stakeholder group. For example, Henkel uses web-based communication and its internet-platform primarily to publish developments on an ongoing basis, particularly for more up-to-date issues with high topicality. For Henkel, the internet offers comprehensive background information and provides several opportunities on download publications and engages in online dialogue. Further, Henkel has a smartly polished guided tour on its website illustrating corporate philosophy.

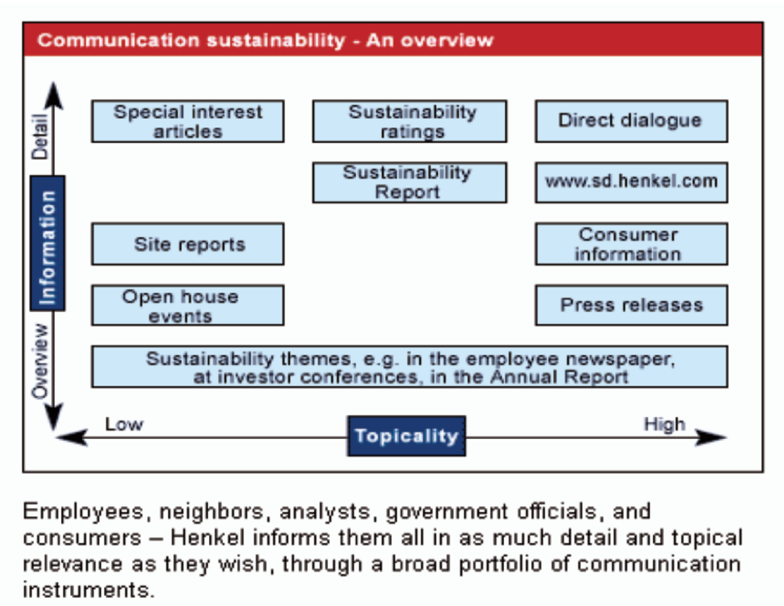

Figure 24-5. Henkel's sustainability communication instruments (2003) as an example of a reporting system.

Of course, the snapshot presented only sheds a little light on current practice. However, the examples demonstrate that companies are already providing some features of interactivity. They are going to pay more attention to target groups' different information needs, and they are offering various opportunities for stakeholder dialogue, often on a step-by-step basis. Since the early incarnations of the field in the late 1980s and early 1990s, companies have made *considerable progress* in sustainability reporting. Current practice however shows that much could be done to improve communication, especially in terms of interactivity, target group tailoring, and stakeholder dialogue while using the internet productively.

4. CONCLUSIONS

Corporate sustainability reporting includes the three pillars of environmental, social, and economic performance and its mutual interrelations, in business terms also called the triple bottom line approach. Since companies are recognising sustainability as a vital business challenge of the 21st century, communicating on such issues and triple bottom line reporting is increasingly entering the business mainstream – worldwide. Today, sustainability reporting is set to become part of companies' daily affairs. It has to be emphasised, however, that there is a vast difference between producing "sustainability *reports"* and "sustainable *companies*", regardless of how corporate sustainability ultimately is defined. The production of sustainability reports does *not* imply that the reporter is sustainable, but it *tells* its stakeholders that the company has *recognised* the challenge as a part of its business.

In a world of economic globalisation and international capital markets, the company's' range of influence often extends across geographical borders. Companies providing sustainability reports feel that their responsibilities extend beyond basic compliance with national law and local regulations, and hence they define their accountability on a global scale, often according to the triple bottom line in terms of reporting on environmental, social, and economic issues in an integrated and more or less balanced manner. Such an approach is also called in fashionable terms "making values count" (ACCA 1998), or labelled as "linking values with value" (KPMG 2000). Sometimes, it is described as "creating value and optimising prosperity according to the Triple P bottom line" (SER 2001) highlighting: profit, people, and planet as the three dimensions of a company's value creation. Others understand the approach as a matter of combining shareholder value, eco efficiency, and corporate citizenship (Echo Research 2003), or see it as a part of corporate social responsibility (CSR Europe 2000). Despite the different terms used (Loew et al. 2004), all efforts mentioned above recognise the recent rapid *increase of interest in sustainability reporting*, partly in response to demand from some of the companies' target groups.

Since its first incarnations a decade ago, companies have made considerable progression in sustainability reporting. As the field matures and practice develops into a more sophisticated stage, issues of communication become of greater importance. In particular, interactivity, target group tailoring, and stakeholder dialogue are of increasing relevance, with considerable impact for corporate reputation. According to the guidebook on sustainability communication and stakeholder involvement (WBCSD 2002:6), "disclosure is the new currency of corporate reputation", especially communications with external stakeholders. Companies have to realise that the early "honeymoon period" (DTTI et al. 1993:9) in which sustainability reports sometimes may have received media response, public attention, and awards just for existing, rather than for what they contained and how the information was communicated is over.

As a prerequisite for improvement, interactive sustainability reporting needs to be incorporated into companies' daily businesses. It can only be successful and create added value if the underlying management systems are appropriate and if the associated processes are effective and operational. For example, goals have to be set, responsibilities have to be assigned to reach the goals, and outcomes must be assessed and used as the basis for forthcoming efforts. Despite the importance of communication, the overall value of sustainability reporting depends very much on the *underlying information systems* such as financial and environmental management accounting. While the first has its focus on monitoring and control various aspects of economic performance, the latter is an excellent source for assessing the company's environmental and integrated performance (Schaltegger and Burritt 2000), at least to a certain extent.

Following Burritt et al. (2002), *environmental management accounting* includes two different perspectives: Monetary environmental management accounting addresses environmental aspects of corporate activities in monetary terms. Physical environmental management accounting measures a company's impact on nature in physical terms. Such a sophisticated management accounting system serves as a solid basis for sustainability reporting. It is particularly needed to provide integrated performance indicators like eco-efficiency. Such disclosures are not simple, as care has to be taken over a company's impact, both in monetary and physical terms, and its consistency over several reporting periods.

Finally, the incorporation of accounting and reporting reflects that sustainability communication is a continuous, long-term process, based on credible information. Today, merely disseminating glossy brochures, only producing hard copies or simple electronic duplicates without any added value, just offering one-way communication, and preparing one size fits all reports is no longer sufficient. Substantial information and greater emphasis on communication issues are required. Also it does not seem to be sufficient to use the internet merely as a further point of distribution. It could be a powerful instrument to tailor reports, facilitate dialogue, and as a source of interactive resources.

When improving sustainability reporting, *interactivity*, and – in a more detailed fashion – the core elements of *target group tailoring* and *stakeholder dialogue* may lay at its heart. Tailor-made reports, individualised or personalised communication vehicles exactly meeting users' heterogeneous needs and fulfilling different requirements proposed by a number of guidelines, as well as instruments providing even one-to one-communication are some of the internet-specific opportunities, companies could use to improve current practice. Partnerships, participation or any other form of stakeholder involvement, be it communication with interested parties or several possibilities for feedback and learning their issues and concerns, could be applied for building corporate trust and enhancing companies' reputation. The increasing awareness of interactive corporate communication in general, together with the growing demand for fine tuned reports, and closely linked with the rising need in stakeholder communications seem to be converging trends pushing the field towards a more interactive sustainability reporting approach.

Use of the *internet* and support by companies' underlying ICT-infrastructure offer an array of benefits to improve sustainability reporting, provide tailored reports, and facilitate stakeholder dialogue. Hence, companies are going to make more use of the internet. Because of its added value creating opportunities, the internet is sometimes announced as an "indispensable tool" (SustainAbility and UNEP 1999:20f., likewise Jones and Walton 1999:425). Despite varying degrees of exploiting its benefits, the internet will likely become a "facilitator" for any forward-looking approach in accounting (Boggs 1999) and reporting (Isenmann 2004, 2005).

At present, the internet is already being used by some reporting companies and target groups as the pivotal platform to provide or access information on environmental, social, and economic performance and other related issues, in very few cases even in a tailor-made fashion. Its great potential for facilitating stakeholder dialogue and its outstanding opportunity for producing customised communication vehicles in an effective, automated, and cost-saving manner however, hardly seems to have been exploited at this point. An analysis of research and literature in the field clearly shows that interactive corporate reporting is still in a *premature stage* – both, in print media as well as on the internet (Lenz 2003). For example, Andrew (2003) points out in a recent study surveying 64 Australian stock-listed companies from 2001-2002 that the type of environmental disclosure does not vary significantly from that of hard copies. Computer-based-media are still far from being utilised to their full potential. To the point "One of the more significant findings of this research was the limited ways in which corporations are using the interactive features of Web technology." (Andrew 2003:12).

In order to improve current practice, a framework of how to progress in sustainability reporting in terms of interactivity was proposed, leading from the abstract to the concrete: A *concept* of interactive sustainability reporting was introduced. This concept rests on at least two approaches, i.e. stakeholder reporting and internet-based reporting. *Examples of current practice* demonstrated that forward-looking companies are already moving away from early stages towards an advanced approach towards interactive sustainability reporting, paying more attention to target groups' different information needs, and offering a number of opportunities for stakeholder dialogue, but clearly with room for further improvement.

5. SUMMARY

Putting more emphasis on communication issues, in particular casting more light onto interactivity, target group tailoring, and stakeholder dialogue, is regarded as a *real progression* of sustainability reporting. Finally, all groups involved in or affected by sustainability reporting, inside and outside the company, benefit from such progression, be they managers, accountants, employees, members of the financial community, customers, suppliers, local authorities, non-governmental institutions, pressure groups, or organisations focused on benchmarking, rating and ranking. This will mean a need to develop conventional reporting towards an advanced approach, providing a set of tailored reporting instruments on different media (print media, internet, and CD-ROM) and in various presentation styles (format, layout), exactly meeting users' needs and preferences, using all distribution principles (push, pull), offering different opportunities for communication, feedback, criticism and learning (one-way, two-way), and therefore a considerable *challenge*.

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Chapter 25

CORPORATE SUSTAINABILITY REPORTING

Evidence from the First Swiss Benchmark Survey

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Abstract: Responding to the ever-changing business climate and new consumer awareness, more and more companies have completed the shift towards more transparent reporting practice. The change includes an adjustment from exclusively reporting on economic performance (in the annual report), to an integrated reporting in which performance with respect to the natural environment and society is outlined. This new type of reporting is termed 'sustainability reporting'. Although a comparatively new phenomenon which has been observed only since the end of the nineties, it is to be assumed that this form of reporting is replacing separate environment and/or social reports in the future.

Against this background, the Institute for Sustainable Management (IfSM) at the University of Applied Sciences, Aargau, North-Western Switzerland, instigated a research project in 2003. This represents the first attempt to perform a quantitative and qualitative analysis of corporate sustainability reporting in Switzerland. This is the second and, at the time, the most comprehensive study worldwide on reporting practices in a single country. The object of this paper is to present the results of the Swiss study, including experiences drawn from interviews with managers from 25 companies, and to briefly reflect on the methodology of the Swiss study independent of other procedures used to date.

1. INTRODUCTION

A change in companies' reporting procedures has now been evident for several years, with an ever-increasing number of companies publishing supplementary reports in addition to their standard annual reports. These new reports serve the purpose of representing the performance of the company

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 557-579.

relative to the natural environment and the society of which they are a part (Daub et al. 2003). They carry a wide range of different titles, common among which are 'Environment', or 'Environment, Health and Safety' (e.g. Heineken 2002, Xerox 2002); 'Social', 'Social Accountability', or 'Social Responsibility' (e.g. British American Tobacco 2002, Daimler Chrysler 2002, Eileen Fisher 2002), and in some cases 'Sustainability' reports (e.g. ABB 2002, Deutsche Telekom 2002, Philips 2003,). Companies in the chemical industry represent a special case. The term 'Responsible Care' (e.g. Merck 2001, Mitsui Chemicals 2001) dominates here, dating back to 1995 when the International Council of Chemical Associations (ICCA) launched an initiative with this name which its member companies were encouraged to use as a platform for demonstrating their resolve to show more responsibility to humanity and the environment.

Taking Sustainability as a linguistic springboard, the term 'Sustainability Reporting' has established itself as a label for a new form of integrated reporting procedure which deals with economic, ecological and social performance. It is possible to talk of a Sustainability Report as a public report in a narrow sense if it is successful in providing information on the current state of a company in terms of its ability to overcome what Schaltegger et al. (2003:338) refer to as "the four challenges of corporate sustainability". It must therefore contain qualitative and quantitative information on the extent to which a company succeeds during a reporting period in raising its eco- and socio-effectiveness and improving its eco- and socio-efficiency, and integrating these aspects into sustainability management. The definition of the World Business Council for Sustainable Development (WBCSD) follows this line: "We define sustainable development reports as public reports by companies to provide internal and external stakeholders with a picture of corporate position and activities on economic, environmental and social dimensions" (WBCSD 2002:7). Even stronger reference is made to the element of a balanced reporting procedure in the KPMG definition of sustainability reporting: "reports that include quantitative and qualitative information on their financial/economic, social/ethical and environmental performance in a balanced way" (KPMG/WIMM 2002:7). Although this represents a relatively new phenomenon which first appeared at the end of the 1990s, various studies have demonstrated a visible growth in this form of reporting in the past, and also the fact that it will probably continue to grow in the future.

The history of reporting on economic performance goes back further than do reporting practices regarding either the environmental or social dimensions. In the 19th century, companies had already been forced by legislation to report on their financial status in an annual report. The practice of environmental reporting arose during the late 1980s, after several international conferences and papers (the Stockholm Conference 1972, the Brundtland Report 1987, and others) along with the development of the ISO 14000 standards and the Eco-Management and Audit Scheme (EMAS), arguing the importance of environmental auditing and reporting. In contrast to the economic and environmental reporting practice that came to stay, social performance reporting experienced a short period of fame in the 1970s. During the profit-oriented 1980s this theme was forgotten, but made a comeback in the 1990s. The Swiss retail corporation Migros was one of the companies which for a few years in the 1970s reported extensively on its social performance, and also revived this practice at the end of the 1990s.

The demand for all-round responsibility of companies for both their ecological and social environments is justified by the concept of the 'quasi-public institution' in modern management theories recurrent to basic commercial-ethical considerations (Ulrich 1977). According to Ulrich and Fluri (1995:60), a company must be viewed "as a multifunctional and therefore pluralistic, legitimised value-added unit, which fulfils socio-economic functions for various target groups". It generates economic value, which means that a company is not just a means to an end but pumps added value back into society (for instance, by paying taxes, wages and salaries). At the same time, it can create negative external effects. The more that a company grows, the more negative and positive effects it generates through its activities, and the more it becomes exposed to the public eye, making it liable to provide reasons for its actions in the face of society.

This very concept provides the starting point for the reports named in the Introduction to this paper, irrespective of the titles that they carry. These are to be understood as the reaction of companies to the increasing demands of society to legitimise their actions which is characterised by terms such as 'corporate citizenship', and 'corporate social responsibility' and 'corporate responsiveness' (Ackerman and Bauer 1976, McGuire 1963, Sethi 1975, WBCSD 1999). This idea of legitimisation is also mirrored in the central reasoning behind the growing spate of often varying publications which are published by companies. Morhardt et al. (2002) state the main reasons for this as follows:

- The effort to comply with legal regulations and to reduce the potential costs of future regulations by actively participating in advance
- An attempt to balance their activities with environmental codes, especially if sanctions are threatened for non-fulfilment
- An attempt to reduce operating expenses
- The effort to improve stakeholder relations

They also refer to the effort to improve perceptions of the company's environmental activities and therefore to uphold or improve its competitive opportunities, and the knowledge that the active environmental management and/or the conscious acceptance of social responsibility which is demonstrated by the report would secure the legitimacy of the company. The WBCSD (2002) also states an almost identical reason in its most recent publication on 'Sustainable Development Reporting'.

Against this background, the IfSM at the University of Applied Sciences in North-Western Switzerland instigated the first comprehensive quantitative and qualitative analysis of corporate sustainability reporting in Switzerland. This is the second and the most comprehensive study worldwide concerning reporting practice in any one country. The Canadian consulting firm Stratos published the first study of this kind, "Stepping Forward" (2001) with an update "Building Confidence" (2003), which referred to the sustainability reports of Canadian companies. The IfSM study in 2003 was the only directly comparable study at the time. Other important benchmarks of sustainability reporting are "The Global Reporters" and "Trust Us" (SustainAbility and UNEP 2000, 2002), where 50 (The Global Reporters) respectively 100 (Trust Us) companies worldwide were investigated.

The Swiss research team specified the following determining factors for its study, based on analyses of literature and interviews with science and business experts:

- So far as possible, the evaluation method should be oriented towards evaluation procedures which have already been established by other studies. This appears logical and necessary since these are based on the guidelines laid down by the Global Reporting Initiative (GRI), which are used by most companies as a reference for developing their own reporting procedures.
- Despite these efforts to harmonise the various systems of evaluation, the methodology should overcome the weaknesses of procedures to date, and hence also contribute to the scientific discourse on the opportunities and restraints of evaluating corporate sustainability reporting.
- In contrast to studies on corporate sustainability reporting which have been published to date, the Swiss study aims to demonstrate the current level of integration of reporting in the top 100 companies in a country, independent of whether a 'real' sustainability report or, for instance, 'merely' an annual report has been submitted. Only this makes it possible to demonstrate the qualitative changes in reporting procedure practice in a country and also track the gradual establishment of corporate sustainability reporting amongst small-to-medium-sized enterprises.

2. EXISTING ASSESSMENTS AND METHODOLOGICAL CONCERNS

Assessments of reporting practice in companies have already existed in various forms for several years. For instance, in many countries, specialist journals have the annual reports from companies which are listed in stock exchange indices tested by experts once a year for the quality of their content and design (in Switzerland, this study is undertaken by the business magazine 'Bilanz': see Internet URL <:http://www.bilanz.ch>).

Another method of evaluation can often be seen in the form of awards for well-designed annual reports. Since companies started moving over to supplementing their annual reports with additional reports, the number of award schemes to recognise good environmental, social and sustainability reports has increased. The Association of Chartered Certified Accountants (ACCA) in Great Britain has been bestowing an award for the best environmental report since 1991, and added an award for the best social report in 1999 and for best sustainability report in 2001.

These newspaper rankings and the various awards are valuable since they promote interest in the reports and contribute to a systematic improvement in their quality. On the other hand, however, they also exercise a strong influence on the independent assessment of reporting practice quality which can be seen in two areas in particular:

1. International and national studies on the quality of corporate sustainability reporting which have been published to date have constantly taken into consideration only individual reports, rather than every report published by a company during the reporting period. Sustainability reports in the narrow sense are not the main concern here (KPMG/WIMM 2002, WBCSD 2002), but all types of special report published by a company in addition to the annual report. In this regard Stratos, for instance, defined a company as a sustainability reporter in its two Canadian benchmark studies from 2001 and 2003 "if it produced an environmental, environment, health and safety (EH&S), community, social responsibility or sustainability report for the 2002 reporting year, or if its 2002 annual report contained more than five pages of environmental and/or social information, including performance data" (Stratos 2003:12). From a total of 338 company reports examined, Stratos selected 35 individual reports for further study. A similar approach was taken by the study teams on the two most recent Benchmark Studies from SustainAbility and UNEP (2000, 2002) which were first published in 1994.
2. Moreover, both of the studies named above endeavour to identify and classify the best practice in corporate sustainability reporting rather than an evaluation of the current situation in reporting procedure practice

which reflects all companies, and to select for detailed study those individual reports that appear to be particularly good from an initial, general evaluation.

Both of these methodological decisions clearly demonstrate both the orientation and also the usefulness of studies of this kind. They provide a good insight into the principal opportunities that exist for companies to present their ecological and/or social performance as an integral part of special reports. Over and above this, they show companies which are planning a report of this kind, or which have already submitted a first but still weak version, the right approach to follow through 'model' reports, and to provide a benchmark for the reporting procedure.

This approach does, however, give rise to several fundamental problems of a methodological nature:

1. If a study is limited to individual reports alone, and the model for best practice is derived from this, this approach implies that the publication of special reports (sustainability, environmental, social reports etc.) should be the preferred model for all reporting procedures which are additional to the traditional annual report. This does not necessarily constitute the right approach to take.
2. To a certain degree, studies published to date have been unable to avoid the problem of 'comparing apples and oranges', due to the degree of variety in the reports referred to in the Introduction. The question of how far it is admissible to compare the sustainability report of one company with the health and safety report of another, and the environmental report of a third, and to devise a ranking, is not explained satisfactorily in any of the reports named.
3. In the case of the Global Reporters studies from SustainAbility and UNEP (2000, 2002) and the best Canadian reporters (Stratos 2001, 2003), only large and mostly multinational companies were evaluated. The argument for this was that those companies which were chosen had adequate financial means at their disposal to draft detailed reports in terms of content and design. It should not be assumed that small-to-medium-sized enterprises are in a position to use these types of reports as models.

3. NEW METHODOLOGICAL APPROACH

The aim of the Corporate Sustainability Reporting in Switzerland project was to analyse and evaluate current practice in sustainability reporting procedures in Swiss companies. These were defined as corporations with their headquarters in Switzerland, and excluded all companies which had subsidiaries in Switzerland but their headquarters abroad.

It was also decided that this initial study would be restricted to include the 100 largest companies in Switzerland, which were selected on the basis of their turnover (in the case of banks, their balance sheet total, and in the case of insurance companies, their gross premium revenue). This information was gathered from the yearly listing of the largest Swiss companies published by the HandelsZeitung (2003). There were several reasons for the decision to concentrate on these companies: experience to date shows that a much larger share of the responsibility for global problems such as the pollution of the environment or social inequality is placed on the shoulders of large companies compared to small-to-medium-sized enterprises, corresponding to the arguments of Ulrich (1977) and Ulrich and Fluri (1995), and on balance they are put under more pressure by their stakeholders.

In line with this, it was to be expected that very few if any sustainability reports would be published by companies which were not active on a multinational scale. The results of the international studies referred to above (Stratos 2001, 2003, SustainAbility and UNEP 2000, 2002) corroborate this: during the primary phase sustainability reports are published mainly by multinational companies (just as their historical precursor, environmental reports, were). Small-to-medium-sized enterprises tend to jump on the bandwagon during a secondary phase. Correspondingly, it was reasonable to assume that nearly all sustainability reports would be included in the study if limited to the named objective.

However, in order to guarantee that all sustainability reports (KPMG/WIMM 2002, WBCSD 2002) would be evaluated, the research team also carried out further in-depth research which revealed that, as well as several of the largest companies, a few medium-sized companies had also submitted sustainability reports during the period of 2001 and 2002 which were worthy of consideration. These reports were assigned a wild card in the study, i.e. they were included even though not from among the largest 100 companies. A total of 103 companies were ultimately selected and asked in writing to submit their annual reports together with any other periodically published public reports (sustainability reports, environmental reports, social reports etc.).

Keeping in mind (1) that the aim of the study was to analyse and evaluate the reporting practice of Swiss corporations, and (2) the problems of focussing a study on the individual reports referred to earlier, it was decided to extend the object of the research to include all reports published by a company. Correspondingly, all company reports with information on economic, ecological or social performance during a specific reporting period were included in the research object definition. Additional information (for instance, from the Internet, or in the form of brochures or newspapers) was included only if it was referred to explicitly as part of the report and if it was possible to identify the information which supplemented what had been provided in the report (for instance, summaries in table form, detailed figures, case studies, etc.).

As mentioned by Morhardt (2002:31), the GRI Sustainability Reporting Guidelines 2000 "are the most detailed, comprehensive, and prescriptive guidelines to date" and to follow them meticulously would be a tremendous performance by any company. The update which followed in 2002 further added to this challenge even despite the fact that the Guidelines, though extensive and supporting the principle of standardising report contents, do not require the company to fulfil or handle all topics. Companies are thus free to use the Guidelines in any way they choose, which can be seen as both a strength and a weakness in them. However, since they have been designed to fit all types of companies, it is not possible to be sure of what a report includes just by knowing that it has been based on the GRI Guidelines. In addition, the topics and indicators are written in a fairly general way, which makes implementation difficult for many companies.

In developing the method of evaluation, for the reasons named above the research team focused mainly on previous studies (Stratos 2001, 2003, SustainAbility and UNEP 2000, 2002) which in turn had mainly used the GRI Guidelines (2002) as a reference (Morhardt 2002). For this reason, the following representation is limited mainly to a description of the essential differences between the various evaluation methods. Further arguments strengthening the choice of a set of GRI-based criteria are given by Moore (2001) and Moore and Robson (2002), who also base their analysis of corporate social and financial performance in the UK supermarket industry on criteria derived from the GRI Guidelines.

The Swiss study makes no essential distinction between the four reporting categories in which the scopes of the statements to be made in a sustainability report are determined. In other words, they combine a specific quantity of significantly correlated criteria: for instance, criteria relating to the credibility and communicative quality of a report, or criteria which query quantitative performance information such as information on the proportion of regenerative energy used in production, or the proportion of women in management positions.

The project team developed a detailed list of criteria to evaluate the reports which were submitted. This list contained 33 individual criteria broken down into four main categories (see Table 25-1), combining a number of meaningfully associated criteria. Note that one criterion consists of several indicators which represent its several different aspects (see Table 25-2). In Reporting Category A (Context and Coverage), general information is collated that is required from the reporting team on the company and the reports submitted. For instance, this includes the company's vision in economic, ecological and social terms, or a representation of the markets in which it would like to become more active, and how this relates to its function as a social and environment policy player. Even in these descriptions it is possible for the reader to recognise relatively easily the extent to which a company has re-defined its economic role and no longer sees itself as a mere driver of sales and source of profit.

Clear and distinct information is collated in Reporting Category B (Policy, Management Systems and Stakeholder Relations). Following a general introduction, the focus should now be placed on stakeholder relations and the company's management system (see Table 25-1). What are the company's target groups? How does it incorporate them into its decision-making processes? How are the economic, ecological and social risks managed? Questions of this type need to be answered by a company in order to prove how serious its interest is in making a contribution to the sustainable development of its social and ecological environment.

While information of a qualitative type is collated in reporting Categories A and B, Reporting Category C (Dimensions of Performance) contains quantitative information. This is the heart of a sustainability report, since it makes reference to hard data and facts which a company can use to demonstrate economically, socially and ecologically responsible action. The performance criteria are divided into four criteria clusters (see Table 25-1), with related criteria in each respective cluster. Under the criteria cluster of Economic Performance are bundled the criteria: Profit, Earnings & Income/ Key Financials, Employee Compensation, Customer Satisfaction & Suppliers, and Community Development and Local Economic Development. Indicators regarding Environmental Performance are covered by the criteria: Consumption of Resources (Quantity), Dealing with Resources (Quality), Environmental Pollution by Emissions to Air, Environmental Pollution by Effluents to Water and Waste, and Ecological Responsibility. The criteria under the heading Social Performance are: Human Resource Management and Corporate Culture, Health and Safety, Distribution of Wages, Benefits and Continuing Education Possibilities and Offers, Labour and Human Rights; Non-Discrimination, Regional and Global Social Development, and Responsibility, and Integrated Performance: Economic, Environmental, and Social key-figures put in relation to another quantity (production unit etc.). Eco-efficiency indicators are bundled in the same way.

Table 25-1. Reporting categories.

Cat.	Themes	Factor	Criteria	Score	(Max.)	in %
A	*Context and Coverage*		*4*		*12*	*8%*
	Company Profile & Report Profile	1	1		3	
	CEO Statement		1		3	
	Corporate Vision		1		3	
	External Business & Sustainable Development Trends		1		3	
B	*Policies, Management Systems and Stakeholder Relations*		*7*		*21*	*15%*
	Code of Conduct & Corporate Philosophy	1	1		3	
	Economic Policy and Organisation		1		3	
	Environmental Policy and Organisation		1		3	
	Social Policy and Organisation		1		3	
	Integration of Sustainability into the Management Systems		1		3	
	Risk Identification		1		3	
	Stakeholder Relations		1		3	
C	*Dimensions of Performance*		*32**		*96*	*65%*
	Economic Performance	2	8		24	
	Environmental Performance		10		30	
	Social Performance		10		30	
	Integrated Performance		4		12	
D	***Transparency and General View***		***6***		***18***	***12%***
	Reliability and Transparency (General View)	**1**	1		3	
	Reliability specifically in the Environmental Dimension		1		3	
	Reliability specifically in the Social Dimension		1		3	
	Comparability		1		3	
	Accessibility and Structure		1		3	
	Layout and Language		1		3	
Total: Criteria and Score			*147*	*100%*		

* These criteria have already been weighted with factor 2. The total score for each performance dimension (economic, environmental, social, and integrated) is listed here.

Reporting Category D (Transparency and General View), as the final category, consists entirely of criteria for measuring the transparency and credibility of the reporting procedure (see Table 25-1). If the information provided is credible, is information on important stakeholders included in the report in support? Is the reporting procedure approached in a manner which allows the reader to form quickly a comprehensive picture of a company's performance – or is he presented with a mountain of paper that confuses more than it explains? Reader-friendliness is covered by including indicators regarding data comparability over several years, changes in the reporting structure and the physical appearance of the report. The criteria Reliability specifically in the Environmental Dimension and Reliability specifically in the Social Dimension include such indicators as memberships in business and industrial associations with environmental/social interests, external acknowledgements such as environmental/social awards, and problems concerning the ecological policy that could not be solved – giving a clearer view on the company's position on these issues. More information on all the individual criteria is available in the book covering the project and the outcomes in detail (Daub et al. 2003).

The Swiss research team oriented itself to the procedures used to date with regard to devising the basic rating scale (0-3) for evaluating the degree of fulfilment of a criterion. The maximum score of 147 points corresponds to a full score on all 33 criteria. Each criterion can receive a maximum of 3 points (see Table 25-2), apart from the 16 criteria of category C which have a maximum score of 6 points (see Table 25-3), due to the double weighting = 3 x 2. Depending on the degree to which the reporting fulfils the criterion, it receives a rating between 0 and 3 (0 and 6 for category C). The end score of the reporting assessment is made up by the total tally of all the individual criterion scores (the score of A1 + A2 + A3…and so on).

0 = No meaningful information is provided on the specific criterion.
1 = Patchy information is provided.
2 = The reporting provides good information on the criterion. However, one relevant area/indicator is not addressed.
3 = The reporting includes full information on the criterion.

The most important difference between the evaluation systems submitted to date and the IfSM's derives from the weighting of Reporting Category C (Dimensions of Performance). The research team took the position that the criteria in Reporting Category C should be weighted with a factor of 2 (compare Table 25-2 and Table 25-3), which is a more substantial weighting than in studies submitted to date, since it contains the hard facts on the performance of a company in the three sustainability dimensions. Although the evaluation system from Stratos (2001, 2003) achieved a similar relative weighting of Reporting Category C in comparison to the other categories, Stratos divided up the individual criteria for evaluating the reporting procedure to such an extent that the correlation was lost. What is more, the evaluation system contained several criteria which could not be used in Switzerland, such as "Indigenous Peoples' Rights".

Category A: Context and Coverage
Criterion A1: Company Profile & Reporting Profile
Table 25-2. Criterion weighted with factor 1 (F1).

Indicators	Comments	
- Number of employees - Major products and/or services, including brands if appropriate - Major clients and target groups - Nature of markets or customers served (e.g. retail, wholesale, governments) - Countries in which the organisation's operations are located - Nature of ownership; legal form; stock exchange listings - Key figures (economic, ecological and social dimensions) - Contact person for the report, including E-mail and web addresses - Reporting period (e.g., fiscal/calendar year) and date of most recent previous report, if any	*In this field the comments on whether or not the indicators are accounted for in the reporting are noted (pages, level of fulfillment etc.). The number of indicators covered and the level of fulfillment then decide the score for the criteria.*	
Scores: 0 – 3	F 1	Total: (maximum score 3 points)

Category C: Dimensions of Performance – Social Performance
Criterion C12: Distribution of Wages, Benefits & Continuing Education Possibilities & Offers
Table 25-3. Criterion weighted with factor 2 (F2).

Indicators	Comments	
- Health and pension benefits provided by the organisation - Percentage of the yearly budget spent on education - Average number of days of education paid per employee (comparison over the last three years)	*In this field the comments on whether or not the indicators are accounted for in the reporting are noted (pages, level of fulfillment etc.). The number of indicators covered and the level of fulfillment then decides the score of the criteria.*	
Scores: 0 – 3	F 2	Total: (maximum score 6 = 3 x 2)

4. THE RESULTS OF THE ASSESSMENTS

Of the 103 companies consulted, 76 companies sent one or more reports, representing a response rate of 74%. The remaining 27 companies either failed to respond or claimed that they did not publish any sustainability, environmental, social or annual report, or said that they had no interest in participating. The project team evaluated a total of 124 sources.

Upon completion of all assessments, the companies were listed and ranked according to their total scores from No. 1 (first place) to No. 76 (last place) (see Table 25-5 for the top ten). The ranking gives only an overview on how well the company reports on sustainability issues according to this particular list of criteria (IfSM), and the level of disclosure of information does not necessarily say anything about how it actually behaves and performs. This was also pointed out by Ullman (1985), when investigating the relationship between social disclosure and social performance, without finding any clear correlation. In other words, this list highlights which companies are already making progress in their efforts to deliver transparent and meaningful information on their performance in economic, environmental and social terms and which companies still have some catching up to do. In addition to the ranking list, the company scores were classified in a rating index ranging from triple A (AAA) to D. This rating index is consistent with the practice used by financial service providers (see Table 25-4) in routinely communicating the quality of a company by means of a rating index; in this case, information on the qualitative status of sustainability reporting among Swiss companies was provided.

Table 25-4. Rating index.

Rating	Points	% of Maximum.
AAA	134–147	91–100
AA	119–133	81–90
A	105–118	71–80
BBB	90–104	61–70
BB	75–89	51–60
B	60–74	41–50
CCC	46–59	31–40
CC	31–45	21–30
C	16–30	11–20
D	0–15	0–10

With a score of 111 (75%) from a possible 147 points, ABB led the way in this investigation and was the only corporation in the study to make at least the lowest of the three A rating categories (Table 25-5.). This was followed by Novartis (103 points, 70%), Migros and SBB (both 98 points, 67%), Swisscom (96 points, 65%) and Holcim (95 points, 65%), in category BBB. Considering that multinationals usually top the lists in international investigations, it was surprising that Migros and SBB, two classically 'national' Swiss companies, shared 3rd place. They were thus ranked higher than a number of global players, some of which were considerably lower ranked (e.g. Nestlé in 14th, UBS in 15th and Roche in 16th place). It should be pointed out, once more, that the results of this investigation are by no means a proof of the companies' actual performance, but judge only their communication skills and whether these are made in a credible and transparent way.

In reaching 8th place on a 'wild card' and ranking above the leading county bank, the Zurich Kantonalbank, the result achieved by the Basellandschaftliche Kantonalbank can only be described as astonishing. With its sustainability report this comparatively small company has set a benchmark that other small companies can try to emulate in future.

Table 25-5. Top-ten list.

	Rank	Reporting Company	Points	Percentage
AAA		—	—	—
AA		—	—	—
A	1	ABB	111	75.51%
BBB	2	Novartis	103	70.07%
	3	Migros	98	66.67%
	4	SBB	98	66.67%
	5	Swisscom	96	65.31%
	6	Holcim	95	64.63%
	7	Bâloise Holding	93	63.27%
	8	BL Kantonalbank	91	61.90%
BB	9	ZKB	87	59.18%
		Co-op	87	59.18%

A total of seven companies submitted a sustainability report in the narrower sense of the term (KPMG 2002, WBCSD 2002), containing information on their performance in all three sustainability dimensions. Three of the top ten companies were among these (ABB, Holcim and Basellandschaftliche Kantonalbank). The remaining four companies were Baer, Credit Suisse, Roche and Swiss Re, which had the poorest ranking in this group (23rd place with 61 points, 41%).

Some renowned Swiss companies were unexpectedly to be found at the back of the field, including such well-known Swiss companies as Mövenpick, Swiss Life, and Lindt & Sprüngli. These organisations restricted their reporting to a straightforward annual report which conveyed no, or only unsatisfactory, information on their performance in economic, environmental and social terms. A total of 19 companies achieved a rating of only C, which was not anticipated since Swiss companies are fond of describing themselves as being particularly socially and/or environmentally oriented. In their reporting, however, it would appear that they are either unable to demonstrate this or do not see any need to do so. The tail-enders are Hero and Kardex, who achieved less than 10% of the maximum number of points and thus finished in rating D.

The relatively pleasing results achieved by a few reporting companies should not disguise the fact that these are the only ones to reach international standard. In contrast, the overwhelming majority of the largest Swiss companies still have a long way to go if they are to meet the demand for disclosure in their reporting of their contribution to the sustainable development of the economy, society and the environment. On average and across all sectors, the companies attained one third (33.33%) of the total points possible. In comparison, in the most important reporting category, the 'Dimensions of Performance' (i.e. the 'hard facts') the percentage was only 29% (Figure 25-1).

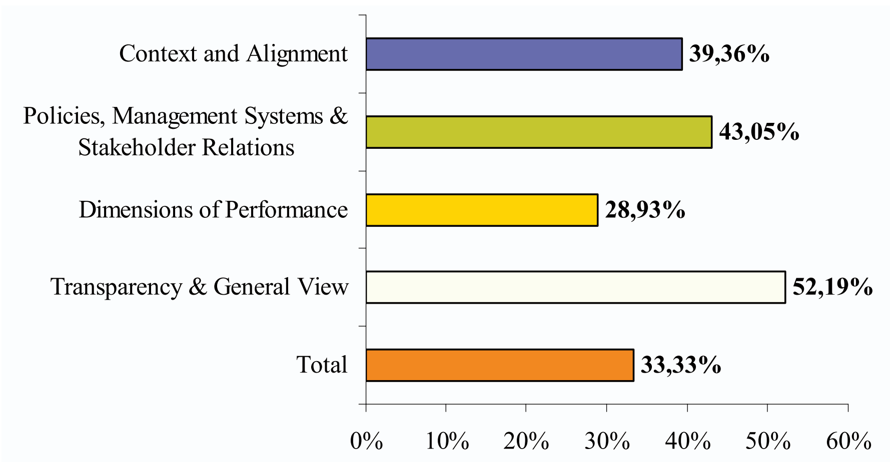

Figure 25-1. Average points per reporting category.

5. PRACTICAL EXPERIENCES FROM THE BENCHMARK SURVEY

As valuable as the results of the study itself were the experiences gained from this first national study of Corporate Sustainability Reporting in Switzerland, and the internal knowledge generation. Trying out the methodology, based on expectations and theories, for the first time in practice was a learning process which generated many new ideas and experiences, some of which are presented below.

If the research team had failed to include annual reports in the survey, they would not have had access to important results. For instance, the report from the Zürcher Kantonalbank would have been overlooked. This company does not publish a sustainability report, nor an environmental and/or social report, but includes detailed information on its ecological and social performance in the annual report. The fact that it was placed ninth in the total rankings confirmed the idea that statements concerning the actual quality of the sustainability reporting procedure and the extent of inclusion of the three sustainability dimensions can be made only if all publications published periodically by a company are taken into consideration.

The fundamental consideration behind the surveys submitted to date, that the publication of a special sustainability report is the preferred practice, could not be substantiated by the IfSM research team following the assessment. The Zürcher Kantonalbank was not the only example of how well companies integrate ecological and/or social aspects into their annual reports in an exemplary manner. EWZ, the energy supply company for the city of Zurich, was ranked number 18 and still appeared above companies who published a special environmental report.

Several companies whose all-round reporting was otherwise comparatively poor achieved the full tally of points in some criteria and also presented the required information in a model manner. This proves the initial theory that the focus should not be placed on only the best reports in an assessment (see Section 2).

An evaluation of the performance of the reporting company in the four reporting clusters resulted in a clear weakness in Reporting Cluster C (Performance Indicators), in which the 76 reporting companies which were examined achieved only 29% (Reporting Cluster A: 40%, Reporting Cluster B: 43%, Reporting Cluster D: 52%) (see Table 25-4.). This proves that the companies have a lot of hard work in front of them to integrate hard data and facts. The double weighting here makes it clear that they will have to place a lot more emphasis on this aspect in the future.

To what extent these results are country-specific and consequently influenced by the Swiss corporate and societal culture is impossible to say at this stage, since there is simply no other study with which the Swiss data can be compared that would answer the question of the country-specific nature of the results. However, pilot studies are currently running or being initiated at partner institutes in other European countries. The aim is to prepare an international database which would allow an analysis of the possible country influence.

Besides the knowledge won from the evaluation and the results of the benchmark study, additional valuable information was gained from interviews with managers which were carried out in connection with the study. Several of the companies expressed their appreciation for the opportunity to discuss their corporate reporting practice with an external analyst, since it is apparently very uncommon for companies to have a chance to discuss the outcomes of a study and to give their points of view on the matter. In addition, these meetings were often used by the managers responsible for corporate reporting to make the top managers aware of the importance, and the accompanying complexity, of what to disclose and to what degree. During these discussions the research team received priceless feedback and information on the dilemmas faced by companies when incorporating the many wants and demands put upon them by internal and external interest groups. Furthermore, the research team received several ideas for improvements and complementary information for next year's study including the topics of supply chain management and product stewardship, which will be handled more explicitly in the next study.

Nevertheless, several companies expressed concerns regarding their poor score in Category C (Dimensions of Performance) and especially in social performance indicators. Considering the double weighting of this category, a patchy reporting practice in one of its dimensions has a considerable impact on the total score. Suspecting that in reality the companies were not socially irresponsible organisations, the question was then: why do they report so poorly on these issues?

Although the tradition of reporting on social issues might be a reason in some cases, as mentioned earlier in the article, another hurdle for reporting is the nature of the issues which are connected with social performance, which are simply perceived as too abstract and unreachable or just too far-fetched for many reporting companies. Criteria regarding child labour and human rights might not be a tangible, everyday problem facing many western companies, although it should be remembered that the subcontractors or end-markets connected to the company production/products might be subject to these ethical issues.

Novartis is a good example of a corporation that has realised its responsibility along the whole value chain. This is one of the leading Swiss companies involved with human rights issues (Leisinger 2003, 2004). It can be assumed that this awareness stems from the fact that Novartis has subsidiaries in countries with other social, cultural and economical prerequisites. In the same way, it can be assumed that for a small regional Swiss company, the awareness regarding its responsibilities has not yet set in.

Granted that issues such as forced labour or bribery might not affect the daily business of the average Swiss company, there are other issues closer to home. Questions regarding corporate responsibility in matters such as job safety, job security, disabled peoples' rights, and freedom of association, are issues that all companies should consider. According to some companies, the reason why these issues were left out in their reporting was that they are explicitly outlined in Swiss labour legislation. However, remembering that reporting is a matter of communication it cannot be expected that every reader is familiar with Swiss legislation. This of course indicates that differences between countries in their legislation regulating these areas could be found to be a major source of discrepancies in an international comparison.

Furthermore, the interviews revealed that companies deliberately excluded from the reports available information which in principle should have been published. Many reasons were given for this: apparently, several companies consciously wanted to avoid giving the public the impression of being too social as an organisation. Companies in the public sector most frequently used this argument. Since they perceive that they already suffer from an excessively social image, they have a need to demonstrate their ability to deal with the challenges of future liberalisation of the market, and argue that they can be successful only if they emphasise their commercial skills and achievements. By publishing ecological and/or social performance indicators, the company would only further stress their soft skills and possibly create a competitive disadvantage. Clearly, these companies see reporting as an important communication tool and consequently choose the areas to emphasise very cautiously. Although choosing key topics for reporting is in line with the idea of Sustainability Reporting, the exclusion of social and environmental performance is not.

The majority of those interviewed criticised the fact that companies are reaching their limit of being able to cope with escalating demands for increasingly detailed and more frequently published reports. Amongst other things, this can be explained by the fact that many companies were at the time implementing the corporate governance guidelines (Swiss Business Federation 2002), which are comparatively stringent in Switzerland. This criticism confirms the assumption that, in future, the usefulness of developing sustainability reporting will have to be further demonstrated to Swiss companies.

In the course of the study, certain trends in reporting practice became evident. Based on the evaluated material, it was clear that there are basically two different reporting models which are evolving. The first is the most widespread approach, and represents a model where the company prepares a separate report on its corporate performance regarding the three dimensions of sustainability (a sustainability report) in addition to the traditional annual report. The other model is an integrated report, in which information regarding the company's performance in all dimensions is integrated into the annual report, as in the case of the above-mentioned Zürcher Kantonalbank.

In ECC Kothes Klewes and Fishburn Hedges' Global Stakeholder Report 2003, 1,697 persons with professional know-how about sustainability were asked to describe how a report should be structured. 64.4% answered "informative and to the point", and 63.7% wanted the report to contain "links to other sources of information", such as Internet-based information, etc. On a question regarding "reading intensity", 39% of the respondents answered that they read only those parts of the report which were of interest to them. This indicates that readers with professional knowledge prefer informative reports with a high level of facts and figures, over a descriptive company presentation. Consequently, it would be suitable for a multinational enterprise, with NGOs and financial analysts etc. as its main stakeholder groups, to issue separate theme-specific reports, whereas companies whose targeted stakeholders hold a more general interest in the company would prefer to publish an integrated report for a broader overview of the company. Most companies, however, need to communicate with several stakeholder groups of varying levels of knowledge of sustainability and hence differing expectations. In this situation the company has to find a solution to fit everyone's communication needs.

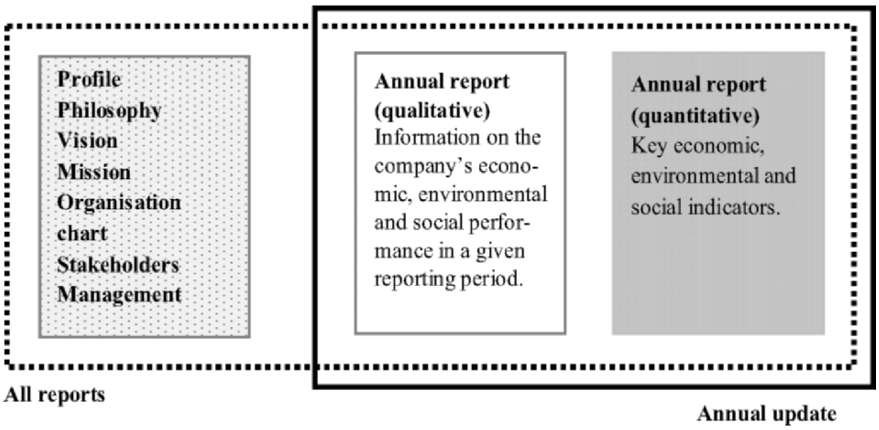

Figure 25-2. Streamlined Reporting Model.

Taking this into account, the project team anticipates a future move towards an even more streamlined reporting practice. Figure 25-2 demonstrates a refined version of the integrated sustainability report which could combine the needs for specialised information and general performance overview.

Following this model (Figure 25-2), the reports periodically produced by a company within a year (all boxes within the dotted line) can be divided into two sections; (1) including information that does not have to be revised every year, even if part of a company's general reporting requirements, and (2) information that has to be updated regularly (boxes with the unbroken line). The first type of information includes the company profile, its corporate philosophy and basic information on dealing with stakeholders, which only rarely undergoes significant change. Repeating this information every year would serve only to increase the scope and cost of a report without the addition of any new content. A number of companies have already started 'spinning off' this kind of information into separate brochures that can be used over several years, but which are still considered a part of a company's overall reporting and are forwarded to interested parties.

Information that needs to be updated annually includes all quantitative information (figures charting the progress of the business and changes in environmental and social performance) and all qualitative information. Ideally, the latter should be prepared in the form of a well-designed and interesting 'activity report' that can easily be read by experts as well as by any others who are interested. Such a report can by all means contain the occasional figure, graphic or table, but should be restrained in this respect and make reference to the quantitative section.

Whilst the qualitative part of the reporting should always be available in printed form, as well as on the Internet, to ensure that all the company's stakeholders can access it without the need for technical infrastructure and the appropriate expertise, another option is to place quantitative information on the Internet (in the graphic above, the white area indicates information that should also be made available in printed form, while the grey area stands for facts and figures that can be made available only online). Banks of figures on changes in cash flows, the percentage of women in senior management positions, and the company's energy consumption, are normally of interest only to stakeholders with the equipment and knowledge needed to obtain this information via the Internet. These include shareholders, NGOs and usually the employees of the company concerned. Information that does not change every year, in turn, should be made available both in printed form and on the Internet. This will include the corporate philosophy, a list of management principles, and information on how the company involves its stakeholders in decision-making processes – basic information that should be available to all interested parties at all times.

All this results in a 'lean', easy-to-read annual report of a new generation that is not rendered over-long by repetitiveness and which provides specific information on what has happened at the company. Unlike its forerunner, however, this information is no longer restricted to economic matters but also contains information on the environmental and social targets achieved, whether this be an increase in the use of renewable energies in the production process or an initiative aimed at integrating people with a disability.

To avoid any misunderstandings, it should be added that the model under description here can in principle also be used by companies who choose to issue an independent sustainability report. It thus deliberately avoids the question of whether information on a company's social and environmental performance should be published in a separate report or integrated in the annual report. The most likely prognosis for the future of corporate reporting is a coexistence of these two formal reporting types, with all previous forms of sustainability reporting likely to have disappeared from the market within a few years.

Nonetheless, online publishing of information implies several new aspects to consider: legal obligations, information safety and Internet access. The rules and regulations on the reporting of corporate financial performance demand a report in paper form. This would of course have to be taken into consideration, so that this information is supplied in printed form. If, or rather when, a change in legislation regarding financial reporting comes which will allow companies to publish this information exclusively online, it will probably be necessary to make investments to assure the safety of the information. However, the most common argument against publishing information online is the lack of Internet access. Considering the spread of IT infrastructure in most multi-national enterprises, and to a lesser extent in small-to-medium-sized enterprises in countries which depend on knowledge transfer, accessibility to Internet and IT-based communications tools are within reach here. Enterprises and stakeholder groups in countries which depend more on traditional producing sectors such as heavy industries or agriculture most probably have a less well-developed IT-infrastructure, which makes accessibility to and usage of these instruments less likely. According to Le Monde Diplomatique (2003), Internet access in Africa in 2002 was restricted to less than 4 persons per 10,000 inhabitants, whereas for the same population the European Union had an average access of between 40 and 750, and the USA between 750 and 2000. This shows that the company has to know with whom it is communicating and who reads their report.

Nevertheless, this paper argues not for a purely IT solution but rather for a more efficient use of the reporting practice which already exists. A majority of the companies which this study assessed use the Internet as a complementary media to the printed report, but systematic use of the possibility of publishing online facts and figures which are not included in the printed format is mastered by only a few companies.

In conclusion, there is no 'one-size-fits-all' solution on how to write or structure a report. Companies will have to find their individualised 'fit for use' reporting strategy depending on societal expectations and the company's characteristics. Based upon the lessons learnt from the investigation of 76 of the 100 biggest Swiss companies 2003 (Daub et al. 2003), and the investigations previous to this paper, addressing your stakeholders in an optimised way both (1) saves money and (2) means that communications outcomes will increase qualitatively.

This alone should be enough to induce companies to rethink their reporting practice. Still, judging from the results of the assessment which has been presented and experiences from the interviews, the importance and usefulness of sustainability reporting to companies has to be promoted further. An assessment such as the one instigated in Switzerland is an important step in achieving this. As mentioned above, this kind of assessment opens up possibilities for both the companies and the research team to learn from each other. By providing another perspective on the critical issues from both sides, the learning potential of such an interaction becomes vast. The next step in the development of the IfSM research is to use the experiences gained from this study, and the interaction with the companies, to optimise the criteria catalogue and to prepare for next year's study with a refined set of perspectives and new ideas. The emphasis will increasingly be placed on small-to-medium-sized enterprises, which form the backbone of the economy in all European countries. The new edition of the IfSM study in 2004 will consider this by extending the survey to include these companies.

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Chapter 26

COMPARABILITY OF SUSTAINABILITY REPORTS

A Comparative Content Analysis of Austrian Sustainability Reports

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Abstract: The comparison of sustainability reports is a scientific endeavour, which is particularly important for financial analysts but also for sustainability managers, who are responsible for a companies' sustainability management system. However, comparability of reports may be limited by the heterogeneity of sustainability reports. This paper presents the results of a comparative content analysis of sustainability reports of both Austrian and multinational corporations. The analysis focuses on differences between sustainability reports, which could reduce their value for sustainability managers. It shows that there are considerable differences between the reports issued by different corporations. The sometimes hidden variations go beyond differences that are due to the industry and the size of a company. These concealed differences may influence the usability of sustainability reports for benchmarking and initiatives for further standardization of sustainability reporting and rankings of companies.

1. INTRODUCTION

As the growing number of companies, which publish Sustainability Reports (SRs) suggests, sustainability reporting seems to play an increasingly important role for corporations (Kolk 2004, KPMG/WIMM 2002:9). For example, between May and August 2004 alone (GRI 2004a), the worldwide number of companies that publish SRs based on GRI guidelines has grown more

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than 15% to 469 and the number of companies that report in accordance with the GRI guidelines has grown more than 50% to 40 companies. The reasons for this development are manifold and range from increasing legislative pressure (e.g. in France or by the Commission of the European Communities (2001), which demands sustainability reporting by large companies) to pressure from different stakeholders like investors, financial analysts or NGOs.

Consequently, an increasing number of analysts, company-representatives and scientists are benchmarking, ranking and analyzing SRs. For example, presently there are some 450 projects dealing with corporate sustainable development (Klein and Steinert 2004). Most of them are examining and ranking the quality of the SRs of companies, while a smaller number of these research projects analyze the actual performance of a company as reflected in an SR. An example for a performance-orientated approach is the analysis conducted by SCORIS (2003) of DAX-30 companies (30 leading companies of the German stock index). However, assessments that focus on the quality of reports play a more prominent role. Such analyses are often the basis for company rankings. The Institute for Sustainable Management in Switzerland has for example conducted an analysis of Swiss sustainability reporting (Daub 2003), and Morhardt (2002) has analyzed the accordance of reports to present report-scoring systems versus the GRI guidelines and ISO 14,031. Furthermore, there are national as well as Europe-wide sustainability reporting competitions, which are also based on the analysis of SRs. Comparative approaches and rankings may be flawed if reporting differences between companies and groups of companies go unnoticed.

Benchmarking is also essential in the context of Socially Responsible Investments (SRI). SRI analysts frequently conduct assessments, which are largely based on SRs. Sustainability Asset Management (SAM) provides one of the best-known examples of such assessments for the Dow Jones Sustainability Index. Again, the usability of SRs could be reduced, not only because dissimilar criteria are used by different rating agencies (Van den Brink 2002), but also in case less obvious aspects of corporate diversity were not integrated into the assessments.

Thus, comparability of reports is important to most of the users of SRs. Hence, there is a drive towards standardization of sustainability reporting which is lead by the Global Reporting Initiative. Its guidelines (GRI 2002) have become the most widely accepted approach, officially endorsed by the UN World Summit on Sustainable Development (GRI 2004b:1ff.). However, even though standardization is under way, the question remains whether there are still differences between SRs that remain unnoticed and thus could impede the comparative analysis of SRs, benchmarking approaches and rankings.

This paper deals with this question. As the number of possible variables is large because of the high variability of reporting companies, it was decided to limit this analysis to two distinct groups of corporations – Austrian ones and multinational corporations (MNCs) (see Section 2 for details). Austrian companies reporting on sustainability use the reports of MNCs as a key benchmark, as sustainability managers have stated. Interviews conducted with sustainability managers (Schön et al. 2004:28f.) revealed that SRs of MNCs are said to be used as primary benchmarks to develop or improve the SRs of Austrian-based companies.

Are there differences between the two groups of reports that go beyond industry and company specific issues, which could reduce comparability and thus the usability of the SRs of MNCs as a benchmark? The following research questions guided the analysis of SRs:

- Are there differences between the reports of Austrian companies and those of MNCs?
- If yes, how can the differences be described and explained?
- What implications might these differences have for the comparability and usability of SRs?

To address with these questions, three focus points guide the content analysis of the SRs:

- Comprehension of sustainable development in the reports
- Reporting on sustainability performance
- Reporting on the management of stakeholder relations

1.1 Comprehension of Sustainable Development in SRs

Sustainable development is a highly dynamic concept, which is also subject to company specific issues. Thus, sustainable development can have a different meaning for different companies. Heemskerk et al. (2002:7) state in this context, that a "'one-size-fits-all' approach does not work for sustainable development reporting. It is up to each company to determine the approach it wishes to take, depending on its situation and needs". GRI (2002:24) states in this context, transparency "requires that, regardless of the format and content of reports, users are fully informed of the […] assumptions embodied in the reported information". Therefore, it is of key importance for the credibility of SRs, that the company presents and consistently follows its assumptions concerning the concept of sustainable development. In consequence, content analysis focused here on corporate understanding of sustainable development as expressed in the reports, and whether there are differences between Austrian and multinational corporations. Section 3 offers the results of this analysis.

1.2 Reporting Sustainability Performance

Since the concept of sustainability performance requires companies to consider their financial bottom line and also to regard their social and environmental performance (e.g. Dyllick and Hockerts 2002, Figge and Hahn 2002), reporting on actual sustainability performance constitutes the core of every SR. The GRI also states: that "the triple bottom line of economic, environmental, and social performance (based on Elkington 1997) is a starting point that is comprehensible to many, and has achieved a degree of consensus as a reasonable entry point into a complex issue" (GRI 2002:9). Therefore, it was not surprising, that each of the reports analyzed somehow distinguished between the three dimensions of sustainable development. This uniformity should make it easier to detect differences separate from the size and industry of the company. This issue will be discussed in Section 4.

1.3 Management of Stakeholder Relations

The management of stakeholder relations has become a company and case-specific issue, or as Andriof and Waddock (2002:19) state, management of stakeholder relations has largely "moved away from an entirely corporate-centric focus in which stakeholders are viewed as subjects to be managed towards more of a network-based, relational and process-orientated view of company-stakeholder engagement". Therefore, in the analysis of the management of stakeholder relations it is important to identify similarities or differences between groups of companies. Section 5 deals with this issue and highlights differences between the SRs of Austrian and MNCs.

2. METHODOLOGY

The analysis combines two approaches, i.e. a content analysis of seven Austrian SRs available at the time of the analysis and of twelve selected MNC SRs. For the analysis, which was conducted in spring 2004, all seven Austrian companies that published SRs were selected (see Table 26-1 below). A full survey and largely qualitative analysis of Austrian SRs was conducted. The analytical framework, which was used for the content analysis of the Austrian SRs can be found in Schön et al. (2004), and the framework which was used for the analysis of the SRs of the 12 MNCs in Konrad et al. (2005:4). Both frameworks have the same basic structure and general content. However, instead of depicting a large number of issues or criteria for sustainable development linked to international documents on sustainable development (e.g. Thierstein and Walser (2002) or SustainAbility/UNEP

(2002), which is elaborated further in SustainAbility (2003)), the frameworks are based on documents such as the Bellagio Principles (Hardi and Zdan 1997), Agenda 21 (UNCED 1992) and the GRI Guidelines (GRI 2002). The reason for this choice was their international acceptance and high relevance as well as the fact that interviews with Austrian sustainability managers also revealed that the GRI is considered to be the most important basis for the structure and content of the reports published in Austria (Schön et al. 2004:29). The documents were analyzed to identify those indicators that are of especially high relevance, as a basis for determining the most relevant indicators. The fourteen indicators that were identified were then used as guiding indicators for the analysis of SRs and whether the indicator was touched upon in the SRs in whole, or in part. Based on this set of indicators, the analysts conducted trial benchmarking, discussions and joint investigation of SRs before the actual analysis took place. The analysis then included the thorough reading of the SRs using a standard analytical table. Results were then jointly discussed and analyzed. An overview of the main aspects of the analytical framework used will be given below. A more detailed description can be found in Steurer et al. (2005).

Probably the single most important characteristic of sustainable development is it's widely acknowledged tripartite core structure, embracing an economic, a social and an environmental dimension, sometimes also referred to as the three "pillars" (see, e.g., Holme and Watts 2000:4). Sustainable development began with the environmental dimension (see, e.g., IUCN 1981) (and environmental issues are often still regarded as being the most important). The major issues used in this context are *resources*, *emissions* and *environmental damages and risks*.

As the social dimension evolved out of the environmental one, it initially addressed intra- and especially intergenerational equity in terms of availability of and accessibility to natural resources (Steurer 2002:249ff.). Its scope is, however, much broader and includes a range of social issues such as human rights and gender issues. In this article four major issues are identified: *equity within the corporation*, *international equity*, *internal social improvements* and *external social improvements*.

Likewise, the economic dimension also evolved out of the environmental perspective. While economic issues were initially addressed as they related to environmental problems (Steurer 2002), they have now developed as an individual dimension with a focus on a long-term economic perspective. The major issues are *financial performance*, *long-term competitiveness* and *economic impact*.

However, the contemporary notion of sustainable development goes beyond the tripartite core of economic, social and environmental issues and principles. As a development orientated concept it also stresses some issues that are process rather than content orientated (*participation* and *reflexivity*) and others that have a general conceptual character (*integration of the three dimensions* of sustainable development and *intergenerational equity*) (Hardi and Zdan 1997:2ff.) relevant to all three dimensions.

To obtain a better understanding of the two groups of companies publishing SRs – Austrian companies and MNCs – the analysis was complemented with an investigation of whether there was a difference in the understanding of sustainable development (see Section 3) and an analysis of the management of stakeholder relations (see Section 5).

The research is based on a rigorous set of indicators, which offer a detailed analysis of the SRs. However, during the analysis it became clear that, even though clearly relevant for each specific indicator, each company presented and approached the issues touched upon in different ways. This made it impossible to complete an in-depth comparative quantitative analysis highlighting the interesting nuances of for example different cultural approaches. A broad quantitative analysis of the SRs published by MNCs can be found e.g. in Konrad et al. (2005).

It should be noted that the framework used for analysis of Austrian SRs includes additional criteria, which were used exclusively for the analysis presented in Schön et al. (2004).

The SRs were selected on the basis of the WBCSD's definition, which defines sustainable development reports "as public reports by companies to provide internal and external stakeholders with a picture of corporate position and activities on economic, environmental and social dimensions" (WBCSD 2002).

2.1 Content Analysis of Austrian SRs

Content analysis aimed to provide a better understanding of the content and focus points of published SRs for seven Austrian based companies. Here a description is provided of the Austrian SRs analyzed and of relevant issues about MNC reports. For the analysis, first, criteria were separated into the separate economic, social and environmental dimensions of sustainable development. These were complemented by a fourth criterion with a focus on interrelationships between the three dimensions. This approach helped to get a better understanding of the overall focus of a sustainability report and of the integrative approach chosen.

Of the seven Austrian companies, only two (OMV and VA Tech) are companies with international operations. SRs of companies with their headquarters outside, but with a branch within, Austria were not included in the content analysis. This distinction was necessary, as SRs of companies headquartered outside Austria either did not specifically refer to Austrian issues or dedicated very little space to them.

Table 26-1. List of Austrian companies.

Company	Industry	Employees	Revenue	Reports
EVN AG – (EVN 2004)	Energy	2,317	1.082 mio E	Third report
Österreichische Bundesfor-ste/ÖBf AG – (ÖBf 2003)	Forest products	1,285	161 mio E	First report
OMV AG – (OMV 2003)	Energy	5,828	7.079 mio E	First report
Senoplast/Senco GmbH & Co.KG – (Senoplast 2003)	Chemicals (synthetic prefabricates)	374	91 mio E	Second report
Telekom Austria AG – (Telekom 2003)	Telecommuni cations	14,951	3.908 mio E	First report
VA Tech AG – (VA Tech 2003)	Energy utilities	17,725	3.872 mio E	Second report
Verbund AG – (Verbund 2003)	Energy	2,827	2.072 mio E	First report

2.2 Content Analysis of MNC SRs

In May 2003, a predominantly qualitative analysis of 12 MNCs was conducted based on the analytical framework of Konrad et al. (2005). The objective of this analysis was to get a better understanding of the structure, themes and goals of sustainability reporting prior to and as a foundation for the analysis of Austrian SRs. The focus on MNCs was because Austrian sustainability managers expressed interested in these reports. Moreover, as the Brent Spar example of Royal Dutch Shell illustrates (Dickson and McCulloch 1996), MNCs are powerful and vulnerable actors at the same time. As they can become subject to intense stakeholder pressure, it is of prime interest to gain insights into how they perceive and handle sustainable development issues.

The 12 MNCs covered in the report (see Table 26-2) were selected from the 100 largest US and European corporations which were listed in both the Global 500 Index (see Internet URL <:http://www.fortune.com/fortune/global500>) and the Global Reporting Initiative (GRI) (see Internet URL <:http://www.globalreporting.org>) in May 2003. By comparing the 100 largest corporations in the Global 500 Index with those listed in the GRI reporting guidelines, a sample of 14 companies was derived. As only 12 of the companies had reports readily available when the analysis was conducted, it covers 5 US and 7 European MNCs. Hence, no Asian companies formed part of the sample. Since an assessment of corporate understanding of sustainable development on the basis of SRs depends very much on report quality, report analysis was restricted to the corporations which voluntarily base their reports on the GRI guidelines.

Table 26-2. List of MNCs analyzed.

Company	Industry	Global 500 Rank (2003)	Country
AT&T – (AT&T 2002)	Telecommunications	40	USA
Deutsche Telekom – (Deutsche Telekom 2002)	Telecommunications	75	Germany
Ford Motor Company – (Ford Motor Company 2002)	Automotive	5	USA
General Motors Corp. – (General Motors Corp. 2003)	Automotive	3	USA
Hewlett Packard – (Hewlett Packard 2003)	Technology	70	USA
HVB Group – (HVB Group 2003)	Financial services	91	Germany
ING Group – (ING Group 2002)	Financial services	20	Netherlands
Metro Group – (Metro Group 2003)	Retailer	72	Germany
Procter & Gamble – (Procter & Gamble 2003)	Household products	93	USA
Royal Dutch/Shell – (Royal Dutch/Shell 2003)	Energy	8	UK
Siemens – (Siemens 2003)	Consumer durables	22	Germany
Volkswagen – (Volkswagen 2002)	Automotive	21	Germany

3. PERSPECTIVES ON SUSTAINABLE DEVELOPMENT

Content analysis revealed that corporations employ two different views of sustainable development, which are made explicit in the introductory chapters of the reports.

The first approach is defined by whether a report clearly refers to a generally acknowledged definition of sustainable development from an external source, such as the Brundtland Report (WCED 1987), or Agenda 21. The reports adopting this approach used a comprehensive understanding of sustainable development that often extended the temporal (and sometimes spatial) horizon of corporate activities. Here the approach is referred to as an *external perspective* on sustainable development.

In the second approach corporations adopt an *internal perspective* on sustainable development, describing the concept as the possibility of sustaining specific corporate values, such as risk reduction. In consequence, management of stakeholder relations was largely seen as a strategy to reduce corporate risks. Table 26-3 provides an overview of how corporations deal with this issue.

Table 26-3. External or internal perspectives on sustainable development.

Austrian SRs	
External perspective	*Internal perspective*
EVN	Telekom Austria
ÖBf	Senoplast
OMV	
VA Tech	
Verbund	
SRs of MNCs	
External perspective	*Internal perspective*
HVB Group	AT&T
Deutsche Telekom	Ford Motor Company
Metro Group	General Motors Corp.
Volkswagen	Hewlett Packard
	ING Group
	Procter & Gamble
	Shell
	Siemens

In general, all reports contained some information about basic corporate understanding of sustainable development. However, provision of general information about sustainable development does not make explicit detailed actual understanding about sustainable development. Furthermore, none of the reports contained a single comprehensive statement about the perspective on sustainable development that was consistent with corporate sustainability performance disclosed in the SRs. In general, SRs sketched out a vague picture of sustainable development, which can be described in the following terms.

In Austria, most reports included some general information on sustainable development. ÖBf, VA Tech, OMV, Verbund and EVN chose an *externally* orientated approach, however, different methods were chosen to present the perspective adopted on sustainable development. ÖBf (2003:20) and VA Tech (2003:29) designated a specific chapter to sustainable development; part of the report of the OMV included an interview between a well known journalist and the CEO on the issue of SD (2003:4); the report of Verbund included a report on a round table discussion (2003:10), and information on the perspective on sustainable development was provided in the mission statement and the foreword of the EVN report. On the other hand, Telekom Austria and Senoplast employed an *internal* perspective in the SR. In particular, Telekom Austria highlighted the goal of sustainable growth (Telekom 2003:16) and risk reduction. The Senoplast report reflected a specific emphasis on environmental as well as risk management objectives for the company, without providing any specific details about the perspective on sustainable development adopted.

In MNC Sustainability Reports the distinction between internal and external perspectives was also apparent. The report of HVB Group provided an *external* perspective on sustainable development and consistently linked sustainable development with the mission of the company. Similar approaches were found in the reports of Volkswagen, Metro Group and Deutsche Telekom. The *internal* perspective on sustainable development was obvious in the case of Procter & Gamble, Shell, ING Group, Siemens, Hewlett Packard, General Motors Corp., AT&T and Ford, all presenting their social and environmental commitment in line with the corporate mission.

However, some of the Austrian and multinational companies (e.g. Metro Group and Verbund) with an external perspective used the terms "sustainable" and "sustainable development" somewhat inconsistently. Even if a direct external reference was made, for example, to the definition of sustainable development in the Brundtland Report (WCED 1987:24), the content of the report primarily referred to economic growth and increased corporate value through sustainable development.

4. REPORTING SUSTAINABILITY PERFORMANCE

Reporting about economic, social and environmental issues linked with sustainability performance forms the core of most SRs, reflecting the connection between sustainable development and the corporate triple-bottom line. The GRI guidelines have a similar departure point: "The GRI Guidelines organize 'sustainability reporting' in terms of economic, environmental, and social performance (also known as the 'triple bottom line')" (GRI 2002:9). This issue is especially important, as medium and long term impacts as well as interrelationships between economic, social and environmental impacts are often disregarded in traditional approaches to financial, environmental and social reporting.

4.1 Economic Sustainability Performance

In the context of economic sustainability performance three issues were specifically addressed – *financial performance* (sufficient cash-flow and persistent returns to shareholders), *long-term competitiveness* (improvement of future competitiveness and company performance) and *economic impact* (economic impact of the corporation on particular stakeholder groups).

In general, extensive information on the *financial performance* of a company is made available in annual reports but not in sustainability reports. Nonetheless, limited information about corporate financial performance is provided in SRs. Financial performance issues were often addressed using indicators such as cash flow, liquidity, sales revenues, profits, profitability, debt-equity ratios and price-earning ratios (shareholder value). In this respect, very detailed information on financial issues was provided by VA Tech (2003), which included a comprehensive set of indicators and a large quantity of economic data. OMV, Verbund, Telekom and EVN provided less detailed economic information. Senoplast, provided very little information on the economic performance of the company within its sustainability report. A different approach was followed by ÖBf, which published its SR in combination with its annual report, at the same time providing detailed information on its economic performance (ÖBf 2003). Companies tended to provide information about financial performance that was already available in their annual reports. In this context, sustainability reports appear to act as a mirror image of annual reports. Overall, sustainability reporting on financial performance and position is extremely varied, with practices ranging from full financial reporting to partial or virtually no financial reporting.

Beyond financial performance, little information was provided, in the SRs analyzed, about issues relevant to the *long-term competitiveness* and *economic impact* of the corporation. As Konrad et al. (2005) argue, financial performance is not the only issue within the economic dimension of corporate sustainability performance. Apart from financial indicators, information on long-term competitiveness including long-term strategic management and planning, R&D, and supply chain management is also relevant for the assessment of economic sustainability performance. Moreover, although information about the corporate economic impact on stakeholders, including information on tax payments, dividends and payroll, could form part of corporate sustainability reports, it is not readily addressed. Only one company (Ford Motor Company 2002) reported, in accordance with the GRI guidelines, about the monetary flows to different stakeholders and taxes paid.

General Motors Corp. and the ING Group have less detailed approaches. In contrast with MNCs, Austrian companies provided somewhat limited information on their take-up of socially responsible investment funds, even though these fund managers are one of the most important stakeholders with an interest in sustainability reports (ECC Kohtes Klewes 2003:37).

Overall, it is striking to note that all of the SRs analyzed provided very little information about economic issues, that went beyond the information traditionally provided in annual reports, even though the GRI (2002:68) emphasizes that "…[s]ustainability reporting has the potential to provide critical information for business analysis that is normally absent from financial reports". For example, none of the SRs provided information about economic impacts on the company's neighbourhood.

4.2 Social Sustainability Performance

In this section four issues were specifically examined: *equity within a corporation* (including issues such as wages policy and job evaluation systems); *international equity* (including issues such as equality in the distribution of income and wealth between countries, including fair trade and supply chain management); *internal social improvements* (including issues such as work-life balance measures, diversity, gender mainstreaming (equitable treatment of females in relation to males), human rights, employee training, health & safety precautions, job security, and *external social improvements* (including issues such as volunteer work, dialogue and participation processes).

It should be noted that social issues of sustainable development received significant attention in most of the SRs of Austrian and MNC companies analyzed. The only noticeable exception was Senoplast, a company that dedicated little space to social issues. However, the companies did not touch evenly upon all four issues. *Internal social improvements* and health and safety as well as *international equity* issues dominated. *Equity within a corporation* was not discussed and *external social improvements* were not specifically highlighted in the SRs.

The analysis showed that the issue "*internal social improvements*", received most attention, in particular in the reports of MNCs. By addressing non-discrimination, US based companies put emphasis on minority and diversity issues (primarily referring to the Affirmative Action Act). European MNCs and Austrian companies focused primarily on mainstreaming gender issues. Popular instruments reportedly used by MNCs to promote minorities and women in the workplace were mentoring programs and employee network groups (Hewlett Packard 2003:12, Procter & Gamble 2003:20). The issue of gender mainstreaming was often related to work-life-balance. In this context HVB Group, for example, emphasized their flexible working hours, part-time work, tele-working and childcare facilities. Austrian companies mainly reported numbers, e.g. the number of female employees in comparison with male employees (Telekom 2003:10, Verbund 2003:ii, ÖBf 2003: 44), and physically handicapped people employed (EVN 2004:56, ÖBf 2003:44). All companies except for Senoplast and ÖBf made policy statements about non-discrimination. To further improve the internal social status, US based MNCs emphasized employee benefit packages such as health-care reimbursements, life insurance plans and pension plans (AT&T 2002:14, General Motors Corp. 2002:73). While European MNCs did not report on such packages, some Austrian companies (Telekom, EVN and Verbund) reported that they offered complementary pension or health care plans. European based MNCs, in contrast, addressed workplace security as an important aspect of internal social improvements. For example, HVB Group (2003:66f.) regarded part-time working schemes as a welcome alternative to a hire-and-fire policy. The same was true for Volkswagen: the "factory that breathes" program enabled the company to adapt the working hours of its entire staff to market developments. It also provided a time asset bond scheme, which allowed employees to shape their working hours in a flexible way (Volkswagen 2002:16), and Deutsche Telekom (2002:67) mentioned that it tried to transfer employees to subsidiaries and affiliated companies where business restructuring occurred. Austrian companies made general statements about "socially acceptable" reductions of their workforce without providing further detail.

In order to improve the motivation and enhance the careers of employees, MNCs often reported that they provided mentoring programs (AT&T 2002:43, HVB Group 2003:66, ING Group 2002:25), training opportunities (General Motors Corp. 2002:80f., Metro Group 2003:33) or annual career reviews (Deutsche Telekom 2002). Although the details of internal social improvements varied between US and European based MNCs, activities related to the issue played a very prominent role in all sustainability reports. All Austrian companies except Senoplast provided information about training opportunities. EVN (2004:54), OMV (2003:27f.) and Telekom (2003: 37f.) all reported on their career development or mentoring schemes.

Health and safety issues played a key role in the SRs of MNCs, because, as Deutsche Telekom (2002:72) explained, "healthy and motivated employees are its most important resource and the key to the company's success". Health and safety issues were addressed with health management systems, health risk assessments, health incident reporting and investigation, global health and safety guidelines and informational events for employees. Moreover, health-related events and services including change and stress management, health days, back training, massage at the workplace, addiction prevention and autogenous training were offered to employees (see, e.g., Deutsche Telekom, 2002:72). Austrian companies paid similar attention to this issue. All companies presented numerical information on workplace accidents, and VA Tech (2003:62) as well as ÖBf (2003:46) offered indicators on health related issues. All companies reported on health and safety measures taken, such as accident risk assessments, training events, immunizations, gymnastics and addiction prevention.

If MNCs addressed the issue of "*international equity*" at all, it was reduced to the promotion of worldwide access to technology and company products (e.g. Procter & Gamble 2002:52f.). In contrast, internationally active Austrian companies (such as OMV and VA Tech) placed great emphasis on international equity issues. OMV (2003:54ff.), for example, reported on specific projects but did not offer numerical information. VA Tech took a similar stance, and reported about social projects in Africa (VA Tech 2003:69f.).

In most cases, reporting on social sustainability performance was very extensive and offered both data and illustrative examples. All reporting companies touched on key aspects such as health and safety issues. The differences detected between groups stem from different cultural and legal backgrounds (e.g. regarding non-discrimination and international equity).

4.3 Environmental Sustainability Performance

Environmentally sustainable development is the third main aspect of sustainability reporting (GRI 2002). Since most production sector companies analyzed here were certified under ISO 14,001 (or EMAS), environmental data provided in the sustainability reports (covering e.g. waste, recycling activities, water use, emissions and energy consumption) was expected to be more comprehensive than the social data for the Austrian companies and the MNCs. *Resources* (responsible use of non-renewable and renewable resources/energy resources); *emissions* (emissions into water, air, soil as well as noise); *environmental damages and risks* (avoidance of environmental damages and risks, risk assessment, impact assessment) were examined. However, contrary to expectations, the information and data provided in the SRs was discovered to be highly selective, company specific and hard to compare across different companies (not only across the Austrian group of companies and MNCs).

Reports about environmental topics depended very much on specific company issues. The issue of *environmental damages and risks* was frequently touched upon. In general, strong emphasis was placed on the reporting of a single issue, especially the emission of greenhouse gases. Aside from a general discussion of climate change (e.g. VA Tech 2003 and Verbund 2003), ways to improve products (e.g. General Motors Corp. 2002:120, Volkswagen 2002:41) or production-processes (e.g. Hewlett Packard 2003:58f., Telekom 2003:24f.) were presented. Other aspects of environmental damages and risks were touched upon in an unsystematic way. US-based companies specifically was reported on fines paid for non-compliance with the law (e.g. General Motors Corp. 202:123, Procter & Gamble 2003:45). Such information was absent from the SRs of Austrian companies. Only two companies (Shell and ÖBf) reported on the topic of biodiversity. Shell (2003:26) highlighted the importance of biodiversity to the company and that it had developed a biodiversity standard with external stakeholders. ÖBf (2003:58f) presented measures on how to protect and enhance biodiversity in areas owned by the company (mostly forests). However, with the exception of reporting on fines, no noticeable differences were found between Austrian companies and MNCs.

As it became clear that there are virtually no differences between the approaches of Austrian companies and MNCs, the analysis then aimed to identify potential differences between other categories of companies. The analysis showed noticeable differences between production and services sectors. A comparison of reporting on environmental sustainability between "production/sites" and "products" showed that production companies included both aspects, while services companies mainly dealt with the issue of "production and sites". In the production sector, *resource* consumption and emissions were tackled in various ways throughout a company's activities, from product design to production to distribution and recycling. *Environmental damages and risks* were addressed by risk assessments and environmental impact assessments, also along the life-cycle (in particular by the automotive sector, see e.g. Volkswagen 2002). Services companies did not take such a comprehensive approach. For example, in the financial services sector, companies focused their environmental reporting mainly on *resource* use (rather than *emissions*) and on office buildings, efficient use of office materials, energy consumption and the environmental training of employees. With the exception of responsible investment products, companies ignored comments on the *environmental risks* of their business activities as capital providers. In the telecommunications sector, a similar approach was visible. Telekom (2003) in Austria, for example, only briefly mentioned the problem of *emissions* of cell phones and transmitters, while dealing extensively with environmental issues related to the provision of services. The energy sector did not direct attention to product issues, such as the efficient use of energy (which is understandable from a strictly economic point of view, as efficient use of energy could reduce sales). No differences on this issue were found between the group of Austrian companies and MNCs.

Overall, companies were found to be reporting in a broad way, but also very heterogeneously, about environmental sustainable performance. No differences were obvious between Austrian companies and MNCs. However, there were considerable differences between companies in the production and the services sectors.

4.4 Interrelations

Of particular importance for sustainable development is the interrelationship and *integration* between the three dimensions of sustainable development. The GRI states that: "…Achieving sustainability requires balancing the complex relationships between current economic, environmental, and social needs in a manner that does not compromise future needs. Defining sustainability in terms of three separate elements (economic, environmental, and social) can sometimes lead to thinking about each element in isolation rather than in an integrated manner" (GRI 2002:9). The GRI also highlights this issue by introducing "cross-cutting indicators" such as "Eco-efficiency measures (e.g., the amount of emissions per unit of output or per monetary unit of turnover) [or] environmental efficiency indicators that measure various types of resource use or pollution emissions against an economic or productivity measure" (GRI 2002:45).

However, despite the fact that the concept of sustainable development in general, or the GRI in particular, put strong emphasis on the integration of economic, social and environmental aspects, integration did not play a prominent role in the MNC SRs analyzed. Although most sustainability reports covered followed the GRI guidelines, economic, social and environmental issues were presented independently, showing no inter-linkages or cross-references. Once again, Austrian reports did not differ noticeably from the MNC reports. Some selective reporting about socio- or eco-efficiency and, in some cases, indicators such as "turnover per employee" (EVN 2004:58), "CO_2 emissions per KWh/MWh" (Verbund 2003:ii) and "solid waste per employee" (e.g. Telekom 2003:27) was evident. However, such cross-cutting indicators were never presented in a single table, which made them hard to locate.

Beyond the information provided about the integration of the three dimensions of sustainable development analysis also aimed to find detailed information about systematic approaches on *intergenerational equity* (WCED 1997). However, companies did not specifically address this issue in their SRs. The issue of interrelationships only received the minimum of attention and was disregarded by virtually all reporting companies.

5. MANAGEMENT OF STAKEHOLDER RELATIONS

The emergence of new stakeholders is one of the main reasons for publishing sustainability reports. However, sustainability reports are not only published to meet the information needs of stakeholders, they are also an expression of how stakeholders are dealt with or integrated into corporate sustainability processes. Hence, the instruments utilized to integrate stakeholders into the sustainability management or reporting process have been analyzed, as have the extent to which information needs of stakeholders have been met.

Considerable differences were found to exist in how stakeholders were identified by Austrian companies and MNCs. MNCs were well aware of their stakeholders and ranked them in importance (Konrad et al. 2005:9). "Providers of capital" were identified as the most important stakeholder group by all MNCs. Other stakeholder groups were seen to have different importance to different companies. In contrast, with two exceptions, Austrian companies were either not able to rank stakeholder groups or explicitly opposed any ranking of stakeholders (Schön et al. 2004:30). Of those companies that were able or willing to rank stakeholder groups, "providers of capital" were identified as the most important group.

In relation to instruments for the management of stakeholder relations, "dialogue with stakeholders" is seen to be a highly company specific issue. In addition, the specific "public affairs management" instrument is seen to be influenced by the cultural setting of a company, as the following sections show.

While most companies restricted their *stakeholder dialogues and consultation processes* to particular groups of stakeholders, some companies, such as Procter & Gamble (2003:28ff.), conducted stakeholder meetings with a broad range of different stakeholders. ING Group (2002:40), for example, pointed out that with some stakeholders they had a dialogue on a regular basis and with others only on a sporadic or case-by-case basis. The business rationale which stands behind corporate transparency and stakeholder involvement was stated by Ford Motor Company (2003:16) as follows: "Through our Stakeholder engagement efforts, we know that acting in partnership with non-governmental organizations and government agencies will be an effective means to help define and build the markets for the products we want to offer."

Shell revealed that stakeholder dialogue sometimes related directly to troubles experienced with particular stakeholder groups. Shell provided a good example of a company that has switched its stakeholder engagement from a reactive communication policy to a proactive involvement strategy.

This strategic change was, a reaction to the international stakeholder pressure Shell experienced regarding its plan to sink the Brent Spar oil platform in the North Sea (Dickson and McCulloch 1996, Shell 2003:34f.) and its controversial Ogoni policy in Nigeria (Boele 2001, Wheeler et al. 2002). Today, Shell (2003:40f.) invites stakeholder comments on its internet platform "Tell Shell" and acknowledges quite openly that its sustainability performance is not perfect, but that it is doing its best to improve it.

However, in Austria, most companies placed a greater emphasis on internal stakeholder dialogue. Two companies were taking specific and complex measures to integrate the interests of the employees into internal sustainability management processes. VA Tech (2003:17) conducted a comprehensive vision process with the entire management of the company, and ÖBf (2003:30) developed the vision statement "ÖBf 2010" with its employees. A third company, Verbund, briefly mentioned that management was interviewed via a "quota analysis" (Verbund 2003:44) and there had been the development of a "commitment index" (Verbund 2003:47). In the case of the latter index, no further details were provided. In other reports, no further information was given on the actual integration of internal stakeholders into sustainability processes. In the OMV (2003:33) report, representatives of external stakeholders (for example from Amnesty International) provided brief statements on issues relevant on the interaction between the stakeholder and the company. Also, some external stakeholders were invited to round table discussions, for example by Verbund (2003:10). However, in this case it was not obvious how the interests of the stakeholders were integrated into the SR process within the company. The SR of ÖBf (2003:49) contained both a broad overview of all company stakeholders and their interests as well as a brief discussion of stakeholders and their interests in relation to each branch of the company.

For some MNCs, public affairs management (Köppl 2000:10ff.) was also seen as another important instrument of stakeholder relations management. Procter & Gamble (2003:32), for example, stated in its sustainability report that it communicated with public authorities as an individual company and through industry associations. The declared aim of this communication was "to ensure that policies take the needs and experience of business into account". ING Group (2002:34) stated that it advises the Dutch government on pension reform. General Motors Corp. (2002:116) provided another example of public affairs management in the context of sustainable development. The car manufacturer was "…actively involved in fostering dialogue between the auto industry and policy makers in Europe on addressing the challenges ahead in reducing transport related CO_2 emissions and creating a common vision of sustainable mobility". General Motors Corp., for example, advised some European countries and Japan on the development of car-recycling laws.

In relation to stakeholder relations management, the approaches employed by Austrian companies did not seem to be as elaborate as those employed by MNCs. Overall, stakeholder relations management was revealed to be very company specific and influenced by the cultural environment of the company.

6. CONCLUSIONS

By and large, substantial heterogeneity in SRs was found, reducing comparability and the usability of the reports e.g. to analysts, scientists or sustainability managers. Differences in sustainability reporting often appear to be the result of company or industry specific issues and preferences. However, there is support for the view that additional considerations are related to the differences detected. It became evident that cultural and legal background was particularly relevant for explaining differences in reporting between Austrian companies and MNCs.

Social sustainability performance seemed to be influenced by different cultural and, to some extent, legal backgrounds. Differences were detected especially in relation to reporting on "internal social improvements" and "international equity". The cultural and legal background determined internal social improvements, while the range of international company activities influenced reporting on intergenerational equity.

In relation to stakeholder relations management, reports of the Austrian companies provided a less elaborate impression than those of the MNCs. Cultural differences between these two groups and a different sense of urgency about the matter were the most evident reasons.

A high level of standardization (e.g. exerted via ISO 14,001 or EMAS) clearly influenced reporting on environmental sustainability performance. No differences were obvious between Austrian companies and MNCs. However, it became apparent that there were differences in reports between production and services companies, which were not caused by specific country particularities. On the one hand, the consideration of these differences could be crucial when companies are compared or ranked, on the other hand, there were strong indications that services companies could extend their sustainability management further to their products.

The analysis reported here shows that there are substantial differences in sustainability reporting between Austrian companies and MNCs. Cultural and legal issues are the main drivers of these differences, even though there are additional issues that are company specific. Therefore, contrary to the statements of sustainability managers, at present there is little evidence to show that there exists a *systematic* approach by the Austrian companies to learn from the approach that MNCs are taking. Increased global standardization could support comparability and usefulness of SRs for different stakeholders, however at present limits to the introduction of global standardization occur because of factors outside the company's influence, such as cultural differences and legal requirements. The high level of standardization on environmental sustainability performance shows that it is possible to determine some common ground for the reporting of sustainability performance.

Further research is necessary to determine in a systematic way the detailed differences between SRs of different groups. For example, analysis of companies based in Asian countries, not included in this analysis, could help provide a better understanding of comparative issues of sustainability reporting. Such research could help identify inconsistencies between groups of companies and the drivers behind sustainability reporting.

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PART VI

EMA COMPUTER TECHNOLOGY DEVELOPMENTS AND INTERNET

Chapter 27

COMPUTER SUPPORT FOR ENVIRONMENTAL MANAGEMENT ACCOUNTING

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Abstract: This article focuses on ways and means to support environmental management accounting (EMA) with computer applications. From the EMA point of view, data collection, data processing, and data support are central features of appropriate computer applications. These considerations lead to common enterprise resource planning (ERP) systems as a prominent data source of environmental management accounting. The article indicates that, in principle, ERP systems cannot cover all fields of comprehensive EMA frameworks. Therefore, further computer support is required. Here computer-based modelling and simulation tools come into play. They are eligible applications in future-oriented EMA ('tools for getting new ideas'). However, the modelling and simulation tools have their weaknesses, too. Hence, the article concludes with a current trend in software engineering and software development: componentisation. This concept allows combining the strengths of the different approaches to support EMA.

1. INTRODUCTION

The comprehensive framework for environmental management accounting (EMA) developed by Burritt et al. (2002a, 2002b) classifies EMA instruments according to their specific decision-making context. Depending on the kind of information required (monetary or physical), the time frame, the length of time frame, and the routineness of information gathering, different instruments are most suitable. Therefore, the adaptation or development of computer-based environmental information systems and tools is challenging.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 605-624.

"To allow for the use of computer artefacts in different situations, the designer must have a mental picture of all possible situations and a sufficiently rich understanding to allow for any potentially relevant activity at any time" (Floyd 2002:25). Depending on the kinds of tasks and the attitudes of users, perceptions of the role of computer applications differ. A typical metaphor in computer science is the term 'machine'. The first mathematical model of computers, the Turing machine, used this metaphor. Others see the computer as a new type of 'tool'. Today, computers and networks are also regarded as a new 'medium'. From a managerial perspective, both machines and tools can be used as instruments that provide relevant data for rational decision-making.

One characteristic of metaphors is "that metaphoric constructs are used naturally and unproblematically all the time in normal communication" (Hamilton 2000:241). Consequently, computer support for environmental management accounting (EMA) is associated with one key metaphor and perspective only: computer-based information systems as 'machines' to provide required information. However, to cover comprehensive frameworks for EMA (Burritt et al. 2002a, 2002b) it could be necessary to express the paradigmatic background by using different key metaphors. In this article we discuss computer support for EMA from two different perspectives: computer-based information systems ('machines') and computer-based modelling and simulation 'tools'. To some degree this is a theoretical partition, but it clarifies the different application domains as well as strengths and weaknesses of appropriate software solutions. Afterwards, the concept of componentisation is discussed. This concept could help to integrate the different fields of EMA and appropriate EMA instruments. For instance, a simulation component for environmental pricing decisions could retrieve required information automatically from cost accounting and material and energy flow accounting systems; life cycle costing components could integrate monetary information and life cycle assessment information; and environmental investment appraisal components could include a monetary and a physical (ecological) assessment of investment options.

2. COMPUTER-BASED EMA SYSTEMS

Direct requirements for computer applications in the domain of EMA are data collection, data processing and data supply. Computer applications should constitute a database for EMA and, at the same time, implement EMA instruments like environmental cost accounting or material and energy flow accounting. Computer artefacts that support data collection, data processing and data supply are called computer-based information systems. Data collection can be efficiently realised only by tracing daily operations. The computer application records all relevant transactions: ordering, deliveries, bank transfers, etc.

An important spin-off is the possibility of automating daily operations. The computer systems implement so-called operational forms. An operational form is a well-defined network of operations. The term operation describes an activity which can be analytically separated through scientific operation (Floyd 2002:18). For instance, the life cycle assessment procedure according to ISO 14000 can be considered as such. The operations are performed by functional units or components. In the system perspective "humans and machines are the same type of components" (Bødker et al. 2000); "the organization is a collection of 'components' (some human, and some mechanical), each of which 'processes and transmits information'" (Winograd 1986). Research is focused mainly on efficiency. A fundamental design question is: What can be efficiently automated (with regard to computer science in general, Denning et al. 1989)?

2.1 Enterprise Resource Planning Systems

Prominent examples of automated information systems are enterprise resource planning systems (ERP systems) like SAP R/3. "ERP addresses operational integration to support daily operations" (Lee et al. 2003:56), like manufacturing, purchasing, or distribution. So the ERP system is not only designed to support a large collection of different business processes but is in fact an integrated system. The ERP system becomes a computer-based representation of the whole enterprise.

To do so, ERP systems have to cover all relevant daily operations and, consequently, are huge software systems. To deal with complexity the ERP package is divided into several modules like financial management, human resources, and materials management. An ERP system consists of highly interdependent large-scale application modules (Sprott 2000), based on a central database.

To manage daily operations ERP systems provide numerous best practice operational forms, and customers are advised to adopt these pre-defined forms. Thus "the deployment of ERP systems often requires reengineering the business processes to align with the ERP system" (Hasselbring 2000:34). In other words, companies have to rethink their existing operational forms and, if necessary, have to introduce new formalised processes. Workflow analysis and design tools help to describe these tasks, and often they contain the standard business processes of the ERP systems as reference models (for further details of reference modelling see Becker et al. 1999).

ERP systems contain essential data required for EMA: not only financial data but also non-financial data (Bennett and James 1998). ERP systems become a data provider for EMA systems (see Figure 27-1). Unfortunately, data structures and data models of common business information systems do not incorporate EMA requirements. Another problem arises from the accounting techniques implemented in common ERP systems. These instruments determine the cost allocation process extensively but are not intended to track and trace environmental costs (Schaltegger and Müller 1998). Therefore, cost allocation based on material and energy flows is insufficiently supported.

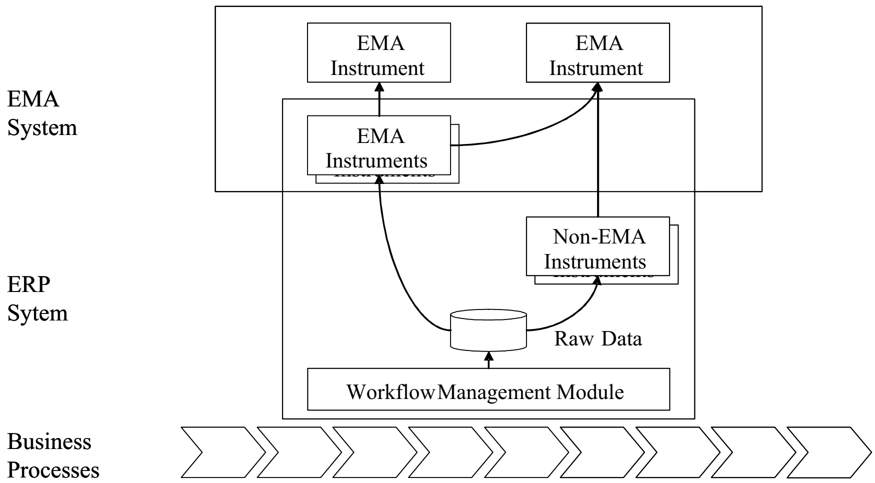

Figure 27-1. ERP System as a data provider for an EMA system.

EMA requires not only a solution to the data provision problem, but also redesign and enhancement of its existing data models, procedures, and instruments. Basically, there are two design options to realise an appropriate computer-based environmental management information system (EMIS, Page and Rautenstrauch 2001). One approach is to implement the computer-based EMA system within the ERP system. In that case EMA can be implemented as a new application module, highly linked to other modules, or EMA can be implemented as a new feature of existing components, e.g. controlling or cost accounting. To some extent these solutions can be regarded as ideal solutions since “ERP implementation is push-oriented, as ERP forces an organisation to accept standard integrated business processes” (Lee et al. 2003:59, Scheide et al. 2001). However, a comprehensive EMA component deals with data on the level of physical material and energy flows and stocks. That requires significant enhancements in other application modules of the ERP system. Therefore ERP vendors should be involved in the development of the system at an early stage.

Significantly easier to implement is a monetary environmental accounting system (MEMA system, Schaltegger et al. 2001, Jasch 2002). An ERP-based MEMA is implemented for example in the ECO-Rapid project (Scheide et al. 2001). The underlying methodology is flow cost accounting (Strobel and Redmann 2002). Indeed, flow cost accounting is material-flow-based, but compared with other EMA tools, e.g. life cycle assessment (LCA), not all material and energy flows have to be incorporated. In principle, an ERP system should provide all relevant data for such an enhancement. Problems arise from inappropriate data formats, problematic aggregations, erroneous allocations, missing filter criteria, etc.

Another approach to supporting EMA with environmental management information systems is to implement a new application beyond the ERP system. This option allows for a clean design of EMA instruments; EMA frameworks can be transformed into system architectures and implementation models from scratch. Particularly, methodologies which cover not only MEMA, but also physical environmental management accounting (PEMA) from different perspectives can be adapted; they have the capability to become an overall-concept within the EMIS. For example, the material flow network approach (Möller et al. 2001, Schmidt et al. 1997) aims to trace the material and energy flows and stocks within a company or between different companies within a value chain. The resulting material and energy flow models can be evaluated in different ways. One evaluation is to calculate and to compile an inventory, methodically comparable with a life cycle inventory; another evaluation is material-flow-based cost accounting. Both are required to compile eco-efficiency indicators and other key figures. Such an overall concept covers PEMA as well as MEMA in an integrated manner.

Such an environmental management information system is basically a stand-alone system, which is, to a large extent, also the case for the ERP system. Integration is an important requirement within ERP systems; not in terms of integrating the ERP package with other applications, but in providing interfaces to the ERP package. Implementing an interface to huge ERP systems like SAP R/3 is an ambitious task. It is not only necessary to deal with technical specifications based on remote function calls (RFCs), business application programming interfaces (BAPIs) and so on; it is also essential to understand several functions and underlying concepts within the ERP system, in theory as well as in practice.

Meanwhile, interoperability standards and interface specifications are being developed to support data exchange between ERP systems and EMIS (see Figure 27-2). PAS 1025 (Publicly Available Specification No. 1025) is such an interface specification (DIN 2003, Wohlgemuth et al. 2004). Indeed, PAS 1025 is not only a technical specification but also a reference model. The specification covers business scenarios which require data exchange between ERP systems and EMIS as well as the generalisation of these scenarios and the resulting requirements for the data format (Beucker et al. 2002). Nevertheless, the interoperability standards and interfaces cannot offer the degree of integration that an EMA module within the ERP system can. Furthermore, the external EMIS, equipped with interfaces to the ERP package, cannot completely overcome conceptual weaknesses of ERP systems concerning EMA.

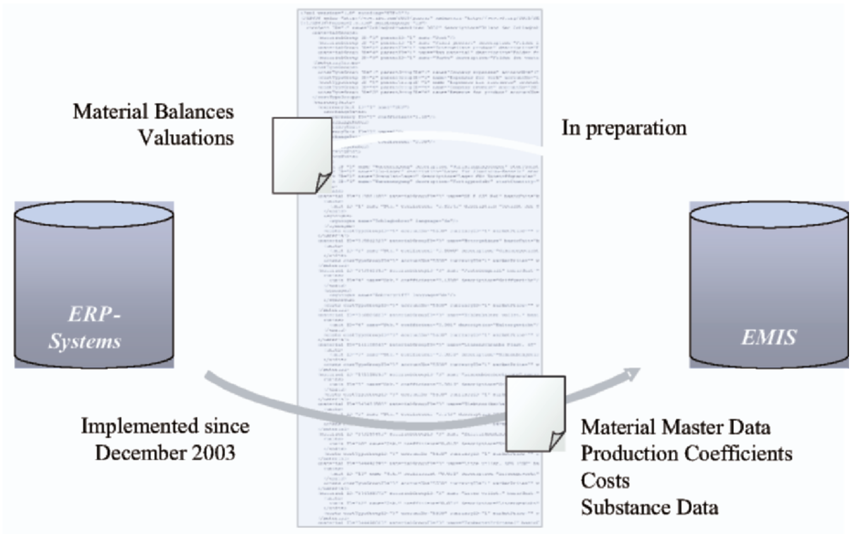

Figure 27-2. PAS 1025-based integration of ERP systems and EMIS (source: Wohlgemuth et al. 2004).

Whereas ERP systems are focused on integration of internal business functions, newer technologies, like Enterprise Application Integration (EAI), try to cover comprehensive supply chains (Holten 2003, Lee et al. 2003). In this context the integration within an all-embracing integrated system is not an alternative. EAI puts emphasis on the data exchange between different computer-based application systems along the value chain. In the EAI concept an integration server connects all the different systems and replaces several point-to-point connections. Only one interface, a so-called connector, must be implemented for each software system. The connectors ‘translate’ between internal data formats and corresponding data formats, but are expressed in a data exchange language, mainly XML. To map different data formats within, the integration server can utilise declarative mappings, also based mainly on XML (XSLT). As a result, the integration challenges can be answered in a standardised way, including the development of business scenarios, business processes and business process orchestration. Accordingly, it seems to be beneficial to implement the PAS 1025 interface using an EAI integration server.

Nowadays software packages like SAP R/3 also cover tasks beyond ERP, particularly through more comprehensive overall-concepts like product life cycle management (PLM) or supply-chain management (SCM). ERP systems are embedded in these concepts as databases of operational data. At the level of software engineering these concepts become an architectural framework with several modules and interfaces. The framework provides numerous extension points. The extension points can be utilised to incorporate EMA issues into the framework (Krasowski 2002, Möller and Rolf 2001). Improved application architectures help to incorporate new functionality into enterprise application, but the primary purposes of ERP systems are not considerably affected.

2.2 Capabilities and Limitiations of ERP Systems in an EMA Context

ERP systems cover the following fields within EMA frameworks (Burritt et al. 2002b, Schaltegger et al. 2001):

- ERP systems are mainly focused on operational transaction data. Cost-accounting modules document transactions and calculate cost-accounting reports; they deal with historical data. Their main purpose is ex-post cost control. Such an accounting module can support only past-oriented environmental management accounting, mainly monetary environmental management accounting (Schaltegger et al. 2000). Additional modules or components within the ERP system or external environmental information systems can support past-oriented physical environmental management accounting as well. In conjunction with cost accounting, ERP systems constitute a basic data source of past-oriented life cycle assessment (LCA) within companies.
- Other purposes of cost accounting modules of ERP systems are short-term planning, budgeting, coordination, and feedback. The modules help to estimate standard costs "that are established in advance to serve as a target to be met and, after the fact, to determine how well those targets were actually met" (Shim and Siegel 1992:177). Cost accounting systems can also support long-range planning and strategic issues, but not directly in a formalised way. So ERP vendors like SAP have developed special applications to support strategic management (SAP SEM – Strategic Enterprise Management). These applications can be regarded as add-ons to the ERP systems, linked to the ERP system by a data warehouse

(Sinzig 2000). As a result, ERP systems can provide some future orientated data for environmental management accounting, e.g. to support monetary environmental operational budgeting or physical environmental budgeting (Schaltegger et al. 2000). Strategic management, however, is not the main focus of ERP systems, so that corresponding EMA techniques, such as future-oriented life cycle costing or life cycle assessment, cannot be supported by ERP systems in a sufficient manner.
- An ERP system is not only a large database combined with a set of instruments. As outlined earlier, it forces organisations to accept standardised business processes (Lee et al. 2003). Customised ERP systems and environmental information systems can embody standardised best practice environmental management and environmental accounting workflows (Krcmar et al. 2000, Scheide et al. 2002). In this case the ERP system is likely to become a "motor" of EMA in the company.
- In addition, as part of external environmental accounting (Schaltegger et al. 2000) computer-based environmental information systems provide continuous data support for environmental reporting, in particular supply of eco-balances and eco-efficiency indicators.

Traditional ERP systems and environmental information systems provide primarily routinely generated operational environmental accounting information. This type of support is clearly needed, but ERP Systems do not cover the whole EMA framework. In particular, the current generation of ERP systems provides minimal support for experience-based interactive modelling and simulation: "Decision makers […] need insights that can come only from their own experience and experimentation with all available data sources. They must be able to explore and experience events from multiple perspectives and revisit them as often as needed to obtain that insight" (Jain 2003:49). This kind of task abets another type of computer application, which is described in the following section.

3. COMPUTER-BASED EMA TOOLS

The term 'tool' stands for an application of computers beyond automated data processing and routinely produced data (in metaphors: beyond 'machines'). The metaphor 'tool' pictures a different relationship between humans and computers than in the system perspective: "Humans use tools to work on material (in analogy to how we use a hammer)" (Bødker et al. 2000:258). Users are regarded as experts in the application context, they are skilled in the use of the tools, and they perform work flows on an ad-hoc basis. Whereas computer-based information systems, developed in the system perspective, can handle only well-defined and formalised problems, the main emphasis of computer tools is placed on enhancing skills to deal with unexpected challenges and to involve new ideas (Suchman 1988).

Typical computer tools are word processors or spreadsheet programs, often supplemented by drawing programs, notepads, or pocket calculators. Icons symbolise these tools on a "desktop", the graphical user interface. Personal computers, particularly in conjunction with Windows operating systems, are a successful environment of computer-based tools.

Some accounting instruments are implemented on the basis of spreadsheet programs. In particular, planning and budgeting can be done using spreadsheets (Horngren et al. 2000, Shim and Siegel 1992), because "it is easy to make different sales projections and see what the resulting costs and profitability will be" (Shim and Siegel 1992:167). Some prototypes of new accounting approaches are implemented as spreadsheet applications.

Some EMA instruments can be implemented using spreadsheets. For example, early life cycle assessments were carried out using Lotus 1-2-3 or Microsoft Excel. But this approach suffers from lack of visualisation of the connections between processes and stages in the life cycles. It became apparent that spreadsheet programs do not provide an appropriate platform for life cycle assessment. Today, some specialised life cycle assessment or material flow analysis tools are available such as SimaPro, Umberto and Gabi.

These tools incorporate domain-specific knowledge bases, mainly material and energy transformation specifications and impact assessment approaches (e.g. eco-indicator 99 or the CML method). In addition, national life cycle assessment databases are in development, for example the Swiss national database ECOINVENT, containing about 3000 data sets (Frischknecht 2001). LCA tools have access to the ECOINVENT database via the standardised data exchange format EcoSpold. The EcoSpold data exchange format covers meta data (process, modelling and validation, administrative information) as well as flow data (area exchanges, area allocations, Frischknecht 2004). It is important to realise that these databases fulfil a completely different function than workflow management components within ERP systems. The databases are targeted at facilitating skilled users; process automation is not their designation.

Hence, model development and experimentation are cornerstones of these applications: "Computer simulation involves experimentation on a computer-based model of some system". "The model is used as a vehicle for experimentation, often in a 'trail and error' way to demonstrate the likely effects of various policies" (Pidd 1992:5). Computer-based modelling and simulation require effective human-computer interaction. Several metaphors refer to human-computer interaction: desktop, toolbox, direct manipulation and so on. On the one hand, these metaphors symbolise how users can interact with the computer via the user interface. On the other hand, metaphors result in design principles and design patterns of computer applications.

One important key term is 'direct manipulation'. The underlying philosophy is the "principle of virtuality – a representation of reality that can be manipulated" (Sheiderman 1998:202). Users should feel that they are directly able to manipulate objects of interest. This requires visibility of objects on a graphical user interface (GUI); access to the objects; and rapid, reversible, incremental actions (Sheiderman 1998). Sheiderman describes the outcomes of well-designed graphical user interfaces: growing enthusiasm among users, mastery of the interface, competence in performing tasks, ease in learning the system originally and in assimilating advanced features, confidence in the capacity to retain mastery over time, enjoyment in using the system, eagerness to show off the system, and desire to explore more powerful aspects of the system (Sheiderman 1998). These outcomes of well-designed computer tools are especially interesting and important in new application domains like environmental management accounting or corporate sustainability management. Proper GUI-driven visual and interactive modelling tools are likely to promote organisational change.

Of course, computer tools have their weaknesses, too. It is difficult to deal with historical data and to perform comprehensive ex-post analyses. A direct link to daily operations as in ERP systems is not provided. So "data input can become a time-consuming chore and therefore a major cost factor. In addition, employees may quickly become tired of typing in data that they know is already stored elsewhere, and therefore – consciously or subconsciously – boycott the system" (Günther 1998:154). Widely-used technologies like XML and corresponding information system infrastructures have alleviated these problems in recent years. Nevertheless, the use of computer tools in fields of EMA which can be supported very well by customised ERP systems or integrated environmental information systems does not seem reasonable. Indeed, the computer tools are not targeting those EMA fields. Computer-based modelling and simulation tools place emphasis on other domains:

- EMA computer tools can be used to perform ex-post analyses in an ad-hoc manner. In that case, appropriate interfaces to ERP systems are very helpful. As mentioned above, ERP systems deal with operational transaction data. They provide routinely generated historical data. Interfaces like PAS 1025 could be utilised for data import.

- Even more important, computer-based modelling and simulation tools support future-oriented EMA. Material and energy flow networks, for instance, can be used as a future-oriented model to investigate possible improvements or to discover the impacts of different policies or strategies on these networks (Pidd 1992). Often the analyses are embedded in methodological frameworks like scenario management (Gausemeier et al. 1996, Scholz and Tietje 2002) or SWOT analysis (Boseman and Phatak 1989). Here, experimentation plays a prominent role, whereby the analysis becomes an iterative modelling process, which consists of the three phases modelling, computing, and simulation within a cyclic process model (Pidd 1992). Hence, the analyst becomes a designer of future possibilities. Obviously, computer-based modelling tools generate mainly ad hoc information. Supplementary data provided by an ERP system can be an important data source to develop and to validate scenarios; but subsequent modelling steps do not require direct connection to the ERP system.
- Whereas a seamless link to ERP system is not essential in future-oriented simulation models providing ad hoc information, it gets more important for applications providing routinely generated future-oriented data, e.g. serving as a Balanced Scorecard database: "In designing Balanced Scorecards, an organisation must measure the critical few parameters that represent its strategy for long-term value creation" (Kaplan and Norton 2004:5). To incorporate sustainability issues into the balanced scorecard, mainly eco-efficiency indicators come into consideration (Schaltegger and Burritt 2000). Providing eco-efficiency indicators again requires the application of life cycle assessment methods (Heijungs 1994, Möller 2000) and environmental costing methods. In that case, the instruments must provide routinely generated data.

The enumerations reveal that computer tools complement computer-based information systems. They cover different fields of environmental accounting. A proper choice depends on the application context. Comprehensive support for environmental management accounting can be realised only by a combination of different perspectives or approaches, respectively (see Table 27-1). The question arises of how to link the different perspectives. At the level of software technology one promising approach is the concept of componentisation.

Table 27-1. EMA Framework and assigned computer support (source: Burritt et al. 2002a).

		Environmental Management Accounting (EMA)			
		Monetary EMA		Physical EMA	
		Short Term Focus	Long Term Focus	Short Term Focus	Long Term Focus
Past Oriented	Routinely generated information	ERP System (internal environmental cost accounting component or customized cost accounting module) or ERP system in conjunction with an external EMIS (external environmental cost accounting system)	ERP System (customized asset accounting module (environmentally induced capital expenditure and revenues))	ERP System in conjunction with an external EMIS via e.g. PAS 1025 interface (integrated material and energy flow accounting system, environmental reporting system)	ERP System and a data warehouse in conjunction with an external EMIS via e.g. PAS 1025 interface (environmental capital impact accounting system)
	Ad hoc information	Modelling tool in conjunction with an ERP system or Stand-alone modelling tool (environmental cost accounting tool, component of an eco-efficiency tool)	Modelling tool in conjunction with an ERP system and a data warehouse or Stand-alone modelling tool (life cycle costing tool, post investment assessment tool)	Modelling tool in conjunction with an ERP System via e.g. PAS 1025 interface or Stand-alone modelling tool (life cycle assessment tool, component of an eco-efficiency tool)	Modelling tool in conjunction with an ERP System and a data warehouse via e.g. PAS 1025 interface or Stand-alone modelling tool (life cycle assessment tool, post investment assessment tool)
Future Oriented	Routinely generated information	ERP System (internal monetary environmental budgeting component) or ERP system in conjunction with an external EMIS (external monetary environmental budgeting component, external environmental capital budgeting component)	ERP system in conjunction with an external EMIS (component of long-term planning support systems, sustainability balanced scorecard data provider)	ERP System in conjunction with an external EMIS via e.g. PAS 1025 interface (physical environmental budgeting system)	External EMIS in conjunction with an ERP system via e.g. PAS 1025 interface (component of long-term planning support systems, sustainability balanced scorecard data provider)
	Ad hoc information	Stand-alone Modelling tool (environmental cost accounting tool, component of an eco-efficiency tool)	Stand-alone Modelling and simulation tool (life cycle costing tool, component of scenario analysis tools, feature of dynamic modelling tools)	Stand-alone Modelling tool (life cycle assessment tool, component of an eco-efficiency tool)	Stand-alone Modelling and simulation tool (life cycle assessment tool, feature of dynamic modelling tools, component of scenario analysis tools)

4. EMA COMPONENTS

Every few years ERP vendors upgrade the architecture of their ERP packages. The development is no longer focused on integrated large-scale modules. They interpret the ERP system as an important service provider within larger business information platforms. These developments reflect the componentisation trend in the software industry (Sprott 2000). Enterprise application providers disaggregate their large scale applications into relatively fine-grained components. Software components are autonomous, replaceable software objects and provide clearly defined services (Kobryn 2000, for an overview of definitions see Gill and Grover 2003). To present functionality via interfaces, components normally utilise other components. As a result, an enterprise application consists of numerous linked components.

Typical components in desktop applications are buttons, list boxes, random number generators, or timers. Larger components are, for example, text processors, chart components, and PDF export plug-ins. In the domain of environmental management accounting some instruments can be implemented as components or as sets of components (features) supporting e.g. data collection, data management based on material and energy accounting concepts, or data presentation in the form of balance sheets or sankey diagrams.

To assemble enterprise applications using components as software building blocks, an enterprise component framework is required (Kobryn 2000). A component framework can be defined as "an architectural pattern that provides an extensible template for applications within a specific domain" (Kobryn 2000:34). These frameworks specify standards and protocols. The standards and protocols should ensure exchangeability, adaptability, and upgradeability. It is possible to exchange components in the networks and to reconfigure the whole composition. From there, enterprise applications based on components are adaptable to a high degree (Sprott 2000). This is important with respect to EMA as adaptability is a fundamental pre-condition to implement new databases and instruments within enterprise applications. The adaptability of componentized enterprise applications allows the replacement of conventional cost accounting components by new environmental cost accounting instruments, and the integration of new components, as desirable, to incorporate PEMA.

Providing exchangeability and adaptability are not the only advantages of components and standardised component frameworks. The interfaces separate the implementation from the service. The implementation can be changed within the component without side effects. It is possible to improve the quality of components without problematic consequences in the whole network of components. Furthermore, class inheritance, metadata tables and reflection (Richter 2002), in line with interface inheritance, facilitate dynamic upgradeability of components (Sprott 2000, Szyperski 2003). It is possible to specify new, inherited interfaces to introduce new services and instruments. In componentized enterprise applications it is feasible to upgrade, for example, conventional cost accounting components to implement flow cost accounting. Another approach is to incorporate material and energy flow accounting requirements into a materials management component.

The advantages of componentized software architectures are not only applicable to huge enterprise applications but also to computer tools. In fact, some well-known office tools are implemented as components. For example, it is possible to embed a spreadsheet table into a text document. The access of spreadsheet applications to databases can be realised using database access components, etc.

Modelling and simulation tools can meet component standards and protocols like COM (Component Object Model, integral part of the up-to-date Windows operations systems) or CORBA. For example, various life cycle assessment tools have implemented COM interfaces for several years. The COM interfaces make it possible to link different models, for example a discrete-event simulation model, within a material flow network to analyse the impacts of a warehousing policy on the resulting transport processes and carbon dioxide emissions (for further examples see Möller et al. 2001). Another domain of COM interfaces is data import (see Figure 27-3) and automated model construction. In this case automated data import is the starting point of scenario development.

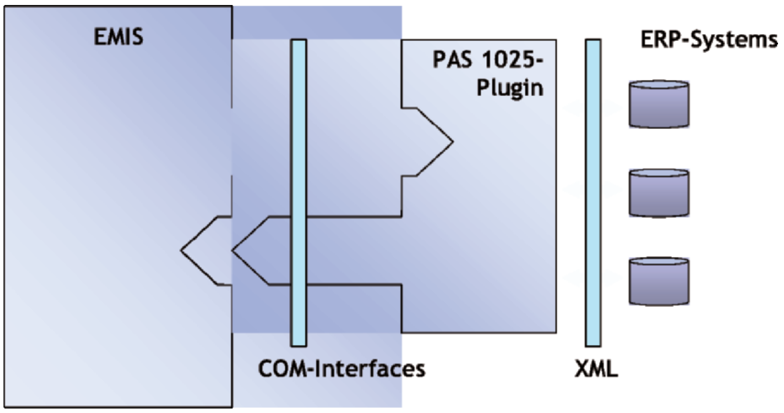

Figure 27-3. Technical implementation of a PAS 1025 component as an EMIS plug-in (source: Wohlgemuth et al. 2004).

At present, computer tools provide interfaces to utilise additional components. The applications themselves are not fully componentized. As in the domain of ERP systems, it is "work in progress" (Sprott 2000). Particularly new software development frameworks and runtime environments like .NET (Richter 2002) promote component-based software development. Componentisation entails a new type of software engineering: Component-based Software Engineering (CBSE). CBSE "is concerned with the development of software systems from reusable parts (components), the development of components, and the system maintenance and improvement by means of component replacement or customisation" (Crnkovic et al. 2002:47). On the one hand, application development deals with the composition of applicable components. On the other hand, component development is concerned with the design and implementation of new components and the enhancement of existing components.

As described above, design and development of components is mainly a challenge for vendors of enterprise applications and providers of modelling and simulation tools. Nevertheless, componentisation facilitates the implementation of new instruments, in particular in domains of EMA. Today, a common way to develop new instruments is to implement a Microsoft Excel or Microsoft Access solution. These small applications are criticised as stand-alone solutions, not applicable in practice. Otherwise, it is not realistic to implement comprehensive enterprise applications to demonstrate new approaches like EMA. Componentisation offers a fundamentally new way to deal with that dilemma. To introduce new approaches, it is adequate to implement a set of new components or to upgrade existing components. Afterwards, users can incorporate the new features into their enterprise applications.

Building applications from components can be characterised more or less as a composition process ('Compositional reasoning', Szyperski 2003). Reusing predefined software parts rather than building software applications from scratch requires specific software engineering practices and design techniques, such as finding suitable components, integrating components, validating a component's behaviour before using it, and managing multiple implementations and versions of components (Gill and Grover 2003).

Unlike component development, component-based application development requires collaboration with experts of the application context. That applies to component-based EMA systems, too: Which fields of the comprehensive EMA framework should be covered by the application (e.g. only monetary environmental management accounting, only past-oriented environmental management accounting, or only future-oriented EMA tools to support strategic management)? How can the harmonisation of different EMA features be realised (e.g. eco-efficiency and sustainability balanced scorecard, material and energy flow accounting and environmental reporting)? Which components beyond EMA are essential (e.g. materials management, conventional cost accounting, production planning and control).

Consequently, EMA experts play a prominent role in component-based application development teams. They initialise the development by defining the tasks and information needs of a required EMA component, e.g. a tool for assessing investment options in financial and ecological terms. Based on these specifications IT experts develop and assemble the component from existing EMA components and applications like material and energy flow accounting applications, ERP systems, environmental impact assessment components, etc. Finally, the EMA expert applies the new component to compute the information needed for the decision.

The variability in the resulting componentized software systems supports changing requirements and evolution (Bosch 2004). Little by little, further components like ‘sustainability reporting’ or ‘sustainability balance scorecard support’ can be integrated. Above all, the concept of componentisation provides a way to merge the system perspective and the tool perspective of computer science. In fact, there is no rigid dividing line between environmental information systems based on the system perspective and interactive computer tools. As an extensive database of transaction data the ERP systems and operational environmental information systems can serve as a basis for specific accounting tools which are used on an ad-hoc basis. Often, special aggregation components such as data warehouses are required to preprocess data (Scheide et al. 2002). As a result, realising component-based EMA applications is not only a development challenge, but an ongoing maintenance task as well.

5. CONCLUSIONS AND OUTLOOK

This article explores environmental information systems in a larger sense and delineates categories of approaches including interactive modelling and simulation tools. Customised ERP systems and computer-based environmental information systems, designed from the system perspective, mainly provide routinely generated operational environmental management accounting information. An adequate ERP system which contains PEMA and MEMA instruments as completely integrated features is most favourable. Furthermore, such an ERP system can be considered as a container of best-practice business processes in the field of environmental management accounting. Up to now, ERP systems do not contain MEMA and PEMA components. Thus, the most favourable solution is not yet an option. Instead, well-defined data exchange between ERP systems and environmental information systems is required. Data exchange languages like XML and appropriate XML processors facilitate this data exchange. Nevertheless, the interfaces and mappings have to bridge different methodologies. In particular comprehensive and coherent energy and materials accounting is not supported by common business information systems.

Computer-based information systems like ERP systems are designed to support mainly routine business processes. To cover further domains of a comprehensive framework for environmental management accounting other forms of computer support are required. The computer science metaphor 'tool' characterises this form of computer support. Tools are very flexible software applications. An outstanding characteristic of computer-based tools is that they serve as a source of inspiration ("tools for getting new ideas", Bødker et al. 2000:252). Accordingly, the primary focus of computer-based modelling and simulation tools is to provide future-oriented data.

Componentisation is a software engineering approach that combines the strengths of the different approaches. Componentisation is 'work in progress' both in the domain of large enterprise applications and in the field of modelling tools. These developments require rethinking the implementation of EMA systems. The introduction of new EMA instruments enforces implementing new EMA components or upgrading existing components, whereas the design of component-based EMA-including enterprise applications is more a composition process.

State of the art computer science offers promising new approaches to meet the requirements of computer-based EMA implementation in enterprises. To promote and propagate EMA successfully well thought-out EMA computer applications are a basic necessity.

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Chapter 28

ENVIRONMENTAL PERFORMANCE MEASUREMENT USING THE EPM-KOMPAS APPROACH AS ONE STEP TOWARDS SUSTAINABILITY

The Assessment Method in the EPM-KOMPAS Approach as a Guide for SMEs Towards Better Environmental Performance

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Abstract: To find a way to measure sustainable performance its three components economic, environmental and social performance have to be defined clearly and both assessed and improved properly. As it is almost impossible to do this simultaneously for these three components, strategies for improving sustainable performance have to be developed.

The EPM-KOMPAS approach, which aims at supporting small and medium sized enterprises (SMEs) in the manufacturing industry in their efforts towards sustainability, provides an instrument to measure, assess and systematically improve the environmental and economic performance of SMEs. This approach offers SMEs an opportunity i) to collect relevant environmental data, ii) to choose the most relevant master parameters, which are the first needing improvement, iii) to set objectives for the improvement and iv) to assess the effectiveness of measures implemented.

After a short introduction this paper places emphasis on the special environmental assessment method in EPM-KOMPAS, which has been developed especially to support SMEs having large difficulties to choose the most relevant environmental aspects, on which their management of environmental performance should focus. This assessment method considers the data available in SMEs in the manufacturing industry and supports them by offering different alternative possibilities for assessments first to rank environmental aspects and, then, to decide which one(s) should be controlled. With this decision SMEs are enabled to set objectives, to determine measures and to assess the success of these measures.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 625-653.

1. INTRODUCTION

> *"Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development 1987)*

In relation to sustainable development as the challenge of present time, management concepts to accomplish such a development had to be generated and the research field of sustainability management arose. In recent times the determination of actual results of sustainability management concepts in general is becoming one of the focuses of management research. Fields of research are concentrating on the identification of consistent criteria for i) the record, ii) the measurement and iii) the assessment of sustainability performance.

Therefore, at first the understanding of sustainability performance needs to be clarified. As there is a multitude of already existing definitions which differ in their understandings, this paper will be based on those parts that are commonly agreed on: sustainability performance has to combine the three components economic performance, environmental performance and social performance.

It is evident to see that these three parts of sustainability performance are leading to a complexity which is nearly impossible for a company to completely record and assess. That is why a company will only be able to measure those parts of its sustainability performance, that are known, that can be recorded and that reflect the requirements of its stakeholders.

Hence, an improvement of one part of the three performance components while maintaining the other ones at the same level can be understood as representing an improvement of sustainability performance. As usually many different individuals are responsible for the three dimensions of sustainability (economic, environmental and social), with the improvement of one dimension of sustainability performance improvement of one area can be achieved without downgrading the others. For example, improving eco-efficiency as an indicator for the environmental dimension of sustainable performance can mean the use of fewer resources (reducing input) and/or causing less waste (reducing undesired output). That situation can be reached by not decreasing economic performance or even by increasing it (Günther et al. 2004).

As it is even more difficult for small and medium sized companies (SMEs) to completely record, measure and assess their sustainability performance, this paper introduces the EPM-KOMPAS approach, which was developed especially for SMEs in the manufacturing industry and which is capable of leading SMEs towards sustainability (given the above definition) by helping them to improve their environmental as well as their economic performance. The EPM-KOMPAS approach as well as the associated software solution is developed in a simple way that SMEs can cope with, that avoids the need for consultancy, includes an easy economic assessment method and takes into consideration the data available in SMEs.

The European Commission defines SMEs as enterprises, which have less than 250 employees, have an annual turnover not exceeding 50 million EUR and/or have an annual balance-sheet total not exceeding 43 million EUR and are independent, i.e. 25% or more of the capital or the voting rights are not owned by a single enterprise, or jointly by several enterprises (European Commission 2003).

Why was the focus on SMEs in the manufacturing industry chosen?

It is known that SMEs have a very high market volume in Europe - over 95% of enterprises in the European Union are SMEs (OECD 2000). Moreover, "SMEs also account for a high percentage of manufacturing firms in many OECD countries and provide at least half of OECD manufacturing employment" (OECD 2000). Furthermore, these companies collectively have a high aggregate environmental impact (Lefebvre et al. 2003). Because of this situation SMEs have a high potential for the prevention of environmental impacts. Therefore the conclusion can be drawn that only by convincing this group to include environmental aspects in their decisions can serious environmental problems be prevented in future (Revell and Rutherfoord 2003, Tilley 1999).

The EPM-KOMPAS approach is the result of a research project also referred to as EPM-KOMPAS at University of Technology Dresden (TUD). As mentioned above, the project focused on SMEs in the manufacturing industry, more precisely in the mechanical engineering sector, as the decisive target group for implementing environmental management and sustainable management. In addition, the research project EPM-KOMPAS co-operated with six Saxon SMEs in the mechanical engineering industry (*inter alia* Metallgießerei Chemnitz, Systemantriebstechnik Dresden, SITEC Chemnitz), who chose to participate for different reasons based on: their commitment to voluntary environmental working groups; support for their first steps in building up the process of a corporate environmental management; or their introduction of EMAS/ISO 14001certification. Furthermore, SMEs as suppliers of multinational companies are already partly required to measure their environmental performance. Therefore multinational companies were integrated in the project as sparring partners, i.e. to discuss the findings and get neutral expert feedback. Moreover, industrial associations (*inter alia* the Federation of German Industries (BDI), Federation of the Engineering Industries (VDMA), German Electrical and Electronic Manufacturers Association (ZVEI)) as well as environmental associations (*inter alia* Industrial

Waste Coordination Association (IKS)) hosted practical development of the EPM-KOMPAS approach.

The EPM-KOMPAS approach follows the *Living Case Method* (Brunner and Friedrichsmeier 1999) of the Harvard Systematization, as it was developed by working with six SMEs and through co-operation and consultation with industrial/environmental associations representing a large number of companies especially SMEs in manufacturing industry. So the EPM-KOMPAS approach not only demonstrates feasibility but also provides representative results.

This paper proceeds as follows: firstly, a short presentation of the comprehensive EPM-KOMPAS approach will be made, by describing each step in the eight-step-circle. Secondly, the newly developed assessment method, which is included in the EPM-KOMPAS approach, will be introduced in detail. Emphasis on the innovational character of the assessment method means that both the development process and the method itself will be presented.

2. THE EPM-KOMPAS APPROACH TO MEASURE ENVIRONMENTAL PERFORMANCE

2.1 Eight-Step-Circle of the EPM-KOMPAS Approach

Before dealing with the measurement and assessment of environmental performance the term needs to be clarified. Environmental performance is already defined in both EMAS II and ISO 14031 as “results of an organisation’s management of its environmental aspects” (European parliament and the Council of the European Union 2001:2c) or more precisely: “environmental performance is the total of a firm’s behaviour towards the natural environment (i.e. its level of total resource consumption and emissions)” (Wagner et al. 2001).

The eight-step-circle of the EPM-KOMPAS approach provides the company, especially the focus group of SMEs in the manufacturing industry, with a complete method ranging from creating input-/output-balances (*inter alia* eco-balances) (→ recording), choosing and influencing significant parameters for environmental performance (→ measuring), and setting environmental objectives for significant corporate parameters as well as analysing the success of measures to meet the objectives (→ assessing the parameters that should be improved) (see Figure 28-1).

At first the company has to decide upon which system boundary environmental performance should be measured. In most cases the system boundary is specified at the level of a company (gate-to-gate) because this is often equal to the boundary for economic decisions, especially in SMEs. However, every other system boundary (e.g. product, process) could be chosen within the EPM-KOMPAS approach.

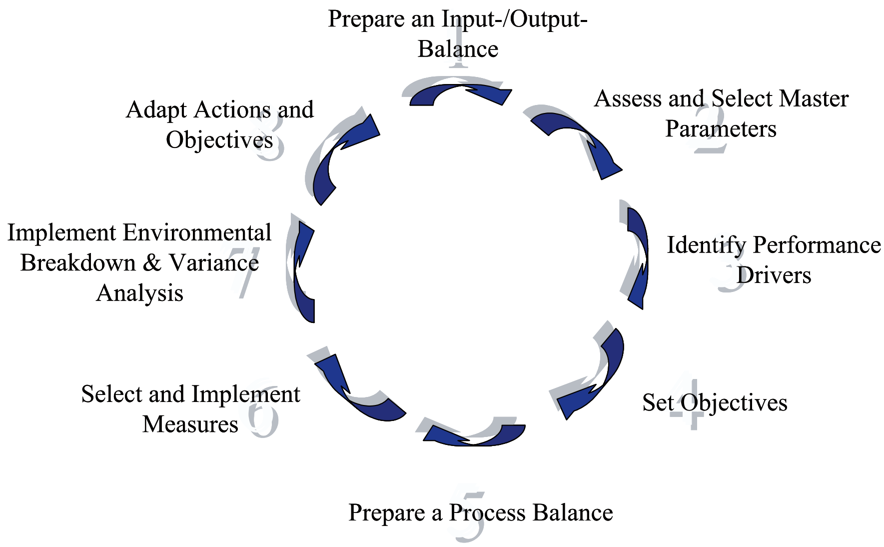

Figure 28-1. Eight-step-circle of the EPM-KOMPAS approach.

Step 1 involves collecting the necessary corporate environmental data. However, practice shows that it is impractical for companies, especially for SMEs, to collect all environmental data (ISO 2004). Because of these difficulties the purpose for collecting data needs to be known (also see Figure 28-3 in Section 3.). The purpose becomes evident when the company gets an overview of its *significant* corporate environmental data, and the relation to environmental impacts. As the first step towards collecting environmental data of use to users the EPM-KOMPAS approach advices companies to collect environmentally significant data, e.g. raw materials, auxiliary materials, hazardous materials, energy consumption, products and waste. A further step can include the collection of a broader range of data as a *continuous improvement process* within the company.

Result of Step 1: Significant corporate environmental data is collected in a balance sheet. This corresponds to recording environmental performance company-wide, for a product or a process (depending on the system boundary chosen).

The second step based on this processed balance is to assess the data in relation to the environment. This step aims at the identification of master parameters where each leading parameter represents a significant environmental aspect of the company, and which has to be improved if environmental performance is to be improved.

For this important but (especially for SMEs) difficult step the EPM-KOMPAS approach offers three possibilities for assessing environmental data: i) free choice, ii) a workshop, including relevant stakeholder questions, which gives the company the incentive to choose a master parameter by answering the questions, and iii) an automatic calculation based on a newly developed method by Günther and Kaulich.

These assessment methods will be described in detail in Section 4.2.3.

Result of Step 2: After completing the balance in Step 1 master parameter(s) are identified and chosen, which indicate content(s) for the objective(s) determined.

Before setting an environmental objective based on an identified significant master parameter analysis of the impacts the parameter causes in the company/the product/the process is undertaken. Hence, in Step 3 cause analysis searches for relations between a master parameter and its *performance driver(s)* within the different processes of a company (structuring step from a process oriented view) and afterwards providing a detailed analysis of the various inputs, outputs and activities of the company (in-depth cause analysis step) (see Figure 28-2).

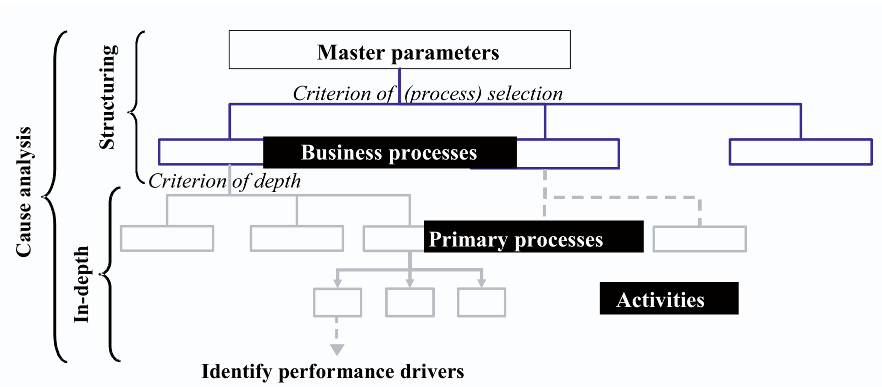

Figure 28-2. Cause analysis from master parameter to performance driver.

By recognising this link between corporate master parameters and performance driver(s) effective environmental (performance) objectives can be determined in Step 4. In respect of this cause analysis the EPM-KOMPAS approach provides SMEs in the manufacturing industry with systematic support to determine environmental objectives. SMEs are enabled to overcome the difficulties they have previously experienced because of a lack of standards for determining objectives (Biondi et al. 2000).

Result of Steps 3 and 4: In respect of the information about the completed input/output balance of Step 1 and the master parameters chosen in Step 2 cause analysis identifies performance driver(s). By knowing which parameter should be improved (master parameter) and how this parameter could be influenced (performance driver) objectives can be determined and targeted.

Viewing a company as a flowchart of combined sub-processes and activities the cause analysis leads to identification of sub-processes or activities within the company in which both the master parameter and its performance driver are included. This sub-process/activity is examined in depth in Step 5 in order to identify which inputs and outputs are included or which interactions (i.e. positive or negative effects) might be caused by an intended measure.

As it is demanded by business administration, even especially for environmental projects, there has to be an economic check in advance to establish whether the intended measure is likely to result in an economic benefit. Hence, in Step 6 the EPM-KOMPAS approach recommends use of the “net present value method” (Drury 2004) as a practical method to assess measures from an economic point of view (see Section 2.2).

Result of Steps 5 and 6: Regarding an identified master parameter (Step 2) and its cause or performance driver (Step 3), a sub-process that includes both has to be analysed to determine whether the measure of this process fulfils the set environmental objective (Step 4).

Once the measure is accomplished its success has necessarily to be checked with the *ecological breakdown,* a *newly developed instrument* based on financial statement analysis and variance analysis (Günther and Kaulich 2005, Drury 2004), which analyses the environmental measures with regard to:

- Components outside the chosen system boundary: to separate them and hence, to analyse only the success factors that are included within the system boundary
- Non-intended components, such as accidents and disasters, which influence intended success either via improvement or deterioration and hence, which need to be separated
- Variances in production (or other corporate reference values) to clarify which components of success are caused by higher production levels and have to be separated such that only the efficiency of the measure itself is analysed
- The efficiency of the measure assuming a constant production level

Step 8 closes the circle of the EPM-KOMPAS approach. Companies can adopt objectives and/or determine new ones or derive alternative actions for the same master parameter and therefore start the EPM-KOMPAS process again.

Result of Steps 7 and 8: Improvement of the master parameters and their causes, the performance driver, has been processed and its success has been measured and analysed with the instrument of ecological breakdown. The set objective is seen to be achieved and new objectives set.

2.2 A Software Solution for the EPM-KOMPAS Approach

Research within the EPM-KOMPAS project lead to development of a software solution for implementation of the EPM-KOMPAS approach in companies as well as development of the EPM-KOMPAS approach and instruments, i.e. ecological breakdown and assessment methods (see Section 4).

The most important differences between standard LCA software and the EPM-KOMPAS software are: the very easy handling that avoids the need for consultancy (*no large efforts* are required to establish familiarity with the software); its base on the Microsoft Office Package (*no large cost* for a totally new software); *free* availability (*no costs to the acquirer*); and economic assessment using the *net present value method* and environmental analysis, both of which are included and automated within the software.

With the help of this software companies can work through the eight-step-circle presented as each step is supported by the software. As both the EPM-KOMPAS approach and the software were developed from a strong practical point of view and in co-operation with SMEs and industrial and environmental associations the software is easy to install and understand and can be implemented within the company by internal staff. The EPM-KOMPAS software is an Access Solution based on Microsoft Office, which is in common use. Without going into detail, as the emphasis of this paper is on the assessment method in the EPM-KOMPAS approach, some functions should be mentioned, for example:

- A menu for choosing the system boundary that suits the company
- An opportunity for creating balance spreadsheets automatically with the materials and energy values entered by the user
- Offering the assessment methods for determining master parameters (see Section 4), e.g. the workshop with a menu containing relevant stakeholder questions where the EPM-KOMPAS users can choose these on their own and save the answers as well as obtain an assessment of these answers with A-priority (high), B-priority (medium) or C-priority (low) on their own (see Section 4)

- An investment method where the user enters all relevant costs and revenues regarding the intended measure and the software calculates a net present value with the result that the user can evaluate the economic benefit of the measure
- The ecological breakdown including all equations to analyse environmental success

As this short comment on the EPM-KOMPAS software shows there is much support within this software tool to enable even SMEs to process the eight-step-circle EPM-KOMPAS in a simple, successful way.

As one idea of the EPM-KOMPAS approach is based on the reduction of complexity of corporate environmental aspects, the crucial step in this eight-step-circle is Step 2, including assessment and selection of master parameters. Therefore, the innovative assessment methods combined in this step as well as their synthesis are considered further in the following section.

3. AIM AND ANALYSIS OF THE DEVELOPMENT PROCESS OF THE ENVIRONMENTAL ASSESSMENT METHOD

As an *improvement in sustainability performance* is defined as an improvement in one part of the three performance components (economic, environmental, social) while maintaining the others at the same level (see Section 1) one of the most important steps of the EPM-KOMPAS approach is to *improve environmental performance* and the identification of a master parameter on which management of environmental performance needs to focus.

As in general it is difficult to determine the best assessment method, it is even more difficult to find the optimal one for a SME. Therefore, analysis of existing assessment methods and data availability in SMEs in the manufacturing industry was undertaken. By comparing the requirements of existing methods with the data available in SMEs within this industry a lack of data was evident. To bridge that gap an assessment method was developed to fit the requirements of SMEs on the one hand and their data situation on the other. This method merges existing methods and further develops them.

3.1 Aim of the Development

The focus on significant environmental aspects for the environmental management of companies has already been adopted in EMAS II. It is based on the idea of identifying master parameters which reflect significant environmental aspects at the company level. In the process the company has to assess all corporate environmental aspects with the help of criteria that are “comprehensive, capable of independent checking, reproducible and made publicly available” (European Parliament and the Council of the European Union 2001). Criteria such as potential to cause environmental harm, fragility of the environment, size and frequency of the aspect, importance to stakeholders and employees of the organisation, etc. were mentioned in the *recommendation* of the commission on guidance for the implementation of regulation EMAS, but they were *not* implemented in the *decision* on this guidance (Commission of the European Parliament 2001a, 2001b).

Nevertheless, concrete steps showing how to assess environmental aspects and how to identify master parameters are missing. So the question during the development of the EPM-KOMPAS approach was: which of the existing assessment methods is the best for SMEs in the manufacturing industry?

To answer this question it was necessary first to analyse the existing environmental assessment methods aimed at finding an environmental assessment focusing on the primary action potential of the companies and, because of the system boundary adopted, which does not require a complete Life Cycle Assessment. The primary action potential can be identified in the internal corporate processes and comprises all factors that can be influenced by the company itself.

In addition, the method should prepare and support *decision-making* and should not only be an information instrument. Science-based assessment should generate meaningful and comprehensible, independently verifiable results for every chosen system boundary (e.g. company-wide, process or product) (see Section 2.1).

3.2 Analysis of Existing Environmental Assessment Methods

In the environmental management research field a large amount of different environmental assessment methods have been developed in recent times. They can be distinguished by their data requirements as well as their inherent assessment method. As each of the methods makes different assumptions and has different data requirements the proposed measures for the same environmental aspect can differ. Hence, a comparison of the results of different assessment methods is often neither sensible nor feasible.

An analysis of existing environmental assessment methods for the EPM-KOMPAS approach suggests:

- The selection of *quantitative* environmental assessment methods able to get results with the help of mathematical equations (see Figure 28-3)

- Focus on the data base necessary for applying the particular method (see Table 28-1)

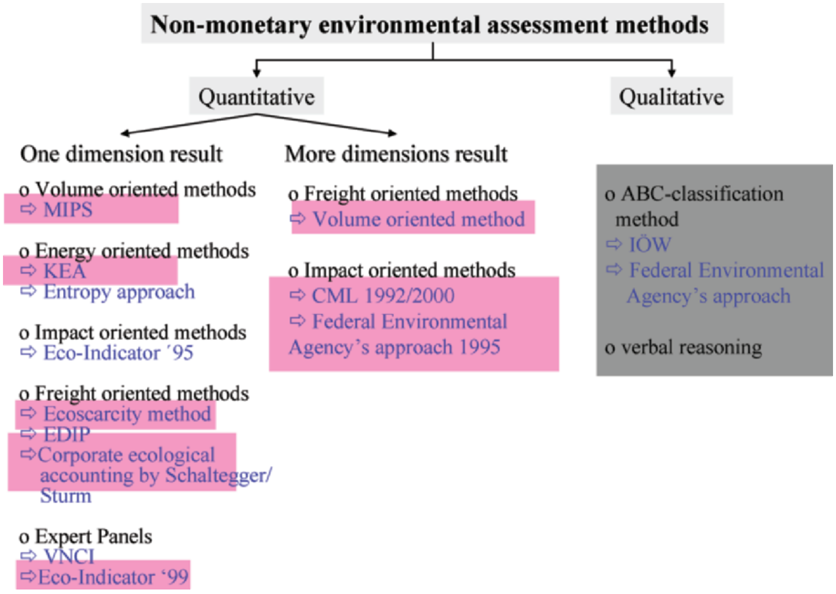

Figure 28-3. Categories of non-monetary assessment methods and the selection of this analysis (source: Schaltegger and Burritt 2000).

The idea is to receive *meaningful results* which help companies to assess and weight their environmental aspects using the chosen environmental assessment method. Table 28-1 shows the assessment methods included in the analysis with their names and a short explanation of the necessary data base for each. For a fuller overview: a *summary*, the *main data fields* needed, and the assessment methods, are included.

The second step includes analysis of the data availabile in SMEs in the manufacturing industry in order to choose the best environmental assessment method. Therefore, the leading question for this component of the analysis was: "Do SMEs have the data bases required for existing environmental assessments?"

Table 28-1. Data bases of selected environmental assessment methods.

Method	Necessary data base	Assessment based on/needs		
		Energy data	Emission data	Detailed input-/output-data
CER (Cumulated Energy Requirement) by the Institute for Applied Ecology	Detailed energy consumption, used during production, use and disposal of the analysed system, i.e. energy consumption in mJ in the life cycle steps	☒ Along the life cycle		
Corporate Ecological Accounting (Schaltegger and Sturm 1998)	Exact data on emissions in water, air and soil, i.e. knowledge about the quantity and kind of emissions is required		☒	
Ecoscarcity Method (Swiss Association for Environmentally Conscious Management) (Braunschweig 1994)	Exact data on energy sources and emissions in water, air and soil, i.e. knowledge about the quantity and kind of emissions is required, as well as the tolerance quantity (critical flows) of the different materials	☒	☒	
Volume Orientated Method by Swiss Federal Agency for the Environment, Forests and Landscape (SAEFL) (SAEFL 1990)	Exact data on emissions in water, air and soil		☒	☒
Federal Environmental Agency's Approach to Valuation as part of Life Cycle Assessment (Federal Environmental Agency 1999)	Exact data on material and energy flows, their classification and the specific contribution to the impact categories and their reference substance	☒		☒
Material Input per Service Unit (MIPS) (Schmidt-Bleek 1993)	Detailed data on material flows, energy consumption, land use and service units	☒	☒	☒
Institute of Environmental Sciences (CML)-Method (Guinée 2002)	Exact data on material and energy flows and their emissions			
Eco-Indicator '99 (Goedkoop and Spriensma 1999)	Exact data on material and energy flows and their emissions	☒	☒	☒

3.3 Analysis of Data Availability, Especially in SMEs in the Manufacturing Industry

It has been suggested that there are information deficits in SMEs (Ammenberg and Hjelm 2003, Biondi et al. 2000, Kolk and Mauser 2002). This lack of data, especially of high quality data, is evident in the different departments of SMEs, not only in environmental management, but also, for example, in cost accounting. This shortage of base data hinders the application of management instruments (e.g. cost accounting systems) for daily use by SMEs.

It is evident that both the documentation and the use of instruments decrease when companies are smaller (Schnauber et al. 1995). For example, energy balances and emission inventories, which could be used for generating input/output balances, exist only to support corporate reporting to regulatory authorities. In general, these instruments are *not* used in companies with less than 500 employees. The picture is similar for input/output balances, which are *not* that much familiar to /or used in companies with less than 250 employees (Schnauber et al. 1995).

Based on strong co-operation with companies as well as industrial and environmental associations while developing the EPM-KOMPAS approach the following information for an environmental assessment can be considered as generally available in SMEs in the manufacturing industry:

- Bills for materials, data from production planning and control systems, list of orders and especially material safety data sheets (for hazardous materials)
- Records of waste management, records of waste water and emission declarations (partial)
- Accounting bills (for water and energy consumption)

These data sources are available in SMEs in the manufacturing industry and if possible, environmental data can be derived from them. It has to be mentioned that there are some environmentally relevant material flows (e.g. air emissions) that are not adequately represented in bills for materials or accounting and other ways of data collection have to be developed.

3.4 Gap-Analysis between Required and Available Data

The analysis shows that SMEs in the manufacturing industry cannot deliver the required data for the common existing environmental assessment methods as there are difficulties with the collection of environmental data resulting in a lack of such data or in poor quality data (Ammenberg and Hjelm 2003, Biondi et al. 2000, Schaltegger et al. 1996).

Therefore, the conclusion can be drawn that the availability of data is critical for the broad use of the available environmental assessment methods available to SMEs. This leads to the so-called *"provided that" dilemma* as the environmental assessment methods work with company data *supposed* to be available. But mostly they are not. In effect the broad use of these assessment methods gets eliminated because of missing data.

3.4.1 The "Provided that" Dilemma

Even if existing methods deliver brilliant results, the fact is that data demand and other necessary prerequisites in companies are missing, and a "provided that" dilemma has to be determined. This can be affected by data availability, data quality and bases for power, as the following explanations show:

- "Provided that" dilemma caused by a gap in data availability.
  Data availability in companies, especially in SMEs, can be restricted, because the required positions are not recorded *separately* by departments, e.g. procurement, production or accounting. This results in only one entire position, which leads to the problem of missing eco-balance positions. As the positions may be known, the corresponding values (e.g. quantities) are not specified clearly enough. This means that available data is either not sufficiently well specified.
- "Provided that"-dilemma caused by a gap in data quality.
  As indicated above there is a gap in the quality of data collected especially about SMEs. To improve the quality of recorded data the principles of plausibility, triviality, individuality and practicability have to be considered:
  - Are the data right? The recorded data have to be checked in relation to their *plausibility*.
  - Are there threshold values for the recording of data? It may appear *trivial* but the company has to check whether the effort associated with recording data is effective.
  - Are there specific company characteristics concerning environmental data? If a company has *individual* environmental characteristics (e.g. in using certain materials, etc.) it should focus on the recording of these special ones aiming at a complete and high qualified record.
  - Can the company influence these parameters? It is *practicable* to record only data which can be influenced by the company.
- "Provided that" dilemma caused by a gap in the power base.
  Even if a company has a large, high quality data base, the analysed assessment methods take for granted that there is enough potential within the company to implement these methods in a corporate decision-making process. The "theory of bases of power" (French and Raven 1959) draws

attention to the situation that the success of a method, especially as used for decision-making, needs to meet several prerequisites, the so-called power bases:

- Reward power, based on the perception that there is an ability to get a reward;
- Coercive power, based on the perception that there is an ability to get a punishment;
- Legitimate power, based on the perception that there is a right to prescribe someone's behaviour;
- Referent power, based on identification with the traits of another person; and
- Expert power, based on the perception that someone has special knowledge.

In SMEs the most crucial prerequisites are the need for special knowledge (expert power) and the desire not to get a punishment in terms of higher costs, or additional work (coercive power).

During the development process of both the EPM-KOMPAS approach and the environmental assessment method this existing "what if" dilemma, which can be seen as being critical as a basis for the broad use of common environmental assessment methods by SMEs, was identified by the industry partners and taken into account during extended research.

3.4.2 Need for a Specific Environmental Assessment Method

After completing the analysis described in Sections 3.2 to 3.4 the conclusion to develop a specific environmental assessment in the EPM-KOMPAS research project, especially to support SMEs in the manufacturing industry, was evident. The method developed is based on existing approaches and combines them in a way which allows usage by SMEs.

In the following section both the development process and its result, the environmental assessment itself, will be presented (see Figure 28-4) in order to provide:

- An example for a problem-oriented solution of the "provided that"-dilemma
- Important support in identifying a master parameter on which the management of environmental performance needs to focus for its improvement (as one dimension of the improvement of sustainability performance)

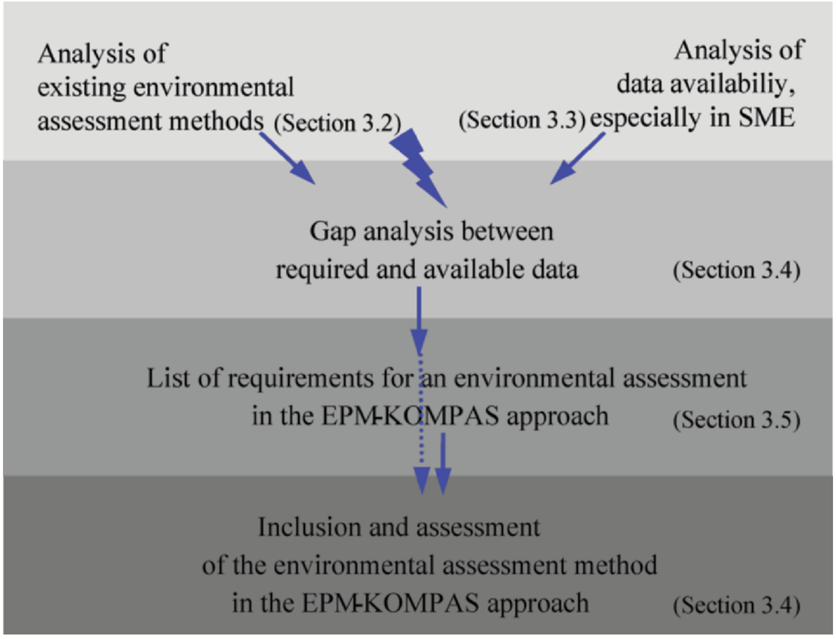

Figure 28-4. Development process of the environmental assessment method in the EPM-KOMPAS approach.

3.5 The Requirements for the Environmental Assessment in the EPM-KOMPAS Approach

It is a general rule in science that every developed approach has to fulfil the following criteria: transparency, comprehensibility, objectivity, exactness, validity and reliability to confirm its scientific quality (Dresbach 1996). Of course the EPM-KOMPAS approach and its assessment method have to face these requirements and they are used to verify the usefulness of results.

Even so, as the developed assessment method wants to bridge the "provided that" dilemma as well as its gaps, it has to fulfil the principles of plausibility, triviality, individuality and practicability (see Section 3.4.1). In addition, the "Environmental Performance Measurement (EPM)" competence centre at the University of Technology Dresden (TUD) set up additional criteria for its research and demanded these criteria be met in both the developed EPM-KOMPAS approach and its assessment method:

- Decision-making.
  The target of the methods developed is to support decision-making in companies and not just to deliver information for third party consumption.

- Stakeholder-orientation.
  As companies are part of a network consisting of different interested parties/stakeholders (Freeman 1984), their value systems have to be considered for decision-making as well.
- Primary action potential.
  Unlike Life Cycle Analysis, which follow a product "from cradle to grave", the methods developed in the competence centre focus on the space that can be influenced by company decisions. This leads to a corresponding system boundary.
- Materiality (Relevance).
  Decisions regarding the management of environmental performance should start with the master parameters. Therefore the criterion of materiality, also used in accounting, i.e. the restriction to the most important environmental aspects, seems to be acceptable.
- Scientific basis.
  Although economic decisions are likely to be prepared the methods developed to take environmental aspects into consideration are based on research in the natural sciences.
- Economic impact.
  To meet the requirement: "Only measures that add value or at least maintain value are suggested". For example, economic impact is calculated using the "net present value method", in the EPM-KOMPAS approach.
- Individuality/openness of the model/possibility of integrating new criteria.
  Depending on the different needs of companies methods can be individually adjusted, e.g. the system boundary can be chosen individually as a product, a process or a site (see Section 2.1).
- Organisational development.
  A success factor for newly developed methods is an internal process of organisational development, e.g. a task force and workshops fulfil this condition.
- Economic and environmental dimension of sustainability.
  Because of the three dimensions of sustainability performance it is obvious that the assessment of sustainability leads to a wide range of complexity. The methods developed at the competence centre at the University of Technology, Dresden (TUD), focus only on the assessment of the economic and the environmental dimension of sustainability.

All these criteria (from natural science/academic theory, practice and the competence centre) have to be fulfilled by the environmental assessment method developed (see Table 28-2).

Table 28-2. List of requirements for the environmental assessment method in the EPM-KOMPAS approach.

Origin	Criterion	Implementation
Academic	Transparency, comprehensibility, objectivity	Basic criterion through science
Academic	Exactness, validity	Basic criterion
Academic	Reliability	Basic criterion
Practice	Practicability and profitability	Recognition (4.1), KOMPAS-assessment (4.2.3)
Practice	Plausibility	Basic criterion through practice
Practice	Triviality	Recognition (4.1)
Practice	Individuality	Recognition (4.1), free choice (4.2.1), workshop (4.2.2)
Competence centre EPM	Individuality/openness of the model/ possibility of integration of new criteria	
Competence centre EPM	Decision-making	Basic criterion through work at TUD
Competence centre EPM	Stakeholder-orientation	Workshop (4.2.2)
Competence centre EPM	Primary action potential	Basic criterion through work at TUD
Competence centre EPM	Materiality	Basic criterion through work at TUD
Competence centre EPM	Scientific basis	KOMPAS-assessment (4.2.3)
Competence centre EPM	Economic impact	Free choice (4.2.1), KOMPAS-assessment (4.2.3)
Competence centre EPM	Organizational development	Workshop (4.2.2)
Competence centre EPM	Economic and environmental dimension of sustainability	Free choice (4.2.1), KOMPAS-assessment (4.2.3)

4. THE ENVIRONMENTAL ASSESSMENT METHOD IN THE EPM-KOMPAS APPROACH

For SMEs it is nearly impossible to record and assess all environmental aspects that are part of their environmental performance. One reason is that knowledge about the environmental impacts of different environmental aspects is still rather poor (*principle of relative completeness*). Other considerations are the economic and technical possibilities for the recording of the data (*principle of profitability*) and the requirements of relevant stakeholders (*principle of being affected*). Therefore, a company will only measure those parts of its environmental performance, which are known and can be recorded as well as reflect the requirements of the stakeholders. This can include several environmental considerations.

4.1 Recognition

In general, there are two ways of developing an assessment. First the assessment method can be developed by looking at the available data with the result that *the assessment follows recognition*. The distinction between recognition and assessment is based on accounting norms, i.e. recognition asks for the recording of data, assessment of their values based on given criteria and methods. The second option is to develop the assessment method regardless of the available data with the result that *recognition follows the assessment*.

With the EPM-KOMPAS approach the assessment follows recognition, i.e. only methods that can assess the available data in SMEs in relation to environmental aspects will be chosen. Based on this approach, the process of recognition already incorporates an assessment in its broader sense as restriction is accepted where data are missing.

As analysis has shown in Section 3.3 SMEs *cannot* deliver the required data for the commonly available environmental assessment methods and/or they have large difficulties in collecting them. Usually this leads to a lack of data or poor quality data. If SMEs do get the opportunity to use an environmental assessment method it has to be based on data that are available in SMEs or data that they can easily gain access to. Otherwise, SMEs will not use the assessment method (→ assessment follows recognition).

The EPM-KOMPAS approach suggests the recording and recognition of significant environmental data (see Section 2.1), *inter alia* raw materials, hazardous materials, energy and waste. These data are clearly incomplete. However, such data collection is based on the principles of *practicability* and *materiality* and focuses on the *primary action potential*. In addition, the EPM-KOMPAS approach suggests that the company only records data over defined threshold value (principle of *triviality*), as well as for an individually defined system boundary (principle of *individuality*).

4.2 Assessment

A key conclusion of the analysis described in Section 3 is the need to develop a special environmental assessment for SMEs in the manufacturing industry using the EPM-KOMPAS approach. The significance of environmental aspects needs to be assessed to allow an assessment as the basis for managing them. Therefore, the assessment method of EPM-KOMPAS includes a catalogue of assessable environmental aspects as the basis for environmental assessment. To establish this catalogue environmental aspects have been recognised according to:

- Requirements of society (qualitative assessment)
- The state of the art in science (quantitative assessment)

Reasons for taking public opinion into consideration in decision-making are the lack of scientific know-how about impacts of environmental aspects as well as the necessity to consider stakeholders and their potential influence (e.g. on corporate reputation). The following sections introduce three possibilities for environmental assessment in SMEs leading to a catalogue of assessed corporate environmental aspects. These three possibilities include both requirements of society and a science based quantitative assessment.

The assessment aims to identify a master parameter which can be improved and on which management of environmental performance can focus (as one dimension of the improvement of sustainability performance).

4.2.1 Alternative 1: Free Choice

A free *individual* choice of master parameters is possible, if these parameters are already known by the company. This may be the case if a third party can set objectives (the affiliated group, etc.), or if one of the existing environmental assessment methods is already in use in the company. This method of assessment in the EPM-KOMPAS approach meets the criteria of *individuality* and the *economic and environmental dimension of sustainability*.

4.2.2 Alternative 2: A Workshop for a Multi-Stakeholder Dialogue

Only the ABC-classification method is used widely as a qualitative method. This method assesses environmental aspects in relation to priorities at level A (high importance), level B (with a middle range importance) and level C (with low importance). Only if external (customers, suppliers, creditors) and internal (management, employees) stakeholders are perceived, will they be integrated into decision-making activities. Consequently, there needs to be a way for the SMEs to enter into a stakeholder-dialogue (Biondi et al. 2000, Freeman 1984). That is why an active part, based on the ABC-classification method, has been integrated in the EPM-KOMPAS software. A workshop has been created, which is based on the stakeholder approach, including a silent moderator. The multi-stakeholder dialogue on Corporate Social

Responsibility (CSR) illustrated, that businesses contribute to sustainable development through CSR. The dialogue with stakeholders is likely to contribute to long-term sustainability of business in society.

A specific option of this second alternative is the special treatment of the "silent moderator". For every stakeholder integrated in the software (*suppliers, costumers, competitors, management, employees, regulators, creditors/ insurance/shareholders, residents/public, and society*) questions which should provide the company with impulses for the process of identifying a master parameter, are built in. By answering these questions systematically companies can get a broad overview of stakeholder interests and the resulting master parameters. Moreover, the impulses can simply be assessed by the company as having a high, a medium or a low corporate priority. This possibility can be applied in companies through an internal task force that answers the questions together. The special task of the software in this context is that of a silent moderator. The workshop takes into consideration the criteria of necessary *organizational development*, *stakeholder-orientation* and *individuality*.

4.2.3 Alternative 3: The Automatic Calculation Based on the KOMPAS-Assessment by Günther/Kaulich

Apart from the previous possibilities a quantitative assessment method that results in automatically calculated parameters is available as a third alternative. This quantitative assessment is based on the impact categories that are already part of the ISO 14042 standard (ISO 2000). An approach should be chosen consciously because the company has to decide upon which aspects of its management of environmental performance to focus. Therefore, the assessment method should provide the company with a multidimensional basis on which an effective decision could be taken.

As the EPM-KOMPAS approach is based on the idea that *assessment follows recognition*, the assessment method is chosen contingent upon the data that are available in SMEs in the manufacturing industry or that they could easy made available. The environmental assessment methods previously analysed work with data that they suppose to be present in companies, but in most cases they are not.

Initially the following information for an environmental assessment can be considered as available in SMEs in the manufacturing industry:

- Bills of material, data from production planning and control systems, list of orders and especially material safety data sheets (for hazardous materials)
- Records of proper waste management, records of waste water and emission declarations (partly)
- Bills (for water and energy consumption)

If possible, environmental data can be derived from these sources, but there are some environmentally relevant material flows (e.g. air emissions) that are not adequately represented in bills of material or accounting and other ways of data collection have to be added (emission declarations).

In the second step, as assessment follows recognition, it has been essential to analyse, which existing science-based assessment methods can be used to obtain this data:

- Regarding the materials that are implemented in the production process of the company the factors "*Cumulated Energy Requirement (CER)*" and "*Cumulated Material Requirement (CMR)*", which are provided in the data base GEMIS, are used for the environmental assessment. This assessment possibility relates to the impact category "*Depletion of energy and material resources*" (Federal Environmental Agency 1999, 2002).
- In particular, the assessment of hazardous materials can be based on the "*Column Model*" ("Spaltenmodell") in line with paragraph 16 of the German regulation on hazardous materials, which provides the opportunity for assessing these materials in relation to the impact categories *Human toxicity* and *Eco-toxicity.*
- The *European Waste Catalogue* offers an assessment through its classification of *waste*. In particular because waste is a crucial environmental field for companies this impact category should also be added in the EPM-KOMPAS.
- In relation to corporate energy consumption the assessment will be based on emission factors with results in the impact categories "*Greenhouse effect", "Acidification" and "Photo-oxidant formation"*. In addition, the absolute quantity of corporate energy consumption should be added.

It can be concluded that the assessment method in the EPM-KOMPAS provides results within the following impact categories, which are based on the impact categories included in ISO 14042:

- Human toxicity
- Eco-toxicity
- Waste
- Energy consumption
- Greenhouse effect
- Acidification
- Photo-oxidant formation
- Depletion of energy and material resources (Federal Environmental Agency 1999, 2002)

SMEs aspire to an integrated management system of environmental, quality and risk aspects. That is why the assessment method in the EPM-KOMPAS approach includes the special category "*Hazard from fire and explosion*".

For reasons of practicability and of focusing on the primary action potential of the companies these impact categories were separated in the EPM-KOMPAS into: *superior impact categories based on pressure from third parties* and *company internal impact categories based on the internal allocation of responsibility*, as shown in Figure 28-5.

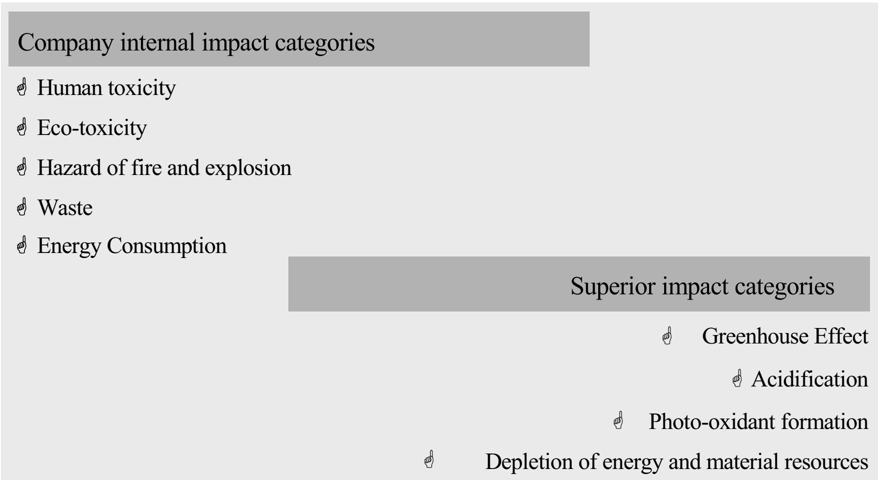

Figure 28-5. Company-internal and superior impact categories in the EPM-KOMPAS (source: Federal Environmental Agency 1999:14, 2002:21).

The "Column Model" from the Institute for Occupational Safety and Health provides a classification of hazardous materials in relation to their risk along the *R-Phrases* and Water Hazard Classes. The classification distinguishes materials with a very high, a high, a medium, a low and a negligible hazard to i) human health (human toxicity), ii) environment (eco-toxicity) and iii) fire and explosion (hazard of fire and explosion) (see Table 28-3).

If the company enters its used hazardous materials with the given R-Phrases and Water Hazard Classes the software EPM-KOMPAS automatically provides an overview of the materials within the three impact categories as well as their hazard levels. Apart from this, environmental assessment is set independently from the quantities used in the software, and the quantities and the costs of the hazardous materials are added to the assessment as well. This follows the principle of the *economic and environmental assessment* in the EPM-KOMPAS.

The assessment of the category "waste" is based on the classification of the European Waste Catalogue and also, separate from this environmental classification, quantities and costs are added. Additional consideration of the absolute quantity of the energy consumption is also suggested.

Table 28-3. Abridged version of the "Column Model" from the Institute for Occupational Safety and Health.

Product	Acute health risks (unique impact, i.e. chemical accident)	Chronic health risks (recurrence impact)	Environmental risks	Fire and explosion risks
Very high hazard	• Very toxic materials/preparations (R-Phrases 26, 27, 28) • Materials/preparations, which could generate very toxic gases if they encounter acid (R-Phrase 32)	• Tumorigenic material of category 1 or 2 (R-Phrases 45, 49) • Genotype changing materials of category 1 or 2 (R-Phrase 46) • …	• Materials/ preparations with risk symbol N and risk identifications R-Phrases 50, 51, 53, 54, 55, 56, 57, 58, 59 • Materials/ preparations of water hazard class Water Hazard Class 3	• Explosive materials/ preparations (R-Phrases 2, 3) • Very high inflammable gases and liquids (R-Phrase 12) • Self inflammable materials/ preparations (R-Phrase 17)
High hazard	• Toxic materials/ preparations (R-Phrases 23, 24, 25) • Strong acid materials/preparations (R-Phrase 35) • Materials/preparations, which could generate very toxic gases if they encounter acid (R-Phrases 29, 31) • …	• Reproduction endangering materials of category 1 or 2 (R-Phrases 60, 61) • Preparations, which contain reproduction endangering materials of category 1 or 2 in a concentration ≥ 0,5 % • …		• High inflammable gases and liquids (R-Phrase 11) • Materials/ preparations, which generate very high inflammable gases in conjunction with water (R-Phrase 15) • Oxidizing materials/ preparations (R-Phrases 7, 8, 9) • …

continued on next page

Table 28-3. *Continued.*

Product	Acute health risks (unique impact, i.e. chemical accident)	Chronic health risks (recurrence impact)	Environmental risks	Fire and explosion risks
Medium hazard	• Noxious toxic materials/preparations (R-Phrases 20, 21, 22) • Material, which could concentrate itself in the breast milk (R-Phrase 64) • Acid materials/ preparations (R-Phrase 34) • …	• Reproduction endangering materials of category 3 (R-Phrases 62, 63) • Preparations, which contain reproduction endangering materials of category 3 in a concentration ≥ 5%	• Materials/preparations with risk symbol N but with risk identifications R-Phrases 52, 53, 59 • Materials/ preparations of water hazard class Water Hazard Class 2	• Inflammable materials/ preparations (R-Phrase 10)
Low hazard	• Toxic materials/ preparations (R-Phrases 36, 37, 38) • Skin impairments by wet work • …	• Other chronic marring materials (with no R-Phrase, but also a hazardous substance)	• Materials/ preparations of water hazard class Water Hazard Class 1	• Poor inflammable materials/ preparations
Negligible hazard	• According to experience harmless materials (i.e. water, sugar, paraffin etc.)		• Non-water-endangering materials/preparations (former Water Hazard Class 0)	• Fire-proof or only very poor inflammable materials/ preparations

In relation to the superior impact category “greenhouse effect” corporate energy consumption is translated to CO_2-equivalents by emission factors in order to make the companies more sensitive about their specific contribution for the greenhouse effect. For the impact categories “acidification” and “photo-oxidant formation” the same principle is applied and the emissions caused by energy consumption are calculated with the help of equivalence factors.

The superior impact category “depletion of energy and material resources” focuses on environmental impacts resulting from the extraction and transformation of raw materials that are inputs for the inventory analysis, especially resource energy (Federal Environmental Agency 1999:A1ff.). Energy consumption for raw materials used in the production, is measured using its “Cumulated Energy Requirement” (Federal Environmental Agency 2002). For the depletion of materials the “Cumulated Material Requirement” is used.

As a result of these assessments a *vector of environmental performance* is generated that is usable for SMEs in the manufacturing sector (see Figure 28-6).

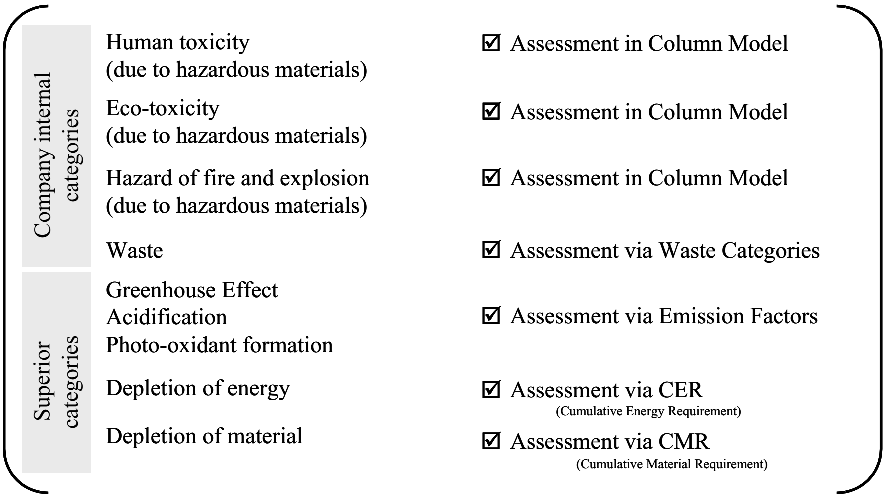

Figure 28-6. Vector of environmental performance in the EPM-KOMPAS.

Figure 28-7 gives an example what the vector can look like once it is completed. This multidimensional result forces the company to choose between the different single impact categories.

Whether there is a dominant category for the company (e.g. energy consumption) has to be discussed. It also may be interesting to see whether one master parameter is relevant to more than one category (in the example THERM ZINC VARNISH shows a high and medium hazard in three impact categories).

Furthermore, a decision between the environmental (quantities) and the economic (costs) dimension has to be taken. Of course, it would be ideal if there were interfaces between the environmental and economic dimensions, e.g. one parameter with high costs dominates a few environmental categories. Is the master parameter the one with the highest costs or with the highest quantities?

Company internal categories	Human Toxicity (due to hazardous material)	↯ **High hazard: FAN-EP accelerator** ↯ **Middle hazard: THERM zinc varnish** ↯ **Middle to low hazard: CHING-PUR Surface coating**
	Eco-toxicity (due to hazardous material)	↯ **Very high hazard: CHING-PUR Surface coating** ↯ **Middle hazard: THERM zinc varnish**
	Hazard of fire and explosion (due to hazardous material)	↯ **High hazard: THERM zinc varnish** ↯ **Middle hazard: CHING-PUR surface coating**
	Waste	↯ **Sludges from paint or varnish containing organic solvents or other dangerous substances**
Superior categories	Greenhouse effect	↯ **29.347,45 kg CO_2**
	Depletion of energy	↯ **Highest CER-Value: Aluminium**
	Depletion of material	↯ **Highest CMR-Value: Sheet steel**

Figure 28-7. Evaluated vector of environmental performance in the EPM-KOMPAS.

5. CONCLUSION

The EPM-KOMPAS approach is one instrument to support the efforts of companies on their way towards sustainability. It was developed to help SMEs achieve a better environmental performance. An improvement of sustainability performance is seen as an improvement of one part of the three performance components (economic, environmental, social) while at least maintaining the other ones at the same level.

The results of the three alternatives: free choice, the workshop, and the Günther and Kaulich KOMPAS-assessment lead to the required catalogue of environmental aspects assessed. Based on this catalogue the company can select its most critical, significant environmental aspects, i.e. its master parameters, on which the management of *environmental performance* needs to focus (e.g. the “TOP 5”) for its *improvement*.

It can be concluded that the wide use of existing environmental assessment methods is hindered by the “provided that” dilemma in relation to the data needed. The environmental assessment method developed at University of Technology Dresden (TUD) that is implemented in the EPM-KOMPAS software takes into consideration the specific data situation in companies, especially in SMEs in the manufacturing industry, and their requirements – practicability, triviality, individuality and plausibility – in all the three assessment alternatives offered. It offers a possibility for bridging the gaps of the “provided that” dilemma.

Moreover, criteria developed at the competence centre for environmental performance measurement were also integrated in the environmental assessment. In particular the implementation of the principles of decision-making, materiality and individuality are added.

In addition, it could be shown that the EPM-KOMPAS approach provides an instrument to measure, assess and systematically improve the environmental performance of SMEs while taking into consideration economic aspects (e.g. economic check in advance for intended measures with the net present value method) as well as social aspects (e.g. implementation of a multi-stakeholder dialogue).

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Chapter 29

WEB-BASED ENVIRONMENTAL MANAGEMENT SYSTEMS FOR SMEs

Enhancing the Diffusion of Environmental Management in the Transportation Sector

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Abstract: Engaging Small and Medium-sized Enterprises (SMEs) in environmental improvement is vital because they constitute the majority of companies, and collectively have a big environmental impact. However, their lack of resources and low awareness of the benefits to be gained from environmental management are barriers to the implementation of a formal environmental management system (EMS). SMEs need user-friendly solutions to facilitate decision-making, understanding of environmental management, and evaluation of environmental performance.

EcoTra is an industry-specific web-based tool based on a model of transportation companies, which enables users to measure, monitor and report their environmental performance and costs. The calculation tool is combined with a training system so that these results and indicators can be used as an environmental decision-making aid. By using EcoTra, organisations enter a cycle of continual improvement while they consider their significant environmental aspects as defined in ISO 14001 and measure their environmental performance. The tool is developed in co-operation with transportation SMEs in three different European countries.

EcoTra answers the specific needs of SMEs by overcoming obstacles of awareness, resources and knowledge; the diffusion of environmental management will be enhanced by the development of similar sector-specific tools.

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 655-677.

1. INTRODUCTION

The need of small and medium-sized enterprises (SMEs) for a reliable means of managing environmental issues has become increasingly important (Biondi et al. 2000). SMEs represent 99.8% of all EU enterprises (EC 2003, Starkey et al. 1998) and 92.5% of these have less than ten employees. It is estimated that SMEs have a significant impact on ecological systems – around 50% of the EU total (Revell and Rutherfoord 2003, ECOTEC 2000). The problem is that SMEs often lack the time and resources to integrate environmental considerations into their management processes, so that engaging SMEs in environmental improvements is viewed as a vital part of the drive towards sustainable development (CEC 2002).

Transportation companies have a big role to play in mitigating the environmental impact of SMEs. Transportation is a substantial user of energy and producer of air emissions, the impact of which is visible in most life cycle assessments, and the transport sector is in fact the fastest growing consumer of energy and producer of greenhouse gases in the EU (EEA 2004). Fortunately, the activities of transportation companies vary little from one to another, so it is possible to identify the typical significant environmental aspects of transportation SMEs which allows a greater spread of environmental management through a standardised approach. To get real environmental data on transport activities, companies need a tool based on environmental accounting methods (Pohjola 1999).

The case study presented here is on the development and diffusion of a web-based tool aimed at integrating environmental considerations into the decision-making processes of companies, so that they can continuously and cost-effectively improve their environmental performance. The tool is specifically developed for transportation SMEs and should enable them to identify, analyse, manage and report environmental factors related to financial functions. It is built on the principles of environmental accounting but with a practical approach to the integration of environmental considerations into decision-making. It should help the user to cost-effectively determine alternatives for improving the environmental performance of their business processes by simulating and considering the environmental benefit and economic efficiency of alternative propositions. In parallel with its management and reporting possibilities, the tool offers tailor-made training in environmental management, at both operational and strategic levels. In effect, it is a decision-making tool for integrating environmental management into strategic business management.

Because SMEs face barriers to implementing EMSs, the European Union has acknowledged the need for a demonstration project that would provide evidence that, by overcoming these barriers, EMSs can become available to

SMEs and bring the same kind of benefits to that type of organisation. The project presented in this paper is co-funded by the European Commission under the LIFE Environment programme; it started in September 2002 and finished in August 2004. At the time of writing, a prototype of the tool has been tested by transportation SMEs in Finland, and information about the tool has been widely disseminated in Portugal and Hungary as well as presented to relevant stakeholders in other EU countries.

2. DRIVERS AND BARRIERS TO THE ADOPTION OF EMSs BY SMEs

2.1 Drivers

Gondran (2001) identifies five groups of drivers to the adoption of environmental management systems (EMSs) by SMEs: regulatory, economic, strategic, events and managerial. Events such as environmental accidents, bad publicity from non-compliance with environmental regulations, or protest from stakeholders and shareholders can force SMEs to consider environmental issues (Biondi et al. 2000). Strategic drivers correspond to the stakeholders' concern for environmental protection, public health issues and quality of life in general. The stakeholders identified as the main drivers for the adoption of a formal EMS are, in order: the customer, local government, the local community, regulators, and employees (Hillary 2000). Customers were cited as the key audience for eco-management and audit scheme (EMAS) statements of small firms in a EU-wide EMAS survey (Hillary 1998). Customers and supply chains are also prominent in driving SMEs' environmental improvements (Charlesworth 1998). The accountability of bigger organisations which buy transportation services from SMEs expands to cover not only the organisation's own activities but the environmental performance of actors up and down the supply chain or in the organisation's sphere of influence. Integrating environmental considerations can also be a response to the requirements of clients and shareholders, thereby creating an economic advantage (Gondran 2001). However, regulators and local authorities exert greater influence on the general environmental performance of SMEs than do customers (Hillary 2000). This correlates to the main drivers for SMEs to implement an EMS identified by Orée (1997): firstly, to ensure legal compliance, then reduce costs, and finally create (or improve on) the image of a responsible enterprise.

Other benefits include the savings that can be achieved through energy efficiency, production efficiency and waste management. Relationships with local communities, local authorities, and economic and financial partners can also benefit from an improved image, and if the companies monitor changes in legislation, they can anticipate and access new markets. The implementation of an EMS can create a competitive advantage for an SME, and may even set an example for its sector.

Internally, there are organisational benefits too, such as improvement in management quality (NALAD 1997), working and environmental conditions, and health and safety. Additionally, employees benefit from the EMS implementation itself through training and the acquisition of new skills and responsibilities. Employees are often more motivated because involvement in global concerns can constitute a significant "feel good factor" (INEM 1999).

2.2 Barriers

However, there are both internal and external barriers to the adoption of EMSs, some of which are specific to SMEs. Internally, SMEs often lack resources, both financial and (more importantly) human (Hillary 2000). This lack of resources is both quantitative and qualitative, and is particularly acute for micro firms. The availability of staff is limited because they are multi-functional and have little time to implement and maintain EMSs, which can be exacerbated by inconsistent management support. Internal environmental skills are also lacking (Hillary 1999, Personne 1998): SMEs are largely ill-informed about environmental legislation, the environmental responsibilities of management, environmental issues in general, and EMSs in particular – how they work and what benefits can be derived from their implementation (Hillary 1999, Personne 1998). Environmental issues are seen as peripheral to the core business, and the lack of human resources leads to initiative fatigue in this area (ECOTEC 2000). Company culture and attitudes can also form barriers: short-term economic difficulties often serve as a mask for medium and long-term strategic perspectives and EMSs are often perceived as expensive and bureaucratic (Hillary 1999, Starkey et al. 1998).

On the other hand, in her study of the perception of the environment in SMEs of less than ten employees, Personne (1998) describes their pragmatic approach to environmental issues. The interviewed companies identified the economic benefits of environmental management immediately, but because this driver restricts the vision that SMEs have of the potential *economic* benefits of EMSs, they do not recognise the other benefits and fear that an EMS would fail to meet their expectations.

Moreover, external barriers are at work here – the certification system for ISO 14001 and the verification system for EMAS. SMEs have found the cost of certification to be a problem and appear to need support and guidance for the environmental review, environmental aspects and significance evaluation

(Hillary 2000). For instance, the legislative constraints are fragmented, and their complexity makes it very difficult for SMEs to get an overall understanding of the relevant legislation for their sector in relation to working conditions, health and safety, and environment. Few SMEs have access to appropriate training and assistance (UN 1998) and the lack of sector-specific guidance and material tailored to different size firms – especially very small firms – is frequently identified as an external barrier (Poole et al. 1999).

2.3 The Vicious Circle and How to Break It

SMEs' lack of resources creates a vicious circle working against the integration of the environment in business management (Gondran 2001). Indeed, the lack of human, time and economic resources prevents SMEs from using them to get environmental information. In turn, the fact that management is ill-informed causes them to focus on short-term issues because they do not understand the benefits that could be gained from integrating environmental management. Combined, these aspects can mean that management is not always aware of changing regulations and will have a reactive approach, instead of anticipating them. This brings us back to the lack of resources and the need to treat short-term issues as they arise.

The European Commission provided financial support and a framework for transportation SMEs to access a simpler EMS through the EcoTra tool. The main barriers that this tool is intended to overcome are cost, lack of resources to access information, and the resulting lack of understanding of what general environmental management models can mean for a given SME in a given sector. The "vicious circle" is broken at two points (see Figure 29-1). EcoTra overcomes the lack of resources by being inexpensive and easy and quick to use. Moreover, it solves the lack of information and awareness by providing training on environmental, legislative and technical issues. It also integrates these aspects into the monitoring tool.

The environmental information was selected for its relevance to the transportation sector and was used in two ways: firstly, in the calculation tool so that the manager can benefit from the information directly, and secondly, through the training system for non-expert readers. The calculation tool is based on accounting for environmental loading and direct environmental costs. The framework for the environmental accounting rules were defined using Schaltegger et al.'s (2000) definitions of ecological performance and environmental performance. For example, case studies were integrated in the tool in order to provide concrete sector-specific examples (Personne 1998) and the tool's vocabulary was also adapted to increase its long-term benefits. Indeed, by raising the environmental awareness and skills of its users, the tool gives them the resources to acknowledge the value of environmental information, which in turn raises management's interest in such issues and can lead them to consider environmental issues as an opportunity rather than a constraint. The extent to which this intention has succeeded cannot be observed at this date because the tool has been only under development and testing. In the pilot SMEs testing the tool, managers and staff have shown interest and motivation to improve their environmental performance. Whether this, in the long-term, leads to a genuine environmental awareness and integration of environmental issues into management practises remains to be seen in the future.

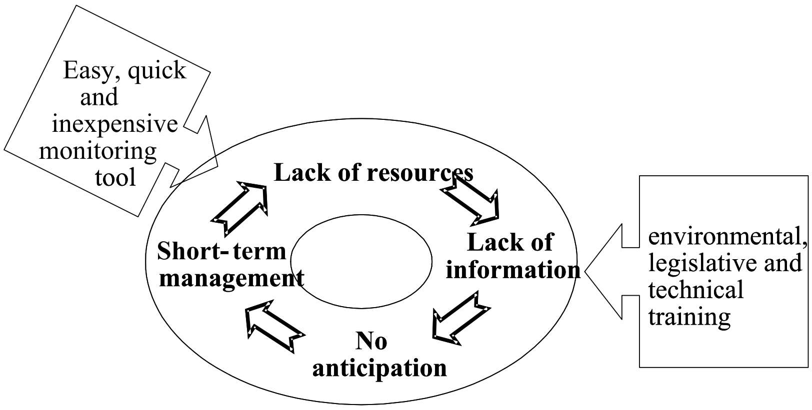

Figure 29-1. The vicious circle and how EcoTra breaks it.

Potentially, this tool should enable SMEs to save fuel and reduce the costs of accidents and excessive wear of tyres through better driving styles. The fact that the equipment is used in a smoother way greatly reduces the costs of repair, maintenance, and indirect environmental impacts. EcoTra can also help companies to optimise their routing and vehicle combinations at low cost.

A parallel can be drawn here between the utilisation of EcoTra, which manages accounting and other administrative tasks, and the experience of joint EMS implementations at Hackefors industrial district in Linköping (Sweden), where 26 small enterprises have formed an environmental network and implemented a joint EMS. Each enterprise within the group has an EMS of its own that fulfils ISO 14001 requirements, and so receives certification. However, these EMSs are very similar and much of the administration is handled by a central organisation; before implementing a joint EMS, the companies had already worked cooperatively in forming a network for waste handling. The joint EMS has resulted in better relations with important stakeholders, such as existing and potential customers, and several environmental improvements have been observed. The EMS model used at Hackefors has become very popular in Sweden (Ammenberg 2003).

2.4 Logistics and Environmental Accounting

Logistics will constitute a significant factor generating environmental loads and impacts in global markets (Murphy et al. 2003). Transportation – road haulage, railways, shipping and air traffic – and storage are the most important tasks in logistics chains, but from an environmental viewpoint packaging and other materials flows which are generated in logistics operations should also be considered (Murphy et al. 2000).

When transportation is considered from an environmental perspective, the important issues are energy consumption (fuels), the amount of hazardous waste (for example waste oil, tyres and filters) generated by transportation companies, the materials used for manufacturing vehicles, and the construction of infrastructures. For transportation companies to manage their environmental impacts and improve the environmental performance in their business sector, they need to keep an account of used materials and estimate the environmental impacts caused by transportation operations (Pohjola 1999).

Environmental management accounting with specific accounting methods and systematic data collection tools will assist companies in improving their environmental responsibility (Schaltegger et al. 2003), and will be a valuable tool for improving environmental issues in transportation companies because it makes explicit the links between non-monetary information (amount of environmental emissions and waste materials) and monetary information (Pohjola 2003). In addition, environmental benchmarking, which may be a motive force for improvements, is possible if non-monetary environmental information is collected, analysed and used in decision-making processes (Schaltegger et al. 2002).

In the road haulage business, the most important environmental issue is fuel consumption, and this is also a significant indicator from the financial viewpoint. The other major indicators of logistics operations are the distance travelled and the amount of freight. Other effective indicators from both environmental and financial viewpoints are the quantities of tyres, waste oils and waste filters which are used (Mäkelä et al. 2002). When data on the indicators mentioned are collected in transport companies, it will be possible to manage environmental reporting and accounting for environmental performance, and benchmarking between transportation companies will be feasible.

3. DESIGNING A WEB-TOOL FOR TRANSPORTATION SMEs

In practice, EMSs require a tool to manage the collection, use and follow-up of information on a regular basis (Personne 1998), and a high degree of confidentiality is needed because companies can be reluctant to provide data (Personne 1998, personal discussions). The EcoTra tool is computerised to provide a user-friendly interface and to facilitate information management, such as updating and archiving (Personne 1998). These two aspects correspond to the technical requirements of the tool. However, since SMEs cannot allocate much time or human resources to the implementation and maintenance of a formal, fully-constructed EMS, the tool is not intended to implement one. Rather, it aims to integrate the principles and assumptions that an EMS would imply, so that it can be seen as both a simplified EMS and a first step towards a fully implemented and standardised system. In the development phase of the tool, the requirements of the two formal EMSs in the market place (EMAS and ISO 14001) were taken into account.

As discussed earlier, the environmental review of an EMS is more difficult for SMEs. The activities of transportation companies vary little from one to another, and it is possible to identify the significant environmental aspects of a typical transportation SME. The EcoTra tool is based on a model of transportation companies that includes the "significant environmental aspects" as defined by ISO 14001. The environmental aspects considered in the model are air emissions from the vehicle, and the impact of fuel consumption. The tool also takes costs into account. Even though other activities of the transportation company (loading/unloading, washing, administration, office maintenance, waste management, vehicle maintenance, etc.) are modelled similarly, the tool includes only the maintenance and driving activities in cost accounting, and only driving in the environmental loading calculations. The concept of the green bottom line (Bennett et al. 2001) for presenting financial and non-financial information on the environmental aspects of business field constitutes the background to the model.

The aspects considered in this web-based tool are priorities for SMEs – this restriction is justified by the relative significance of the chosen environmental aspects compared with those which have deliberately been omitted (for example, the impact of office work is far smaller than that of vehicle emissions). Equally, this simplification of the model makes it accessible to SMEs that have a limited time in which to measure and report on environmental and financial factors.

3.1 Modelling the Business Processes of Transportation SMEs

The calculation tool is based on the Environmental Modelling System discussed in Pohjola's thesis (1999) to help in understanding and analysing business processes. The transportation SME's activities were analysed from three points of view – operational, environmental and financial – and the environmental modelling system was developed to take into account interactions between these factors.

From a generic environmental model, three basic models were defined: energy consumption, transportation and logistics chains. The transportation model was developed for road, rail, air and water transport, and several vehicles were modelled for each type of transport. EcoTra is based on the road transportation model. To develop a generic environmental model, the business processes of a given organisation must be described by representing the relationship between their process, environmental and financial components.

The different elements used to model the transportation SMEs' inputs/ outputs, activities and business processes (related, structured activities that produce a specific service or product) can be classified into the following categories (Pohjola 1999):

- Business factors
  i.e. management, support and operational processes
- Environmental factors
  i.e. energy consumption, material flows, packaging materials, transportation and waste management
- Financial factors
  i.e. legislative and other variable costs

In EcoTra, financial factors include the cost of the vehicle and its maintenance, fuel costs, salaries, and other costs such as insurance. For transportation SMEs, process and environmental factors are associated with each vehicle, and include whatever technical characteristics of the vehicle that influence its emission factors – namely, the type of engine and the model. They also include the operational variables used to evaluate the environmental load of the driving activity – namely, the type of fuel, the distance driven at a given speed and the number of cold starts. SMEs' analysis of all this enables measurement of their vehicles' environmental performance. The principles of how the tool works are described in Figure 29-2.

Environmental management is no longer separated from other management activities but is interwoven in all decision-making and management processes (Epstein 1996, Welford et al. 1993). It can be said that environmental management is integrated into the management processes of the company. There are several decision-making processes where the information delivered by EcoTra can be used:

- Procurement decisions: which vehicle should be replaced and by what, and how much saving would be achieved from investing in a vehicle which performs better in terms of environmental aspects
- Customer relationship management and marketing: to use the information on environmental issues to communicate with customers and possibly to target marketing communication towards potential customers who might be more sensitive to this type of information
- Human resources management: determine the need for environmental training or eco-driving training of the employees depending on their environmental performance

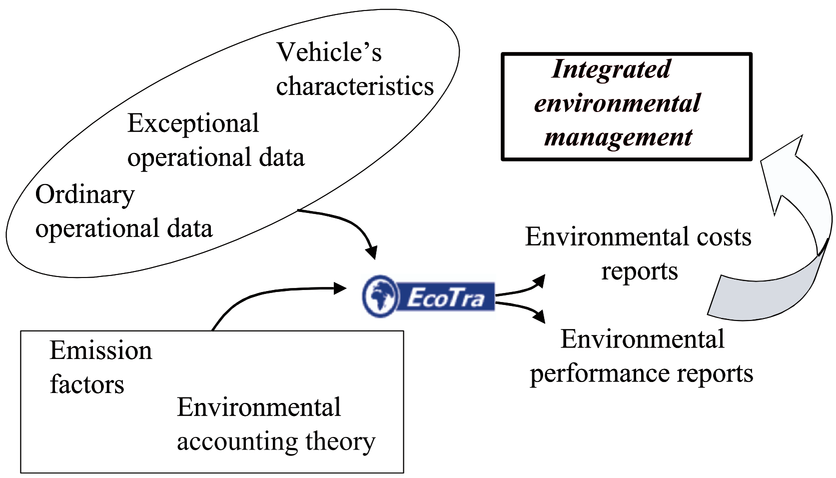

Figure 29-2. The principles of how EcoTra works.

3.1.1 Parameters of the Tool

The user is asked to input only a limited amount of data and does not need any specific training to do this; it is simply a matter of form and field filling, and each field is described in the manual and in help files. EcoTra is built on the expertise and environmental skills of its developers to process data, calculate environmental indicators and costs, and display the results. Figure 29-3 describes the data managed by the tool and the relationship of one set of data to another.

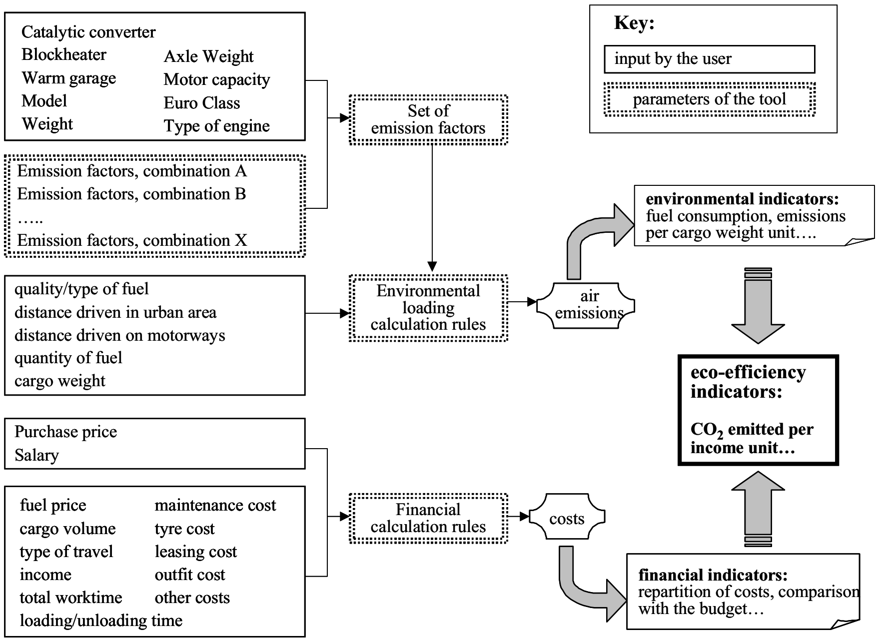

Figure 29-3. Data manipulated by the tool and how one set of data inter-relates with another.

The user inputs the technical description of the vehicle only once, as shown in the box in the top-left corner. For each combination of engine, fuel type and driving speed, there is a corresponding emission factor for eight airborne compounds: CO, CO_2, SO_2, NO_X, PM, VOC, CH_4 and N_2O, expressed in mass per distance driven. The emission factors are derived from the transportation model Lipasto (VTT 2002) developed by the Technical Research Centre of Finland. The user also inputs the vehicle purchase price and the salary of the driver only once, unless it needs updating. Data linked to operations, as shown in the box in the bottom-left corner and the box related to distances driven, have to be provided each time the vehicle is used or put through maintenance. Thanks to on-board devices that measure the data and send it to a remote station, this data input can be automated. Each cost can then be estimated and the user can prepare a budget for each vehicle, following the changing costs calculated by EcoTra and comparing them with the budget.

3.1.2 Environmental and Financial Performance Indicators

The system is able to measure both the technical and financial parameters of an SME's operations. Combined, these enable three types of measurement to be calculated: eco-efficiency indicators (for instance, CO_2 emissions per unit of turnover), pure environmental indicators (for instance, emissions of SO_2 into the air per year) and financial indicators (for instance, costs of repairs in a given year). Environmental performance indicators are based on environmental business accounting principles. For the transportation sector, eco-efficiency and financial performance are tightly linked. For example, the main environmental aspect – fuel consumption – is also a major financial factor.

The environmental performance of transportation can be expressed by indicators representing the relationship between the environmental load generated and/or resources used, and output in terms of transportation operations (Pohjola 1999). Indicators can be expressed as a ratio between the annual amount of each airborne emission and the total energy consumption, or the annual transport distances and the annual environmental impact. Indicators of environmental impact during a year can be calculated, based on the type of vehicle, the fuel consumption and the type of driving conditions (urban or motorway), which can be expressed in terms of the quantity of carbon dioxide produced or total energy consumed, for example.

If a user is interested in financial performance indicators, it is possible to monitor the maintenance, workforce, fuel and other costs. For example, if the manager of an SME has prepared a budget, then he or she can compare the actual results with this budget. It is also possible to analyse the structure of the costs or compare the income from each vehicle. When combining environmental and financial parameters, the eco-efficiency indicators (such as the average amount of fuel used for an income unit) can easily be calculated.

3.2 Meeting ISO 14001 and EMAS Requirements

During the first phase of the project, all participants had a hand in defining the tool's requirements, one aspect of which was to be consistent with ISO 14001 and EMAS requirements. The full document is available on the project web page (see Internet URL <:http://www.life02.net>), showing each element of the EMS, and each additional requirement from EMAS; for each of these, the authors described how the tool should correspond to the requirements. Common to both EMAS and ISO 14001 is the need for an organisation to implement a number of management system stages to formalise the organisation's policies, procedures and practices that control environmental aspects (Hillary 2000). Several aspects of EcoTra satisfy these requirements.

When using EcoTra, organisations enter a cycle of continual improvement by considering their significant environmental aspects, as defined in ISO 14001, and measuring their environmental performance against them. Subsequently, once the situation has been analysed and possible improvements have been evaluated and compared, the organisations review their environmental objectives and targets and improve their performance. This continual improvement cycle is characteristic of the ISO 14001 EMS. Indeed, all EMSs consist of a continual cycle of planning, implementing, reviewing and improving the processes and actions that an organisation undertakes to meet its environmental obligations (Stapleton et al. 2001).

Some of the requirements are met by a given parameter or option of the tool. EMAS has the added requirement of an environmental statement which publicly reports on the company's environmental performance. The reports provided by EcoTra, and the guidelines available in the training system, help users to prepare such documents if they wish.

It is also worth noting that the environmental aspects taken into account by the tool, as identified through an initial environmental review, are all significant for a transportation company. If an SME should wish to implement a formal certified EMS, it can begin with the existing list of identified environmental aspects and, with the help of the training section on EMS, the manager can then start to identify other environmental aspects.

EcoTra can help SMEs to meet EMAS requirements to "be able to demonstrate that they … provide for legal compliance with environmental legislation; and have procedures in place that enable the organisation to meet these requirements on an ongoing basis." (EMAS 2001). EcoTra can be used to monitor environmental performance and analyse the improvements achieved or required. ISO 14001 (and EMAS) also require the organisation that implements an EMS to provide appropriate training to its employees: "…the organisation shall identify training needs. It shall require that all personnel whose work may create a significant impact upon the environment have received appropriate training. It shall establish and maintain procedures to make its employees or members at each relevant function and level aware of … the significant environmental impacts, actual or potential, of their work activities and the environmental benefits of improved personal performance; … personnel performing the tasks which can cause significant environmental impacts shall be competent on the basis of appropriate education, training and/or experience" (ISO 1996).

3.3 Training

One of the barriers to SMEs getting environmental information and adopting EMSs is communication, so the training system aims to adapt general legislative text and standards to the transportation sector and to render them more practical. Thanks to the training system, the user can better understand the framework in which EcoTra has been developed, its aims and how to use the reported environmental and financial performance for decision-making.

The content covers general environmental issues such as air emissions and their impact, environmental management, and also suggestions for improvement, by taking into account the environmental aspects that are not included in the tool. The environmental training serves two purposes: in the short term, it enables the user to understand the reports and, for instance, the impact of a given compound emitted to air. In the long term, it raises the awareness of the user and should help SMEs to consider the benefits of environmental management beyond simple economics.

The content of the tool is presented in Table 29-1. The modules are grouped into four chapters:

- The first chapter introduces environmental management. It presents the management systems: their structure, the existing standards and the possible benefits. It also explains the purpose, means and benefits of environmental communication.
- The second chapter covers general environmental knowledge: the key concepts necessary to understand fully the aims of environmental management, the policies in place and the challenges that companies will face in the future, and the notion of environmental responsibility, to place these concepts in a broader framework.
- The third chapter is more practical and gives guidelines and examples on how to manage environmental issues in transportation SMEs in both ordinary working conditions and exceptional conditions.
- The fourth chapter aims at providing sound financial training to the users.

Each module contains several documents, each covering a different aspect of the subject. For instance in the module on EMAS in chapter 1, one document briefly introduces EMAS, the following one describes the differences between EMAS and ISO 14001, the next explains what benefits EMAS can bring to SMEs, and finally several more documents cover each element of an environmental management system developed according to EMAS requirements.

Concepts such as eco-efficiency and life cycles are explained: eco-efficiency is essential to understand the reports and work towards environmental performance improvement; life cycle approaches are used at several levels of the environmental model, both when considering the environmental aspects of the transportation activities (life cycle inventory or life cycle assessment), and when modelling the processes and considering the environmental costs inherent in them (life cycle cost assessment). However, the tool has not been designed to provide data for LCA (life cycle assessment) software, and if a common database were to be used it would be necessary to make the data compatible with this.

Table 29-1. Structure and content of the training application.

Chapters	Modules
Chapter 1: Environmental Management	Environmental Management Systems (EMS) and environmental accounting
	EMAS
	ISO 14001
	Environmental communication
	How can you manage your environmental impact
Chapter 2: Introduction to environmental issues	Key concepts:
	Sustainability, eco-efficiency, renewables, life cycle concept
	Environmental Responsibility
Chapter 3: In Practice	Impact of vehicles on health and the environment
	Reduce your environmental impact: interpretation of the reports getting the right equipment maintenance of the vehicles route optimisation other environmental aspects environmental performance of suppliers
	Safety
	Eco-driving
Chapter 4: Financial training	Financial training

More specific knowledge of EMSs is provided so that environmental considerations can slowly be integrated into other aspects of the business. Guidance is also provided to facilitate EMS implementation without costly consultation or time-consuming reading of documents. For example, the tool helps users to perform the environmental review through pre-selection of the main environmental aspects, while the training system provides concrete examples of their direct and indirect environmental aspects.

The user interface – what the user can see on the screen when using the tool – is represented in Figure 29-4. It was built to reflect transparently the structure of the training application's content as described in Table 29-1, and it is very simple so that navigation would be easy. On the left hand side of the screen, all the available courses are displayed. The list is very much a copy of Table 29-1. On the right part of the screen, the document selected by the user is displayed (so-called "active document" in Figure 29-4).

At any time, the user can navigate to another course, in either another or the same chapter. The user can click on any of the displayed "links" to access a course in any chapter at any time. However, the courses within each chapter are accessible from the numbered buttons on top of the screen (in Figure 29-4, buttons 1, 2, 3 and 4) and it is recommended to study them in that order since the first documents provide an introduction and general information while those following go more into detail.

After studying the content, users can pass a quick test (the button “check questions” in Figure 29-4) and display a summary (button “summary” in Figure 29-4) to verify that they have acquired the basics in the given field. Specialised and key terms are defined in a glossary.

Users can also at any time consult the glossary or interrupt their studying.

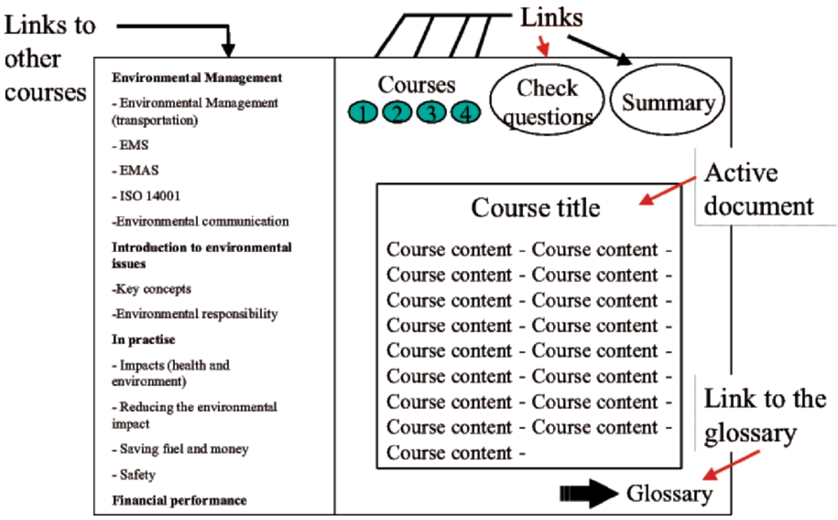

Figure 29-4. Interface of the training application.

The testing of the training tool was not sufficient from which to draw any conclusions. Users and developers focused on the development and testing of the monitoring and reporting functionalities of the tool rather than on the training tool. However, some of the courses were inspired by the training material provided by the professional organisation “Finnish Transport and Logistics SKAL”, which has been tested by transportation companies in the format of a booklet.

4. RESULTS

Up to August 2004, the tool has been through an 18-month testing period, during which time transportation SMEs have used it and given their feedback and suggestions for improvements. The main problems and limitations have been identified, and positive results noted.

4.1 Method

Transportation SMEs were contacted by the project members in Finland, Hungary and Portugal and the tool's objectives and practicalities were presented to them. It was explained that the tool was under development and that real-case testing was required to implement the automatic data collection systems, and to improve the tool in terms of user-friendliness and reliability and also adapt it for the users. Seven Finnish and two Portuguese transportation SMEs agreed to use the tool and to monitor several of their vehicles. User accounts were created for each organisation, and the project members demonstrated to each pilot company's manager how the tool can be used. A data collection device was installed on-board lorries which sent operational data such as speed, geographical position and fuel consumption from the vehicle to the database. Additionally, users input data manually on maintenance and other aspects that cannot be input automatically.

On a regular basis, project members met the companies or contacted them by phone or e-mail to enquire about the possible problems encountered by the users. A standard feedback form was designed so that the feedback collection would be systematic, but the communication was free and the companies could also spontaneously contact the developer whenever they needed advice or support or wished to request a change in EcoTra. A few round table discussions were organised in which pilot companies could share their experience and discuss together about possible improvements and difficulties. The training tool was insufficiently tested, as the monitoring tool required more attention than expected while planning the project. However, the tool will be continuously upgraded despite the fact that the LIFE project itself has ended.

4.2 Problems Encountered

In general, the same barriers as those to the spread of EMSs have also hindered the spread of EcoTra. SMEs which were contacted to test the tool and participate in its development lacked the resources and environmental awareness to do so, and because the benefits were not yet demonstrated, it was difficult to convince companies to test the tool. Some of the managers did not perceive any need for environmental management or did not value it sufficiently to be willing to pay for the service offered.

The extent to which SMEs use modern technological and electronic instruments was the second main obstacle for companies in Portugal and Hungary. Unfortunately, no SME in these countries could be persuaded to test the tool or to participate in its development, even though the interface was simplified to enable users who were unfamiliar with advanced structures to navigate the web pages and use the tool after only a very short learning period. The tool was perceived by companies as a new technology that would require a long learning process and be difficult to use. They expressed mistrust in new technology and feared that such an electronic communication channel would not be secure.

One of the critical factors for SMEs testing the tool was the time required to use it. It was a necessary pre-condition that most of the data collection and data input would be automatic; though some existing technical solutions were tested (an on-board device measured fuel consumption, speed and driving duration, and sent the data automatically to the EcoTra database via GSM or GPS communication), the cost of those solutions remains a barrier for some SMEs. One of the most promising evolutions is the possibility of using the built-in on-board computers that vehicle manufacturers deliver on new vehicles as a matter of course, from which data can be collected automatically with the only minor extra costs incurred by telecommunication fees. The relatively expensive on-board devices which were tested during the project will become obsolete as the vehicle fleets are renewed.

It was also extremely time-consuming to publicise the tool to professional transport organisations, ministries, and other energy and environment agencies in the European Union. A great deal of effort could have been spared by better uniformity of, and coordination and communication between, organisations that encourage the transport sector towards more sustainable practices at national and EU levels. The diffusion of best practise at a more general level would be enhanced by better coordination.

4.3 Benefits and Positive Results

The main benefits from EcoTra are due to its sector specificity. Other positive aspects are the automatic data collection system and the simplicity: the main environmental aspects that are specific to the transport sector have already been identified. It is also possible with EcoTra to extend the scope of the environmental accounting to collect and report data on indirect environmental issues. In addition, EcoTra can be easily translated, which constitutes an advantage particularly for small countries. From a technical viewpoint, EcoTra is robust as it stores all the data in a database, which is more secure and easier than the use of Microsoft Excel sheets, for example. The data cannot be modified and accessed by the user, so that it is reliable and cannot be manipulated. In addition, EcoTra is built on Linux and is compatible with all operating systems. It is more advanced than, for instance, air emission evaluation tools such as BUWAL's PC tool "Handbook emission factors" HBEFA (a database of emission factors for road transports on CD-Rom), because it makes direct managerial use of the database and is used online.

Some positive results have already been obtained from the pilot phase during which EcoTra was tested by transportation SMEs in Finland. A simple web-based tool for transportation SMEs to manage their environmental performance is feasible and the automatic data input is technically possible, which is a critical factor for the adoption of the tool by SMEs. Thanks to cooperation with other European Union countries, the information reached many potential users and decision-makers. Another important practical advantage of the tool is that it can easily be adapted for local users; the tool is easily localised and the content of the training system can be adapted to local laws and conditions. The significantly greater interest shown by the new generation of transportation SME employees and managers is encouraging, and a sign that the spread of EMSs through that sector will continue to grow.

A similar type of sector-specific EMS has been implemented in the transport SME Jaakko Pohjola Ltd. (turnover: 3.5 million EUR). The benefit that they have seen from the implementation of an EMS is a drop in their fuel consumption of more than ten per cent over the first two years, and the knowledge of EMSs that they acquired helped in developing their management system. Kesko Ltd., the largest wholesaler in Finland, developed this type of sector-specific tool in 1995 to assist the management of environmental issues in the organisation. The new operating waste management system generated considerable savings, and the environmental accounting function of the tool enabled the company to produce high quality environmental reports. They were selected as publishing the best sustainability report in Finland in 2001 and 2004, and produced an environmental report that was ranked among the top 50 (and first in its category) in the 2002 UNEP worldwide reporting competition.

There are numerous other examples of corporations that have implemented an EMS and which as a result have improved their environmental performance and competitiveness (Leal 2003). For instance, Stora Enso consistently reduced their environmental loads during the period when their production units' Environmental Management Systems were being certified (Stora Enso 2003). Another example, Rio Tinto Plc, have reduced relative energy use and SO_X emissions through implementing an EMS in their operations (Rio Tinto 2003).

So far, it has been possible to analyse the costs/benefits in bigger organisations, but not in SMEs. The tool has been developed and implemented during this two-year project and during the pilot phase, only minor improvements could be documented as the data collection system did not provide reliable data for a sufficient period to enable comparison. However, the pilot companies which have implemented the tool have learnt about their activities and the related environmental impacts. The personnel in those companies also showed greater motivation to manage environmental issues and higher awareness of the impact of their company's activities. A more systematic analysis of the results and feedback should be made in a few years to place the results in a longer time span, and to answer such questions as "are the companies still interested after several years, or is their curiosity and motivation eroding?", "Are the drivers interested in the training tool?", "Are they "competing" with each other on their environmental performance?", "Are the customers of the companies interested in the environmental reports from their suppliers?", "Are the SMEs using their environmental management practises as a marketing argument?", etc.

Implementation is more expensive for SMEs, which is one of the reasons why public funding is required. The EU aimed to use this project to demonstrate that SMEs can implement these measures just as effectively as their larger counterparts once the cost barrier has been overcome.

5. CONCLUSIONS

The information needed to consider environmental performance measurement and improvement is usually available in a format that is too general for SMEs. In EcoTra, the degree of abstraction was lowered and information was selected to develop a sector-specific tool and training system, so that the effort required is minimised and awareness is increased through training and practical demonstration. The evolution of environmental, financial and eco-efficiency indicators can help decision-makers to track improvements and identify the source of costs and/or environmental impacts, and so discover opportunities for improvement. In this way, the consideration of environmental issues in decision-making becomes possible. However, it will be feasible to consider whether objectives have been met only after EcoTra has been fully tested by transportation SMEs because the tool has not yet been used in real market conditions. The potential for reduction in fuel consumption has already been demonstrated by one SME that has adopted an EMS, but it remains to be seen whether the training achieves its goal of broadening the environmental awareness of users and their efforts to improve other aspects not included in the tool. Moreover, the testing focused essentially on developing the monitoring and reporting functionalities of the tool while the training was not sufficiently tested to draw any conclusion. The development and improvement of the tool are still continuing, but outside the frame of the two-year project that initiated it.

Sector-specific solutions seem to be the way to overcome barriers to the spread of environmental management in SMEs, and such an approach can be used in other sectors as well. The model of business processes and their environmental factors might not be as generally applicable in other industries, but a common framework can be defined for a flexible tool that would adapt to each user.

The scope is restricted to the main environmental impacts, but for companies that have already improved their fuel consumption and impact on air quality, EcoTra does not at present offer room for improvement in other environmental aspects. However, the training includes a section on the identification and minimisation of other environmental impacts, such as waste and the use of resources in the office, suggesting an extension of the management system to other activities.

The tool constitutes only one element of the effort to encourage environmental management, but it is a first step that should enable further improvements; as users' environmental awareness is increased, they become more receptive to other elements such as updating information, sharing the experience of environmental management, and training through other media. As transportation SMEs collectively represent a major contributor to energy use and air emissions, for them to join the effort towards a reduced impact on the environment should have far-reaching consequences on the larger effort towards sustainability by society as a whole. However, one can argue that the objective of eco-efficiency is not sufficient on its own, and that a wider system change is required as well in order to mitigate the extensive use of transportation.

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PART VII

TOWARDS INTEGRATED SUSTAINABILITY PERFORMANCE MEASUREMENT AND MANAGEMENT

Chapter 30

MANAGING SUSTAINABILITY PERFORMANCE MEASUREMENT AND REPORTING IN AN INTEGRATED MANNER

Sustainability Accounting as the Link between the Sustainability Balanced Scorecard and Sustainability Reporting

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Abstract: Sustainability performance management is a newly emerging term in the debate about business and corporate social responsibility. It aims at addressing the social, environmental and economic (performance) aspects of corporate management in general, and of corporate sustainability management in particular. The management of sustainability performance in all of its perspectives and facets requires a sound management framework which on the one hand links environmental and social management with the business and competitive strategy and management and, on the other hand, integrates environmental and social information with economic business information and sustainability reporting.

This article addresses the link between the Sustainability Balanced Scorecard as a strategic information and management approach, sustainability accounting as a supporting measurement approach, and sustainability reporting for communication and reporting.

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1. INTRODUCTION

Sustainability performance management is a newly emerging term in the debate about business and corporate social responsibility. It aims at addressing the social, environmental and economic (performance) aspects of corporate management in general, and of corporate sustainability management in particular (Schaltegger et al. 2003, Wagner and Schaltegger 2004). Management of sustainability performance in all of its perspectives and facets requires a sound management framework which, on the one hand, links environmental and social management with the business and competitive strategy and management and, on the other hand, integrates environmental and social information with economic business information.

Early empirical research into environmental and social management and reporting was partly founded in the 1970's business ethics debate. During the 1980s research centred, firstly, around the societal (i.e. environmental and social) performance of corporations (partly as a result of dissatisfaction with the early empirical work on social performance), and secondly, on a more theoretical discussion of how to define and measure environmental and social performance, corporate social responsibility, or corporate citizenship, all of which are constituent elements of the idea of what is nowadays called sustainability management. Two examples which illustrate the first approaches to measuring environmental and/or social performance are the development of life cycle assessment (LCA) approaches (see e.g. Heijungs et al. 1992, Hofstetter and Heijungs 1996, ICI 1997, Wright et al. 1997) and social indicator developments (e.g. Epstein and Roy 2003, GRI 2002, Hoffmann et al. 1997, Holme and Watts 2000, Keeble et al. 2002, Steering Group of the Global Principles Network 2003). An example of the latter approach is that CSR is considered to be the subset of corporate responsibilities that addresses a firm's voluntary or discretionary relationships with its societal and community stakeholders. This means that in most cases CSR is typically undertaken with some intention to improve an important aspect of society, or relationships with communities or non-governmental or non-profit organisations (Caroll 1979). CSR defined in this way is frequently operationalised in terms of community relations, philanthropic activities, multi-sector collaborations, or volunteer activities, which cover only very limited aspects of the broader definition. However different these approaches may be, they have in common that they do not particularly integrate business issues with social and environmental activities, and they do not consider the general economic relevance of corporate societal engagement. These CSR activities result in establishing a parallel organisation in the company (e.g. environmental department and delegates, employee relations, etc.) to deal with non-economic issues and measure non-economic aspects of performance.

However, there are three problems with such an approach. Firstly, parallel or supplementary developments contrast with the basic vision of sustainability to integrate social, environmental and economic issues. Secondly, sustainable development and corporate sustainability require participation and stakeholder involvement, not just with societal stakeholders but also an involvement by conventional business managers. Business strategy and sustainability communications and reporting should therefore be linked with sustainability performance management. To link sustainability management with strategy and strategy implementation requires an interlinkage between the respective actors, i.e. between the environmental/sustainability department, information management and accounting department, public relations department and external communications. Thirdly, building up parallel organisational structures with satellite management and measurement methods always faces the danger of being cut back in times when corporate economic performance is under pressure, since parallel developments can be managed as a discretionary activity. Furthermore, such a satellite approach to the measurement, management and reporting of social and environmental issues often conflicts in organisations with the business reality of conventional production, financial and accounting managers. Sustainability information and communication should thus be dealt with as a process of overlapping departments in the same way as strategic planning, accounting, and public relations and reporting.

This is why sustainability performance measurement and management requires a framework which firstly links business strategy with sustainability performance measurement and management, and secondly links performance measurement and management with reporting and communication. In particular, the link between performance measurement and management with sustainability reporting has not so far been investigated. This paper therefore focuses on linking strategic aspects of corporate social responsibility with sustainability reporting by means of sustainability performance measurement and management.

2. A FRAMEWORK FOR SUSTAINABILITY PERFORMANCE MEASUREMENT, MANAGEMENT AND REPORTING

Sustainability performance measurement and management can be defined (based on Bennett and James 1997) as the measurement and management of the interaction between business, society and the environment. The issues and perspectives of sustainability performance measurement and management can be analysed at three levels: the level of individual sustainability performance indicators, the level of the overall performance measurement system, and the level of the relationship of this overall system with the external environment (Neely 1993). The first level has been extensively analysed (see e.g. Schaltegger and Burritt 2000 or Olsthoorn et al. 2001 for an overview, and Wagner 2005 for linkages to economic performance and environmental reporting). The focus of the remainder of this section is on the second level, the overall performance measurement system and its relation to the external business environment. The third level is examined in the following section on sustainability reporting and sustainability performance measurement and management.

The link between performance management, measurement and reporting can be characterised by an external "outside-in perspective" or by strategic considerations reflecting an "inside-out perspective". The outside-in perspective will screen publicly-discussed issues, communicate the corporate contribution to these issues, and thus define measurement and management activities on the basis of these issues. The inside-out perspective is based on the business strategy and the analysis of what issues are relevant to implement this effectively and succeed with it. This latter approach, which is followed in this contribution, will analyse stakeholder relationships, their strategic relevance, and what aspects characterising the relationships should be managed and measured.

The interests of various stakeholders drive the development of sustainability performance measurement (James and Wehrmeyer 1996). These aim mainly to support regulatory data requirements, pressure groups' demands for detailed information and data (Seidel 1988, 1992), internal environment-related decision making, and the requirements of financial institutions, mainly banks, insurers and funds (Lascelles 1993). Customer interests in environmental and sustainability performance (Wells et al. 1992) and the requirements of environmental and social management standards (Gilbert 1994, Grafe-Buckens 1997, 1998, Marsanich 1998) are also important drivers. Another set of driving forces stems from the final objectives of sustainability performance measurement and management. The relevant issues in this respect are whether sustainability performance measurement and management should be business-linked or solely oriented towards environmental and social improvements, and whether they should be primarily long-term or short-term orientated (James and Bennett 1996, James and Wehrmeyer 1996). This in turn points to the question of whether sustainability performance measurement and management should take a life-cycle approach or a more practical management-orientated one.

Clearly all these forces are interrelated, and depend on stakeholder interests. In other words, what is understood by sustainability performance is influenced by the stakeholder environment of a company. As a consequence, sustainability performance measurement requires management to define the goals and criteria of what is understood by corporate sustainability performance in a communicative interaction with stakeholders, and to establish an information, measurement, and reporting system which supports the management and communication of those indicators and issues which are key to stakeholders and the business's success.

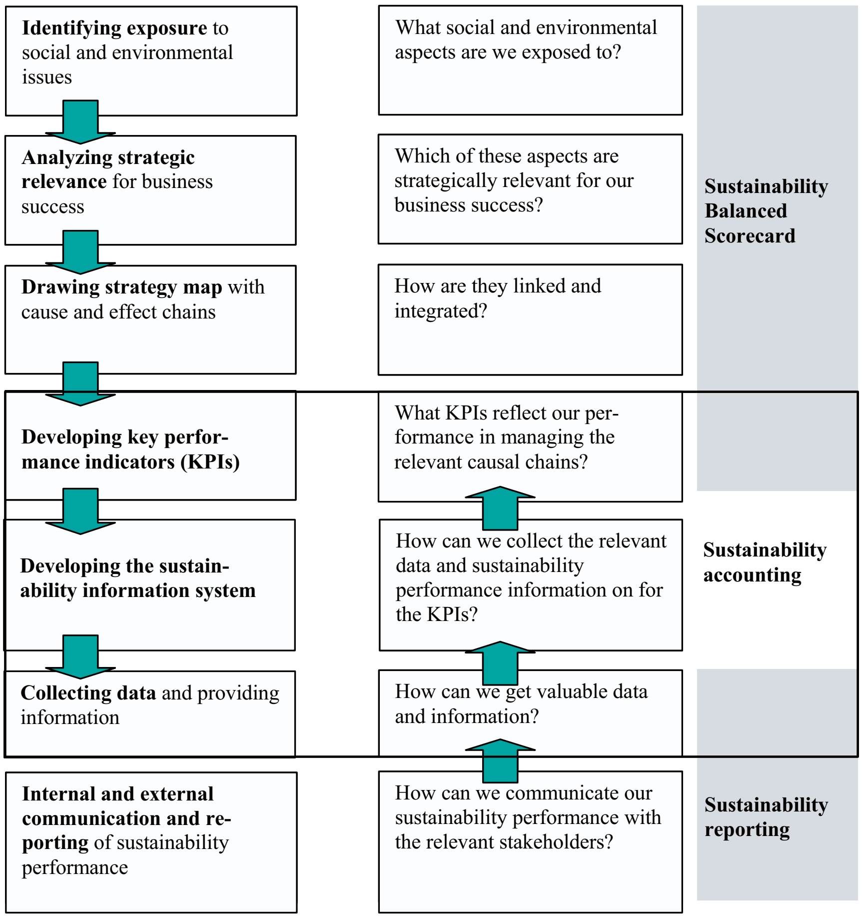

Figure 30-1. An integrated framework for sustainability performance measurement and management linking the SBSC, sustainability accounting and sustainability reporting.

Figure 30-1 shows an integrated framework approach linking the Sustainability Balanced Scorecard with sustainability accounting and reporting in order to achieve the integrative task of sustainability performance measurement, management and reporting. The framework represents the inside-out logic (arrows from top down) as distinct from the more common outside-in approach (arrows from bottom up) in which issues are taken up from the media and public debate. The conceptual development of the measurement and management approach can also be driven by the reporting agenda and requirements, but this approach mostly does not link with strategy and the balanced scorecard. The integrative character of the framework attempts to link three main management approaches and the respective departments by taking an inside-out approach based on corporate and business strategy:

- The Sustainability Balanced Scorecard and the strategic planning department
- Sustainability Accounting and the accounting and information department
- Sustainability Reporting and the public relations, communications and marketing department

The framework shows core questions driving the management of sustainability performance in the right column and the respective management activities in the left column. The questions and activities can be organised in three overlapping groups of approaches: the Sustainability Balanced Scorecard, sustainability accounting, and sustainability reporting.

The link between sustainability accounting and reporting and the Sustainability Balanced Scorecard will be introduced in the next section, following a short introduction to the Sustainability Balanced Scorecard approach.

3. SUSTAINABILITY PERFORMANCE MEASUREMENT AND MANAGEMENT WITH THE SUSTAINABILITY BALANCED SCORECARD

The Sustainability Balanced Scorecard (Figge et al. 2002, Hahn and Wagner 2002, Schaltegger 2004, Schaltegger and Dyllick 2002) is one of the most promising instruments for better integration of the environmental, social and economic aspects of corporate sustainability measurement and management. The Balanced Scorecard is highly popular and has experienced rapid diffusion as a management tool and, because of this and its multidimensional conception, it is well placed to address efficiently the major challenges of corporate sustainability management. The Sustainability Balanced Scorecard – which in addition to the issues addressed by the conventional Balanced Scorecard, also addresses non-market issues of high business relevance – combines performance measurement simultaneously with performance management in all dimensions of sustainability (Figge et al. 2000, Hahn and

Wagner 2002, Hahn et al. 2002, Schaltegger 2004, Schaltegger and Dyllick 2002).

In reality, environmental and social performance indicators rarely stand alone and separate from each other (see e.g. Schaltegger and Burritt 2000, Schaltegger and Sturm 1990). Therefore, the issues are:

- How to combine these into an overall performance measurement system covering all significant environmental and social performance aspects of a company's operations.
- To determine what indicators are needed in an overall performance measurement system to measure and report the achievement of strategic and operational goals.

An overall performance measurement system can, for example, be mainly defined by the industry sector, resulting in a set or sub-set of sector-specific indicators. Other determinants could be the level of public concern, the strictness of national legislation and the size of the organisation (James and Wehrmeyer 1996, Schreiner 1991). Yet another set of determinants could result from the relative importance of stakeholders to the company (Schaltegger and Figge 2000, Schaltegger and Sturm 1990, 2000). Much of the discussion is about identifying a suitable 'balanced scorecard' of monetary and non-monetary (i.e. physical) indicators (Bennett and James 1997). This is why the Sustainability Balanced Scorecard (SBSC) approach seems suitable for linking performance measurement with reporting and management.

The starting point of the Balanced Scorecard is the business strategy which is operationalised through four to five management perspectives (finance, customer, processes, learning and organisational development, and non-market perspective; see Figge et al. 2000, Schaltegger and Dyllick 2002) based on cause and effect chains linking the strategically relevant aspects in each perspective. The conventional Balanced Scorecard approach (Kaplan and Norton 1992, 1996, 2001) in its original form emerged from the alleged weaknesses of conventional management accounting (Johnson and Kaplan 1997) and distinguishes a financial perspective, a customer perspective, a business process perspective, and a learning and development perspective (Kaplan and Norton 1997, 2002, Olve et al. 1999). The Sustainability Balanced Scorecard also integrates market issues with a possible fifth perspective – the non-market perspective (Figge et al. 2002, Hahn and Wagner 2002, Schaltegger and Dyllick 2002). The non-market perspective covers strategically relevant issues which are not covered in market arrangements with the company such as child labour at a supplier, which can have a substantial influence on sales even though the company has no market relationship with the children employed by the supplier. The perspectives are linked by cause and effect chains. Beyond being a performance measurement system, the approach also represents an overall management concept (see e.g. Kaplan and Norton 2001).

To develop a SBSC, a number of essential steps need to be completed (see Hahn and Wagner 2002 and Hahn et al. 2002 for detailed descriptions and examples): identification and analysis of the environmental and social exposure of the business; development of cause and effect chains; and the definition of key performance indicators. In order to link sustainability reporting with performance measurement and management, the following steps can be followed:

1. Identifying the environmental and social exposure of the business
2. Analysing the strategic relevance of environmental and social aspects
3. Development of causal chains and the strategy map
4. Definition of key performance indicators and development of the measurement methods to create the respective performance information
5. Consideration of the key sustainability performance indicators identified for the company, internal and external communication, and reporting activities
6. SBSC implementation, revision and reporting on sustainability indicators

The first step aims to identify those environmental and social aspects which are relevant for a specific company. Since these may differ, depending on the company and the business field, e.g. depending on products, production processes, and site location, it is necessary to identify them specifically, based on criteria matrices providing an overview of environmental and social issues (see Hahn et al. 2002:71 for a detailed explanation how this is achieved). These matrices are structured according to resource use, environmental impacts, and stakeholders, and serve as checklists to identify the *environmental and social exposure* of a company.

The second step in the SBSC process is the identification of *strategically relevant* environmental and social aspects, i.e. to identify the subset of environmental and social aspects which potentially has a material impact on the firm’s business success. Identification is carried out in an order consistent with the logic of the conventional Balanced Scorecard (BSC), that is starting from the financial perspective and then progressing through the customer and process perspectives down to the learning and development perspective. An important addition here (which is specific to the SBSC) is an analysis of non-market aspects of corporate activity which is captured through a dedicated non-market perspective (see Schaltegger 2004:511f. for a discussion of the interaction of the market and non-market aspects of corporate activity).

The development of causal chains as a third step is important to reflect linkages between the strategically relevant social and environmental aspects and the company’s business goals and corporate activities, in order to assess the potential influence of the former on business success. An important instrument used here is *strategy maps*, which are becoming increasingly relevant also for conventional BSC development (Kaplan and Norton 2004 reflect this). Based on a strategy map, which focuses on the essential linkages within a company aimed at concisely describing the business model (Gaiser and Wunder 2004), target levels, performance indicators, and activities can then be formulated and implemented. The sustainability performance indicators defined in the fourth step of this process reflect the first level of sustainability performance measurement and management, and provide a very important link to sustainability reporting (the fifth step).

The sixth step of the SBSC process is the implementation and review of the resulting SBSC. Here it is important to ensure that the SBSC is continuously reviewed in terms of the underlying strategy, indicators and activities. As well as being a performance measurement tool, this also brings out more fully the strength of the BSC method as a management system.

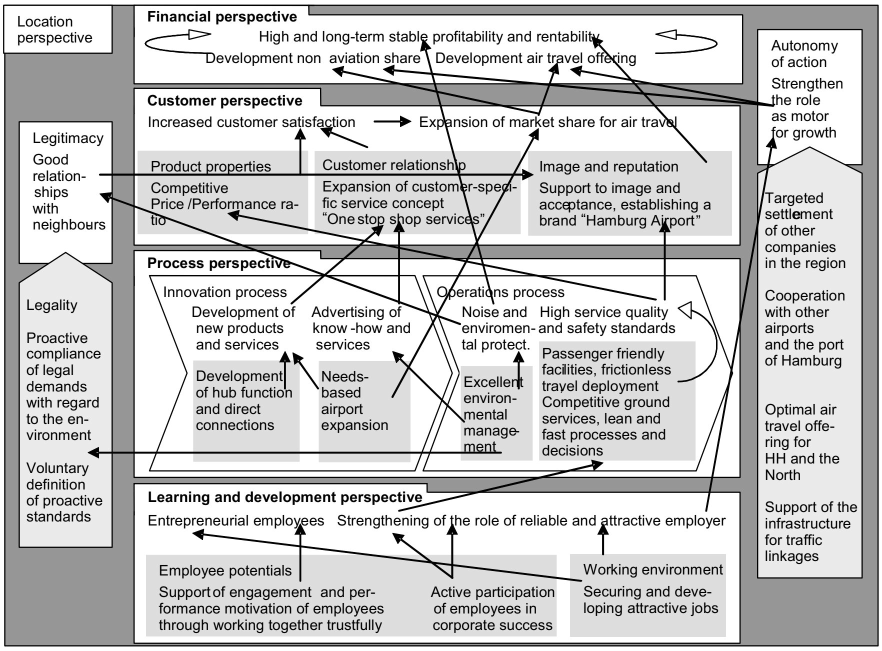

Figure 30-2. An example of a Sustainability Balanced Scorecard (source: based on Diaz Guerrero et al. 2002) HH = Hamburg.

Once this process of SBSC development is finished, the result is a hierarchical causal chain network which enables successful strategy implementation (see Kaplan and Norton 1997:28 for more details on this crucial aspect).

Based on this, the relevant sustainability performance indicators are defined. Figure 30-2 provides an example of such a strategy map based on the Sustainability Balanced Scorecard.

Once the Sustainability Balanced Scorecard, including the strategy map and the performance indicators for the measurement of the key aspects of performance, is developed for the company, the management challenge is to integrate this sustainability performance measurement system with the internal company business information and reporting systems.

Prior to detailing this linkage, the next section briefly introduces sustainability accounting and reporting in the context of performance measurement and management.

4. SUSTAINABILITY ACCOUNTING LINKED TO THE SUSTAINABILITY BALANCED SCORECARD

Sustainability accounting is an important "bridge" between strategic management of corporate sustainability based on the Sustainability Balanced Scorecard and sustainability reporting. A first step towards integrated sustainability reporting requires design of the internal information and reporting systems in a way that ensures the correct company-internal information is made available, at the right level of quality, to calculate the key performance indicators identified with the SBSC approach and to assess the achievement of goals (Möller and Schaltegger 2005, Schaltegger 2004, Schaltegger and Burritt 2000).

Sustainability accounting and reporting can be defined as a subset of accounting and reporting that deals with activities, methods and systems to record, analyse and report firstly, environmentally and socially induced economic impacts; secondly, ecological and social impacts of a company, production site, etc.; and thirdly, and perhaps the most important, measurement of the interactions and links between social, environmental and economic issues constituting the three dimensions of sustainability (for an overview of environmental accounting see Burritt et al. 2002, Schaltegger and Burritt 2000).

The challenge for management is to link business success and value creation with environmental and social considerations. The proposed framework (Figure 30-1) becomes part of the management process when corporate strategic goals and the business strategy have been defined. Based on the business and financial goals of the company, which can differ substantially between different organisations, the SBSC supports the "translation" of the strategic goals into the identification of strategic core aspects, the formulation of key performance indicators, the design of the accounting system, and operational activities, as well as the contents of corporate communication and reporting activities. This requires a substantial change in conventional corporate accounting systems, to incorporate environmental and social issues and their financial impacts. One way to establish links between the measurement of social and environmental issues to which a company is exposed and its business success is to determine key performance indicators with the SBSC and to orientate the accounting systems towards the provision of the necessary data for these indicators. Such an approach distinguishes itself clearly from any accounting approach which tries to measure an overall sustainability or eco-efficiency performance. Sustainability accounting based on the SBSC is instead focused on the provision of those strategic and operational indicators which have been identified as key to business success, and the creation of shareholder value. Such a sustainability accounting system will in most cases provide a mixture of strategic and operational, monetary and non-monetary, and quantitative and qualitative information (Schaltegger 2004).

Business success, defined as the effective achievement of the strategic goals of the company, is always a product of a collaboration between the company and its most important stakeholders (e.g. Figge and Schaltegger 2000). One way to identify the importance of stakeholders is to analyse whether and how they are related to the key performance indicators of the SBSC. A logical consequence for communication and reporting with the important stakeholders is that it should also cover achievements and deficiencies in the areas of the key performance indicators. On this basis internal and external corporate reporting can be designed on a strategically based sound sustainability performance measurement, accounting and management system.

5. SUSTAINABILITY REPORTING IN THE CONTEXT OF PERFORMANCE MEASUREMENT

Several papers and recent initiatives on environmental, social and sustainability reporting stress the need for more standardisation of accounting and reporting procedures (Ditz and Ranganathan 1997, Bennett and James 1998, CERES 1998, GRI 2000, 2002, Schaltegger 1998), the need for systematic measurement of sustainability (Callens and Tyteca 1999, Wehrmeyer and Tyteca 1998) and eco-efficiency (Schaltegger and Sturm 1990, Schaltegger and Sturm 1998, Schmidheiny and BCSD 1992), the consideration of life-cycle thinking (Bennett and James 1998, Heijungs et al. 1992, Hofstetter and Heijungs 1996, ICI 1997, Wagner 2004a, Wright et al. 1997), and a narrower but deeper analysis of core areas of environmental and social performance (see e.g. Bennett and James 1998 on environmental performance). Some initiatives point to the need to use sector-specific performance indicators within an overall performance measurement system to mirror sector-specific social and environmental impacts (CERES 1998, GRI 2000, 2002). The implications of these considerations of performance measurement, management and reporting will be illustrated in the remainder of this section by focussing on environmental performance. Similar arguments can be formulated for social performance, and thus also for sustainability performance as a whole.

A trend that emerges from these initiatives in terms of environmental performance is that relative indicators, aimed at measuring efficiency rather than effectiveness, are increasingly being proposed for performance measurement (MEPI 2000, NRTEE 1997, Olsthoorn et al. 2001). Linked to this, another trend is the proposal of key resource flows/areas around which to cluster measurement and indicators of environmental performance (Ditz and Ranganathan 1997, Gee and Moll 1998, ISO 1999). Areas proposed are the quantities and types of materials used, quantities and types of energy consumption or generation, non-product output (i.e. waste generated before recycling) and pollutant release to air, water and land.

There are clear consequences of the major trends, issues and developments of overall performance measurement systems for performance management and reporting. The objective of achieving comparable, transparent and complete (environmental) performance indicators implies the need to adopt a standard set of universally reported indicators. It thus requires the development of accounting and reporting standards ensuring high information quality (Schaltegger 1998, Wagner 2004b) and has likely effects on reporting requirements, since it provides incentives for tracking environmental performance in a standardised way (Ditz and Ranganathan 1997). These developments could therefore form a basis for consistent standards of accountability for environmental performance. Such standardisation is likely to result from the combined efforts of governments, international standards and ratings organisations, and inter-firm co-operation, possibly facilitated by industry associations.

One challenge for sustainability performance measurement, management and reporting as practical means for internally measuring and externally communicating social and environmental performance improvements, is how to serve diverse audiences with different information needs. One model could be a type of 'generic' performance measurement and reporting that concentrates on key information which is relevant to all major target audiences (Azzone et al. 1997). The Global Reporting Initiative's (GRI) Guidelines move in this direction. However, in order to become effective in a company, those sustainability indicators which are relevant for its success have to be selected from the general framework. The trend towards standardisation of reporting indicators and the striving for a core set of broadly applicable metrics makes it necessary for corporate managers to identify, select and focus on those indicators which relate to and best reflect the core areas of performance. This requires a systematic approach such as the SBSC to determine which indicators are strategically relevant. The strategically relevant indicators, in turn, define the data collection needs and the focus of the sustainability accounting approach. Furthermore, the respective accounting information provides the main information content for sustainability reporting if reporting needs to address those sustainability issues to stakeholders which are of core strategic relevance to the company.

6. CONCLUSIONS

Whilst the type of sustainability reporting which is described as the endpoint of the above process (inside-out and strategy-based) would be a very structured and focused way of communicating on the basis of a strategically determined integrated measurement of sustainability performance, it needs to be noted that the practical and historical evolution of sustainability reporting (for overviews see Elkington et al. 1998, KPMG 1996, UBA 1999) is currently much more strongly influenced by a number of contingent factors. These are the publication of guidance documents or quasi-standards for environmental and sustainability reporting such as e.g. EC (1993), Müller et al. (1994) or IRRC (1995), which may imply a system lock-in (see e.g. Clausen and Klaffke 2000 and IMUG et al. 2000 for a discussion of such aspects). The guideline developments are driven by general societal and political factors discussed in various groups or based on a multi-stakeholder consultation process. Also, specific reporting competitions and rankings (e.g. Future and IÖW 1998, SustainAbility 2004) may provide incentives for some “tuning” of reports towards specific formal aspects of these competitions, rather than basing them on a fully consistent performance measurement and management system. No doubt, from a reputational, signalling and marketing perspective, these developments have to be considered by corporate management. However, to achieve efficiently the best sustainability performance with those social and environmental activities which contribute most to the company’s business success and shareholder value, the structured analysis and identification of core strategic social and environmental issues determined on the basis of the SBSC may have to drive sustainability performance measurement and management.

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