Building Culture & Environment

INFORMING LOCAL AND GLOBAL PRACTICES

EDITED BY
Raymond J. Cole and
Richard Lorch

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Preface

This book presents a beginning to define and engage with cultural issues that researchers, practitioners, clients, user groups, product suppliers and policy makers in the built environment need to consider in creating, utilising and exchanging knowledge. The chapters collectively provide a mosaic of questions and positions, offer some provocative visions and represent a broadening synergy while recognising practical constraints. The goal is to address the complex problems surrounding the increasing diffusion of international information and technologies while respecting the needs and limitations of local social and cultural contexts. Although a growing body of literature exists on the general questions of globalisation and knowledge, they do not explicitly focus on the special nature and questions confronting the built environment. The authors' motivation for this book is to promote further thought, discussion and actions within the built environment, to encourage a community to coalesce and to initiate the development of an appropriate vocabulary and set of new competencies for understanding, interpreting and applying global information.

The dilemma is how the supply side of the construction industry (including the research community and policy makers) can develop new capabilities for understanding and enhancing regional identity in a globalising world, while making appropriate use of information and techniques originating from 'foreign' sources. Focusing on industrialised Northern countries, this book considers the way in which information and technologies are currently being diffused across different cultures, the positive and negative implications of this transfer and the potential for change. The main issues addressed directly and indirectly in the various chapters are as follows:

- The ways that human/social/cultural expectations and acceptance limit technological advances and performance improvements.
- The conflict between regionally appropriate environmental building practices within an increasingly global technical and economic culture.

- How knowledge on environmentally progressive buildings can legitimately be transferred across cultures without compromising regional and local practices.

This book stems from the recognition that successful environmental research, information, technologies and practices are often compromised when imported into another region or country. Strategies and technologies running counter to user expectations have a high risk of failure and therefore compromise the goal of producing an environmentally progressive building. Compounding this issue is the very real problem for designers in affluent societies of how to manage social and cultural change in order to provide levels of comfort which are more environmentally benign.

There is now an emerging pattern based on a number of case studies suggesting that a limiting factor was the inability to articulate, understand and account for the contexts of local user expectations, social and cultural values as well as ways of life. Although this is immediately obvious (especially to historians, social scientists and others), it has not been operationalised by many stakeholders involved in the built environment – on both the supply and demand sides.

The rise of the International Movement and internationalism in architecture over the past 75 years has led to an 'amnesia' about how local culture, values and the groups of stakeholders (especially the occupants) actually influence the success or failure of a project. In addition, several functional and symbolic impacts of the built environment have been marginalised over an extended period of time. Architectural magazines, technological journals and the Internet, coupled with a growing cadre of architects, consultants, suppliers and contractors working in international markets, have accelerated the spread of internationalism. The recent rise of performance-based codes and regulations may further stimulate an international building design and research culture.

The pressing issue underlying this discussion is the increasing recognition of the need for sustainable urban development. Over two-thirds of Europeans live in urban areas and over half of the world population now live in cities. Cities in developing countries are experiencing high rates of urbanisation – in certain cities the population doubles every 12 years. Very large resources are consumed by cities. In energy consumption 75% of the total is accounted for by buildings and transportation and in the United Kingdom 6 tonnes of building materials are consumed annually for each person. Waste and pollution created by cities have been a major cause for environmental, social, economic and quality of life concerns. Actions are required not only for these immediately pressing problems but also for longer term issues implied by the longevity of new buildings and city infrastructures.

Environmental problems require international cooperation in setting agendas, targets, assessments and standards as well as the sharing of sound environmental knowledge and practices. The creation of new abilities to understand and interpret such global knowledge is urgently needed. Paradoxically, the trend toward an international culture has significantly increased the access to and dissemination of building-related environmental information from almost any part of the world offering it. The result of enhanced communication is often not cultural convergence, but deepening incomprehension.

The collaborators in the present book determined initially to examine these questions within the confines of selected OECD countries which have similar economic prosperity, access to technologies and climates but diverse cultural values. The complex North–South issues of information and technology exchange are extremely important but need to be considered separately. It is intended to undertake this larger concern as a subsequent exercise.

This book is based upon an invited international research workshop 'The Cross-Cultural Transfer of Environmental Building Information' organised by Raymond J. Cole and Richard Lorch which took place in March 2002 at the University of British Columbia, Vancouver, Canada. For many within the diverse group of participants and authors, this entailed the difficult and unusual task of stepping outside their normal disciplinary boundaries to explore social and cultural implications of knowledge exchange. The chapters in this book are the product of feedback, exchange and an iterative process between different viewpoints, disciplines and cultures occurring during and after the workshop.

Although few answers are provided, this book presents a broadening synergy and charts the beginning of a journey for the many stakeholders in the built environment. This recognises the limitations of transferring information and technologies, the linkages between culture and technology and the need for developing knowledge of local social/cultural/user issues for improved fit. It is not a rejection of globalism *per se*, but instead suggests that new capabilities are necessary to discuss, exchange and interpret 'foreign' information and that local/regional identity has a significant role in the formation of a sustainable built environment.

The editors and authors are thankful to the Winter Research Institute of Hokkaido, Japan, for providing funding for the workshop, thereby allowing the many cross-disciplinary discussions to occur.

Richard Lorch and Raymond J. Cole

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1

Introduction: Knowledge, Values and Building Design

Raymond J. Cole and Richard Lorch

The environmental imperative

We presently have greater scientific understanding of human-induced stresses on natural systems and unprecedented individual and collective access to information about these issues. The weight of evidence traces the roots of current environmental problems to the fact that industrialised societies operate within a social and economic system that implicitly considers human activity dominant over, and essentially independent of, the ecosystems. Coupled with the low efficiency that natural resources are 'converted into useful, sustainable products and life-supporting services' (Talbot and Magnoli, 2000, see also Hawken *et al.*, 1999), all meaningful indicators suggest that the resulting current patterns of human activity and settlement are not sustainable. Given the pressing timescale of critical environmental issues such as climate change, it is difficult to imagine that a sustainable system of production and consumption will emerge simply from minor changes to current practices. A key issue, therefore, lies in the considerable difference between the levels of change that the scientific community is advocating and those that are socially, economically, and politically acceptable.

Resource use and the resulting environmental degradation have, of course, always been unavoidable parts of human existence. Although historically these effects have often been intense and catastrophic, they have been geographically specific and modest in scale compared with the biological production and assimilative capabilities of the planet. Many environmental problems in the recent past, such as toxic industrial emissions, logging old-growth forests, oil slicks, dioxins, asbestos, illegal dumping, etc., have also been localised, highly visible, and politically charged.

However, since society as a whole has generally benefited from their remediation, '. . . progressive action has been possible, if not always easy' (Burke, 1996). The recognition of the types and scales of environmental issues have also changed considerably since the early 1980s. Although specific challenges will continue to emerge with any fundamental transition toward sustainability, these challenges will increasingly be subsumed by a much more complex and less distinct set of issues. Despite the increasing intensity and frequency of environmentally related catastrophes, the most critical threats to sustainability are now recognised as taking the form of 'cumulative, slow, and gradual processes' (Gladwin *et al.*, 1997, p. 243). The current scale and the types of human activity are producing impacts that are both dispersed and close to or exceeding global limits of ecological assimilation (Rees, 1999). Moreover, rather than being directly apparent, adverse environmental effects are now 'revealed in a growing body of scientific data . . .' (Guy and Farmer, 2000, p. 74).

Information transfer versus knowledge exchange

The built environment can be characterised as the embodiment of human values and ingenuity, as represented by the knowledge and priorities of its creators. Further, the acquisition and assimilation of the knowledge to create the built environment are clearly shaped by a broad range of contextual issues.

It is important to distinguish between the notions of 'information' and 'knowledge' in the development and acquisition of new ideas and skills to improve the environmental performance of buildings. Knowledge is not easily transferable and is attached to an individual or group. Unlike information, it is context dependent. As Gann makes clear in Chapter 4, knowledge is a deeper understanding of a subject (the 'why') and also entails capabilities of assessment to form judgement, interpretation and understanding. By contrast, information is simply data which can be stored and distributed. By itself information does not provide any significant or deep understanding and limits the users who act upon it.

Publications and other forms of information are important vehicles for the formal exchange of *explicit knowledge* between researchers and practitioners. By contrast, *tacit knowledge* (know-how) is acquired through practice, and its transfer requires person-to-person contact, and individual learning and experience. Such knowledge is central to the building design and construction process, and this is provided largely through the experience of the diverse members of the design team. Similar distinctions must clearly be recognised in the cross-cultural transfer of information and knowledge. Building information has been, and continues to be, transferred with the re-interpretation of texts in foreign contexts, international conferences and more recently via information and communications technologies. Absorption of relocated information into knowledge could be slow, evolving and adapting to incumbent social and physical surroundings or fast in response to political will or unforeseen disaster.

Similarly, tacit knowledge has also been, and continues to be transferred. Historically, this moved slowly with migrating populations and became mediated by changes in political, social and economic structures and in response to differences in climate and materials. Movement of skilled people (either permanently through immigration or temporarily through exchanges and international consortia and projects) accelerates the interaction and exchange of knowledge.

Tijssen (2001) identifies that local and national based on a 'web of personal relationships' are often a crucial element in knowledge transfer processes since they create and store an accumulation of capabilities. Tijssen further emphasises that '. . . effective science–technology interfaces are primarily human in character and hinge on person-embodied "tacit" knowledge and skills'. Further, he suggests:

> '. . . in order to develop and exploit new knowledge, or to transfer existing forms of knowledge, research performers and users therefore often engage in close and informal interaction. These personal links and transfer channels are usually a key feature of domestic science–technology interfaces and are profoundly influenced by proximity and by social and cultural factors' (Tijssen, 2001).

The importance of the interpersonal communications in terms of both research and technological innovation evident above suggests the benefits tend to be 'geographically and linguistically localised' (Pavitt, 1998).

Implications for the built environment

The scale and complexity of global environmental problems require an unprecedented degree of international cooperation and the sharing of sound environmental knowledge and practices. This may stimulate the creation of new abilities to understand and interpret data, case studies and other information from 'foreign' sources. Paradoxically, the trend toward an international culture has significantly increased the potential for considerable access to and dissemination of building-related environmental information from almost any part of the world. Information and communication technologies have also added yet another powerful homogenising mechanism. The result of enhanced communication is often not cultural convergence, but deepening incomprehension and an increasing failure of buildings to perform as intended. Moreover, the movement towards the adoption of performance-based codes and regulations is creating an international building design and research culture which risks homogenisation and the establishment of inappropriately high standards.

The authors in this book consider the problem of understanding the local culture as an important key to creating buildings which have good fit, function well and are durable. Local culture embraces values, symbols, meanings and understandings, climate, resources and history with their convergence as a way of life – the practical ways in which things are performed and achieved. Although we live in an increasingly globalised society with an increasing amount of global building types, Shields suggests in Chapter 3 that we are able simultaneously to negotiate a number of different levels of built environment from global portals to the local. The lesson is that the generic, anonymous, homogenised, global built environments actually reinforce the need (and desire) for the local, culturally embedded buildings and environments. The challenge is to avoid the ersatz historical pastiche and engage with a living culture as Kohler (Chapter 6), Oliver (Chapter 15) and Cohen *et al*. (Chapter 18) argue. Improving building performance is not only a technological question, it embraces the users' expectations of comfort. Brager and de Dear (Chapter 11) discuss the dilemma of how local expectations have been raised to inappropriate levels and make the important distinction between deep cultural values and transitory life styles. Contemporary life style expectations in the developed world are both unrealistic and unsustainable. However, since they are also malleable, the need for positive intervention and change at a social and cultural level is clearly a critical concern.

Technological change

Scientific and technological development has a direct bearing on environmental progress. Pavitt (1998) suggests that patterns of scientific strengths and weaknesses 'are strongly influenced by the nature of the societal and technological problems to be solved'. This is echoed by Leaman in Chapter 10, which uses the notion of 'cultural perceptions of risk and hazards' to describe how significant environmental constraints are manifest in a country's competence in overcoming them.

For the vast majority of the world's population, day-to-day survival dominates human activity. Homer-Dixon (1995) suggests that, as scarcity worsens, some poor societies will face a widening 'ingenuity gap', further compromising their abilities to respond, adapt creatively to changing conditions and eventually chart a path to recovery. This is compounded by a necessary investment of public expenditure on academic research to create a country's capacity for technical change (Pavitt, 1998). By contrast, depending on how they are deployed, the collective intellectual and economic resources of the industrialised nations suggest a future with a capacity for change and adaptation.

Given the complexity of environmental problems, solutions are likely to require an unprecedented degree of international cooperation and communication. The sharing of sound environmental practices at a variety of levels will be increasingly necessary and demanded. However, the exchange of information and technologies raises profound issues regarding the recognition and maintenance of cultural continuity. The traditional transfer of technologies across regional and international borders had often occurred at a slow rate of diffusion and also allowed for the social and cultural adaptation of the technology by local inhabitants. By contrast, the ease and speed of contemporary information and technological exchange leaves little opportunity for its considered assimilation. In addition to the obvious adverse homogenising effects, such practices typically incur environmental costs and dependencies. Sufficient evidence exists that the performance of buildings through time will be compromised unless technological advances are respectful of personal expectation and cultural values. Simply stated, design strategies that are considered inappropriate by users will invariably be replaced or disregarded – often at significant cost to retrofit those deemed more acceptable.

Solutions to complex problems that involve a wide range of scales of influence and time frames require the ability to appreciate and address linkages and interrelationships between a broad range of often conflicting requirements. However, Gladwin *et al.* (1997) suggest that people tend toward '. . . simplicity in causal mapping, and engage in isolated, one-factor-at-a-time analysis rather than dynamic whole-systems appraisal'.

Although the majority of contemporary academic and industrial research uses methods and techniques within the confines of specific disciplines, the capacity to cope with emerging complex problems depends on an increasing range and combination of complementary fields of technical knowledge. Indeed, leading-edge firms are '. . . becoming increasingly "multi-technology", incorporating a growing number of fields of knowledge into their problem-solving armory' (Pavitt, 1998).

Building design also requires the resolution and synthesis of a broad range of human and technical issues. Yet this process has historically been fragmented with specific issues falling into the realm of specialist consultants and examined largely independent of their impact on, or interaction with, others. These professional barriers have only recently been breached through increased commitment to more integrated approaches to design. Integrated design, however, is not only a matter of bringing the design team's members together at the outset of a project. Setting performance targets, developing a shared view of the project, improving the quality of communication and information to guide design and ensuring an appropriate cultural/social fit are central to creating quality buildings within tight economic and time constraints.

The exchange of building information and technologies is increasingly occurring largely in arrogance or ignorance of local cultures and traditions. As commodities turn increasingly into 'information', the distinction between a product and a service begins to blur. This will invariably require a greater understanding of the way in which information and technologies are ultimately used and therefore require a greater understanding of the cultural context.

Almost all sustainability and building environmental concepts are universal in their validity. However, if these are to be successful then the specific interpretation and manifestation in design should reflect local context. In too much contemporary green design a literal transfer of technological strategies occurs without any serious critiques of either their local validity or engagement by building occupants. A key factor will be developing supply side capabilities to assess critically and adapt global information to local cultural expectations and use, coupled with local climatic conditions, materials and technologies.

This book provides a series of perspectives on the cross-cultural transfer of building environmental knowledge. It initiates a discourse to address a series of questions for the many stakeholders in the built environment: the owners of buildings, the occupants, the designers, the education and research community, regulators and policy makers as follows:

- The ways that human/social/cultural expectations and acceptance limit technological advances and performance improvements at the level of individual buildings, large developments, cities and policy/regulation.
- The conflict between regionally appropriate environmental building practices within an increasingly global technical and economic culture.
- How knowledge on environmentally progressive building can legitimately be transferred across cultures without compromising regional and local practices.
- Does the built environment supply chain sufficiently understand and embrace the local cultural expectations?
- What new capabilities are needed? Do the providers of information currently have the capabilities to understand the cultural contexts of the users of building information? Do the users of this information have the capabilities to successfully translate it into knowledge which embraces local culture and expectations?

However, the pressing issues of disparity between developed and developing countries along with issues of knowledge and technological exchange between them are specifically excluded from this book. The first, and relatively simpler, stage consists of examining these issues to understand similar industrialised countries where a considerable disparity exists between necessary improvements in building design and willingness to commit to environmental responsibility.

Environmentally progressive and sustainable buildings will occur when the supply side has a much improved knowledge of and engagement with clients', occupants' and users' needs and expectations while simultaneously engaging with appropriate environmental practices.

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Section I

Understanding Context

2 Section introduction

Understanding Context

Ian Cooper

Buildings as expressions of culture

Buildings and settlement patterns are material expressions of the cultures that construct them. Deeply embedded in them are hosts of (barely perceived and so largely unspoken) assumptions about:

- what are deemed appropriate patterns of production, consumption and other forms of social, economic and political behaviour; and
- hence what is valued and what is not by those who control and regulate the production, operation and management of the built environment in a specific culture.

As a consequence, individual buildings (and their agglomeration into towns and cities) stand as highly concrete and durable statements:

- not just about prevailing patterns of power and privilege between people;
- but of preferred relationships between humans and other species (both flora and fauna), materials and other resources too.

Even within a single culture, these issues – and the built environments that give expression to them – are often hotly contested, particularly between those who hold power and those, with opposing world views, who seek to challenge them.

Seemingly neutral information and technologies – of the kind enshrined in design guidance and standards about how buildings should be built or cities be laid out – are, in practice, tacit surrogates for often intractably opposed views of how we could and should live. The tacit, taken-for-granted nature of such design guidance and standards begins to become clearer when we start to consider exchanging them between cultures. Once this is proposed, arguments are raised about the appropriateness of such exchange. In design and development circles, these arguments are often couched in the vocabulary of understanding and responding to 'context' in order, for instance, to protect local identities or cultural heritage. Seen from this vantage point, a key issue in this debate is the (mis)use of information and technologies when they are moved from one culture to another, typically from a more 'developed' country to a less 'developed' one – more rarely vice versa.

This debate is the focus of attention in Chapters 3 to 6 of this book. They illustrate sharply divergent interpretations placed on exchanging information about, and technologies for, the design of environmentally 'progressive' building between cultures. Each of the four authors starts from a different perspective: see Fig. 2.1. The perspectives offered scarcely touch, although the concerns they raise do overlap. Apart from agreeing that such cross-cultural transfer is problematic, they share surprisingly little ground about how or why to tackle it. This is largely because they confront the exchange of knowledge involved by drawing on widely differing discipline backgrounds and conceptual frameworks.

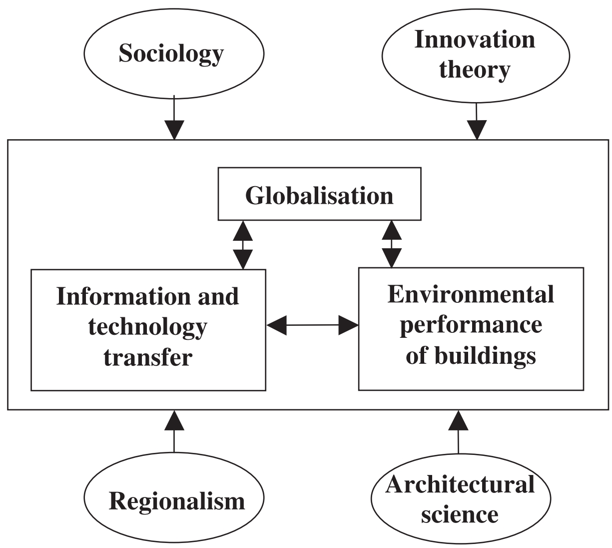

Fig. 2.1 Different perspectives applied to knowledge exchange

A sociological perspective

In Chapter 3, Shields offers a sociological perspective. He starts with an overview of the unfolding debate about globalisation. He argues that this has proceeded through at least two stages. Initially globalisation was castigated as a wave of (Western) cultural imperialism that was causing global homogenisation by eradicating local differences. Now, in the social sciences at least, it is recognised that globalisation involves many contradictory processes and can, as a result, have widely diverse outcomes. So, instead of being monolithic, he portrays globalisation as complex and pluralistic. He suggests it is resulting in two processes, *hybridity* and *adaptation*, that blur the conventional boundaries between categories such as the 'global' and the 'local', with partial adoptions from one place occurring in another.

For Shields, however, what is significant about globalisation for architecture is the production of globalised built environments – relatively standardised spaces epitomised by airport terminals, international hotels, and tourist or sporting facilities. Often these are branded spaces such as restaurant franchises, covered by copyrighted design. These anonymous, non-place, spaces are seen as being without historical precedent. They are described as being dominated by a devotion to mobility and movement, without any sense of fixity, place or local identity. Significantly, such repetitive environments require, regardless of local conditions, supporting infrastructures capable of delivering internationalised standards of health and safety. Consequently, they act as portals for flows between localities, deploying innovations from one place in another location or jurisdiction.

The significance of global buildings – especially branded spaces such as Planet Hollywood – is then that, like satellite TV, for instance, they act as interfaces for flows between localities. But, while TV offers dematerialised glimpses into foreign ideas about distant ways of life, global buildings are physically present, locally grounded artefacts, yet often based on equally distant, internationalised design standards and practices.

An 'innovation theory' perspective

In Chapter 4, Gann sets off from an entirely different starting point. He draws on innovation theory, identifying a range of factors as creating new requirements for international exchange of knowledge about how and what is built:

- globalisation of markets and production;
- development and exploitation of technical opportunities (here ICTs and smart, green, buildings);
- demographic, social and economic changes – ageing populations and resource scarcity;
- global environmental change; and
- pan-national regulations and protocols for dealing with the impact of climate change.

Gann's argument is driven by a perceived need to design buildings that are both sustainable and sensitive to their local context. He believes that, to confront these pressures, design organisations, construction firms, and research institutions need to develop better approaches to the exchange of information and knowledge.

Gann explores two separate aspects of knowledge exchange. First, he focuses on how professionals from different cultures learn from one another. And, second, he concentrates on how knowledge can be shared between professionals from different disciplines – particular in project-based working environments. These two aspects of knowledge exchange are discussed within a framework formed by six concepts drawn from innovation theory:

- national systems of innovation;
- networks of innovators;
- communities of practice;
- the role of research processes;
- the absortive capacity of individual firms; and
- the management of firms' dynamic capabilities.

Gann believes that built environment professionals should be well placed to share and exchange knowledge between disciplines because they often work in teams as 'systems integrators'. But their capacity to do so is hindered by organisational processes employed in construction projects, especially where cross-cultural and interdisciplinary knowledge has to be exchanged. And he concludes that identification of commonly agreed definitions of sustainable buildings is not currently available, let alone commonly defined actions and solutions. Designers, planners and developers typically learn to work within the limits of their own bioregion. He questions how much of the knowledge they acquire can be transferred, cross-culturally, outside the context that created it.

A socialised 'architectural science' perspective

In Chapter 5, Cole grounds his argument in, but is highly critical of, the traditional approach of architectural science to knowledge exchange. This is, he suggests, typically technically framed, focused on technical systems and, in this context, their potential for reducing resource use and environmental impact. However, he sees the performance of 'green' buildings as being severely compromised if they fail to account adequately for their inhabitants' needs, expectations and behaviour. Accordingly, robust solutions to green buildings have to be culturally grounded and will depend on major changes in human values and actions. As a result, he calls for reconciliation between technological change (what is technically possible) and occupant engagement (what occupants expect and aspire to). This means turning our attention to those aspects of human expectation, behaviour and culture – such as values and world views, especially in relation to comfort and environmental control – that can usefully inform clients and designers when making strategic decisions about building design.

Cole believes that addressing the environmental agenda will require both significant improvements in building performance beyond current practice and appreciable technological change. However, this transitional period will need to be carefully managed. While the concepts behind the design of green buildings are seen as being universal, their interpretation and realisation needs to be context-specific. He criticises the supply side of the construction industry for transferring 'foreign' technologies and design standards across regional and cultural boundaries without understanding local contexts. Cole sees a key factor in the success of green building practices being the development of supply side capabilities that can critically assess and adapt global information to local cultural expectations, habits and patterns of living, coupled with local climatic conditions, materials and technologies.

Cole warns that the willingness of building users to accept and engage in green building strategies cannot be assumed. Evidence suggests that, confronted by green buildings, occupants may make changes to realign them to more conventional expectations, thereby reversing their intended environmental benefits. So ensuring the success of green buildings may require a transitional period that enables users to undertake the necessary learning, reassessment and accustomisation to different conditions if they are not to revert to old expectations and habits. In turn, this will require a longer and more comprehensive view of building performance as well as of how the success or failure of environmental strategies are judged.

A regionalist perspective

Finally, in Chapter 6, Kohler adopts a regionalist perspective. He attempts a synthesis of two previously separate notions and scales – global ecological carrying capacity and regional cultural diversity. His thesis is that the prevailing technocratic approach to 'green' buildings will ultimately fail because current attempts to transfer 'progressive' environmental technologies are not based on a sound knowledge of the intended host regional cultures. He argues that a region's existing stock of buildings and the form of its urban fabric should be seen as an essential part of its cultural diversity. So, for Kohler, cross-cultural transfer of information and technologies for green buildings has to begin with specific consideration of the context to which such transfer is being proposed. Fundamentally, however, he believes that there is no conflict between delivering regionally appropriate and environmentally appropriate buildings. The apparent conflict between these twin goals is a pernicious product of the anti-regional 'international style' championed by the modern movement in architecture during the twentieth century.

Echoing Shields's description of the first stage in the debate about globalisation in the social sciences, Kohler decries the imperative to export 'progressive' environmental practices from European (or more broadly OECD) countries, especially to transitional or developing economies, as a form of cultural imperialism incompatible with the protection of regional cultural identities. And Kohler defines protecting such identities as a critical component of sustainable development, enshrined by the Treaty of European Union in the principle of 'subsidiarity'.

Kohler concludes that there is a clear difference between 'green' and 'sustainable' approaches to the production and maintenance of the built environment. In 'green' approaches, he argues, the emphasis is on limits to environmental factors (resource use and pollution), while in a sustainable approach the focus is on achieving synergies between environmental, economic and social objectives, using scalable indicators linked to an intergenerational perspective. 'Globalisation', in the form of internationalised markets, disregards regional cultural traditions and so is judged incapable of delivering a stable, long-term, framework for development.

Partial views

Each of the perspectives offered in these four chapters offers its own insights into the problems of cross-cultural information and technology transfer. But each of them is also partial. Each offers a view of knowledge exchange from within a specific conceptual framework. And, although this is rarely made explicit (except by Kohler) each is underpinned by a different set of values or ethical standpoint. So each highlights and so 'values' a different set of factors that need to be taken into account when trying to exchange knowledge about environmentally 'progressive' buildings between cultures.

3

Globalisation – Entangled Places, Interface Buildings, Generic Design

Rob Shields

This chapter provides an overview of social, cultural and economic debates on globalisation as a basis for discussing globalisation in relation to the built environment. At first, globalisation was widely believed to be the antithesis of approaches which emphasised sensitivity to local context and the merit of local cultures. But further research on globalisation over the decade and a half since the mid-1980s has shown that globalisation involves many contradictory processes and has diverse outcomes. It has forced a rethinking of locality and context dependency. The situation is not a matter of simple homogenisation. The debate has developed away from a binary opposition of either global standardisation or local distinctiveness. In place of this dualism, a pattern of hybridity and adaptation has emerged, displacing the 'local or global' view of globalisation which held sway in the early 1980s. Definitions and debates on globalisation are followed by a discussion of the implications of hybridity, the blurring of conventional boundaries, and the 'virtual' quality of both 'the global' and 'the local'. The categories of 'the global' and 'the local' mask the complexity of partial adoptions from one place in another and their naturalisation, a cultural process that is discussed under the label of 'creolisation'.

One aspect of globalisation is the spread of generic spaces and design in relation to generic uses (such as airport terminals). To what extent can one meaningfully speak of a 'globalised built environment' or relatively standardised spaces, technologies and uses? Do these presume equally generic uses? There is a long-running tendency in design schools to treat architecture as a set of global principles. Construction, on the other hand, is relegated to the local, to craft traditions, the capacity of the bodies of labourers, the *genius loci* and logistics of the site. Thus, in the built environment one finds both local forms and recognisable representatives of international 'styles', materials, uses (building types) and technical approaches. The latter are nonetheless usually both adapted to local conditions and tuned to generic, globalised functions. Buildings and even large-scale projects are not isolated entities but set in a context of related facilities and needs which might be literally 'next door' or at some distance – the next rail or bus station, or airport.

Definitions

Globalisation has been called 'the' concept by which we name the current moment and the transition into the third millennium AD. It is not only a theory of social space, but also a social theory of time born in, and highlighting, specific worries and opportunities. Most social scientists writing in European languages seem to accept that some such process is under way. Where there is debate, it concerns the impact of globalisation and whether or not it is fundamentally new or rather a new wave of a process which has been ongoing for the last 400 years of European expansion and Westernisation – something more typically referred to as 'modernisation'.

But what exactly is globalisation? Globalisation is a descriptive term which 'names' the current moment. This has been described as the emergence of a trans-national social order which transcends previous economic models of internationalisation. Writing for a student audience, Waters (2001, p. 5) defines globalisation as:

> 'A social process in which the constraints of geography on economic, political, social and cultural arrangements recede, in which people become increasingly aware that they are receding and in which people act accordingly.'

The *Oxford English Dictionary* finds uses of 'the global' dating back 400 years, but to speak of something as 'globalised' and 'globalisation' are mid-twentieth century turns of phrase (see *The Economist* (4/4/1959); *Spectator* (5/10/1962); *Webster's Dictionary* (1961)). The French were writing about the global, *le planetaire*, as a question of scale in the 1970s (Lefebvre, 1991). Academic recognition of 'globalisation' is signalled by the argument and collation of 1980s theories of trade and the dissemination of notions of Western civility and civil society. The seminal text was Roland Robertson's book *Globalization* (1992; see also Robertson and Lechiner, 1985):

> 'Globalization as a concept refers both to the compression of the world and the intensification of consciousness of the world as a whole. . . '.
>
> Robertson, 1992, p. 8

Such definitions all emphasise a process of 'thinking up' and linking up from a local to a trans-national scale. In dictionaries, globalisation has continued to mean 'diffusion' and export on a world-wide scale. However, academic analyses reveal not only the spectre of a homogenised global cultural and economic space, but a simultaneous phenomenon involving the take-up of regional cultures internationally. This involves the creation, in many cases, of new hybrids as ideas and products from elsewhere are integrated with local practice and conditions. Albrow summarises globalisation as 'all those processes by which the peoples of the world are incorporated into a single world society, global society' (Albrow, 1990; cited in Pieterse, 1993).

Antecedents

Globalisation rests on a number of antecedents, none of which is as broad as the current term. For example, Marx was committed to a globalising theory of capitalism, especially in regard to the exploitation of European colonies and the establishment of a 'world market'. This took place by opening up navigation to Asia (Marx, 1964, p. 222). But Marx's view was that the nation-state would remain unchallenged until the emergence of a world-wide proletarian movement. Marxian dependency theory (e.g. Amin, 1980) and functionalist modernisation theory (Levy, 1966) inherit the assumption of an economic globalisation alongside national political and cultural identities. World-system theory (Wallerstein, 1974) prefigures globalisation theory. It is not only economically deterministic but the notion of 'world' which Wallerstein uses is phenomenological not geographical. Thus, the Roman Empire is a 'world' (Wallerstein, 1974, p. 348). The state stabilises this process, rather than being challenged by it, and a multiplicity of separate cultures is envisioned (Waters, 2001, p. 11). These are important differences from the globalisation theories and debates of the late twentieth century.

In political science and law, the emergence of trans-national political spheres has been understood as the emergence of a dual system in which states retain sovereignty even while developing and being challenged by a series of 'multilateral' institutions (Burton, 1972; Rosenau, 1990). McLuhan's notion of a 'global village' is one of the first to focus on culture in the context of the expansion of television media (Carpenter and McLuhan, 1970, p. xi). Other accounts neglect culture, defer examining the cultural impact of economic globalisation or argue that culture remains autonomous (Wallerstein, 1991). By contrast, late twentieth century theories of globalisation suggest the relativisation of at least parts of local cultures and the displacement of the effectivity and integrity of the nation-state both as a polity and as an 'imagined community'.

Economically, globalisation has extended the influence and profits of an elite group of companies. Most of these are based in Europe, North America and Japan, but regional players follow closely behind. If globalisation is Japanese cars and Microsoft Windows it is also Finland-based Nokia mobile phones, or Mexico-based Cemex concrete, not to mention conglomerates in South Asia, South America and South Africa. Some of the greatest challenges posed by globalisation are at the level of the impact of low-priced commodity goods which now circulate more widely due to the lowering of tariff barriers – Chinese rice exported to Thailand, for example. Thus rather than a problem of architectural style or lifestyle it is likely to be a smaller scale of genetics and geology – the geographic sources and destinations of rice strains and aggregates.

The cultural perspective

Globalisation theories received a boost in attention with the coming together of Wallerstein's approach with the historical studies of colonial architecture and urbanism of Anthony King. King's historical sociology of colonial forms, notably the adoption of the South Asian bungalow in Britain, emphasised the linkages and flows of not only commodities but ideas, styles and consumption forms, between parts of the British Empire (King, 1984). *Culture, Globalization and the World-System* (King, 1991) emerged out of a symposium at Binghamton University (NY) which brought the two approaches together.

The two strands in the late twentieth century globalsation debate emphasise homogenisation, on the one hand, and hybridisation on the other. In architectural theory of the early 1980s, Kenneth Frampton posed regional cultural identities as a critical basis for resisting 'universalisation'.

This process implied the destruction of the

> '. . . creative nucleus of great cultures, that nucleus on the basis of which we interpret life, what I shall call in advance the ethical and mythical nucleus of mankind . . . we have the feeling that this single world civilization . . . exerts a sort of attrition or wearing away at the experience of the cultural resources which have made the great civilizations of the past . . . the spreading of a mediocre civilization which is the absurd counterpart of . . . elementary culture. Everywhere throughout the world, one finds the same bad movie, the same slot machines, the same plastic or aluminum atrocities, the same twisting of language by propaganda, etc. It seems as if mankind, by approaching en masse a basic consumer culture, were also stopped en masse at a subcultural level.'
>
> Frampton, 1983, p. 16

However, the terms in which such a dualism could be conceived were being challenged even as Frampton wrote. The local could not be so easily located. A gradual shift in the literature shows the move from concerns over massive Americanisation (or 'McDonaldisation' as Ritzer (2000) puts it) toward empirical studies of the emergence of local–global hybrids, partial adoptions and reworkings of foreign forms in specific localities (Appadurai, 1996; Pieterse, 1993).

Pieterse (1993), joined by Appadurai (1996) and Hermans and Kempen (1998), argues against a reductionist view of globalisation as Westernisation. This analysis is criticised for its reliance on a dichotomous appreciation of intercultural relations (Hermans and Kempen, 1998). The West is consistently opposed to 'the Rest'[1]. Cultures are presented in binary oppositions, relying on internal homogeneity and external distinctiveness. These is no room for movement, exchange and de-territorialisation, as observed by the authors mentioned above. This view can be criticised for depicting cultures as static, and as following a clearly demarcated path of development which has already been cleared by 'Western' civilisation. In addition, this standpoint completely ignores the fact that many cultural industries exported from the West result from contact with non-Western cultures, and are therefore of mixed origins themselves (Pieterse, 1993,

[1] Edward Said (1978) has called this self-definition of Europe in particular by contrasting European identity and nature against Near and Far Eastern as 'Orientalism'.

p. 8). Thus, this point of view is limited and dull for two reasons. First, because it fails to account for the richness and creativity inherent to global cultural flows. Second, it does not accommodate complex questions like the relationships between the local and the global, and between time and space (Cappeliez, 2001, p. 3).

The changing role of the local

The opening up of new markets and the elimination of barriers to trade allow for new rounds of accumulation. Cultural trends circulated by global media and telecommunications leap borders from metropolis to metropolis regardless of moral objections of local elites. In the process of globalisation, it is argued that specific localities are linked together more closely than ever before. Local happenings are shaped by distant events and decisions in a 'lateral extension of social contexts across time and space' (Giddens, 1990, p. 64). It is not simply that places are linked into larger and larger networks, but that something of one place is extended into another. By forcing agents to make explicit decisions about which elements of the local economy and culture will be maintained and what aspects of global amenities and values will be adopted, this process implies reflexivity and 'localisation' as much as globalisation.

Attempts theoretically to distinguish 'places' from the flows between places (Castells, 1996) have foundered in practice despite being useful models for specific sectors. (Consider the geography of concrete production and distribution, which has clear sites of production and placement and distances of travel between them.) The local becomes less a matter of bounded, material place and close physical proximity (Appadurai, 1996). In terms of economy and communication, places themselves are extended to link up so intimately with other places that they seem to include other flows from distant parts. They take on a variable scale, become 'over-dimensionally' extended. They blur into each other as jurisdictions and scales of regulation and intervention. The specificity of place as a node in the global network thus depends on the practical context for which a local area is being difined. The size of 'the local' is elastic – the demarcation between local and region, for example, which varies depending on whether one is dealing with a transportation strategy or a bird nesting area.

The nature of social, ecological and economic problems requires coordinated responses across jurisdictions. The obvious examples are pollution, global warming and risks of fallout from nuclear accidents such as

Chernobyl. Environmental problems pay no heed to natural boundaries, and shifts in, for example, an ocean current may affect entire hemispheres. Responses involve the built environment, including changes in building method to achieve higher levels of energy efficiency, overall attention to sustainability of urban development, and policies directly affecting the operation and economics of buildings, such as taxes on fuels for heating and cooling. Hence the observation that the global scale of environmental, economic and cultural processes represents a challenge to which nation states have had to adapt.

Virtually globalised but actually . . . ?

In such an inclusive form, globalisation becomes more than an hypothesis. It is a general rubric, an attempt to name the present, which emphasises not only homogenising global forces, but also localising forces and emergent hybrids (Pieterse, 1993). Globalisation is abstract, understood as something neither tangible nor concrete but which nonetheless has material impacts. It is a piece of cognitive shorthand, a 'virtual' simulation of the complexity of the planet, approached via an abstract concept (Shields, 2002). The theoretical literature quickly becomes mired in the abstract, but when it is applied, it tends to make the virtual into a self-fulfilling prophecy. The 'virtual' is real but intangible or not 'actually-so' including things such as 'the spirit' of the law, memories and dreams. These are 'essences' and can be mistaken for concrete experiences. Notions of locality are also warped as they are entangled with the far-off and absent. And, like the global, when the local is treated as a totality, as a miniature world and context of action, it too is transformed from a concrete milieu into a virtual category fronted by an abstract concept – a simulation of the messiness and complexity of a given context.

The importance of understanding the virtuality of these concepts – these simulacra – can be summarised as follows:

- First, it pinpoints why the terms are so useful as simplified, shorthand expressions for complex phenomena.
- Second, it directs our attention to the tendency to uncritically actualise our conception of 'globalisation' in a naïve manner which often fails in practice.
- Third, it directs attention back to concrete risks, while allowing actors to take advantage of specific opportunities.

Bauman has popularized the term 'glocalisation', a play on words which highlights the importance of the local as the cradle of all concrete processes. Globalisation is a 'wisp of nothingness'; it is not a place separate from the local (Bauman, 2000). Rather than a dialectic of local versus global, the process must be understood materially. It is a local empirical change in behaviours such as risk-taking, of evaluation criteria in decision making, of patterns of circulation and dissemination of products, and of specific approaches, designs or processes which take account of distant conditions, orders, opportunities and tastes.

In effect, globalisation involves a process of shifting terms of reference. Through stressful adaptation, and much public debate, people expand their cognitive maps of the circle of factors relevant to day-to-day business. The social 'spatialisation' of the world as a far-flung environment of relevant and irrelevant places and events must be revised (Shields, 1991).

Narrow notions of place are redrawn and 're-placed'. The posts demarcating the edge of the local and the beginning of 'the foreign' are moved outward so that geographical areas or spheres of different localities overlap.

Hybrids

If the aspects of local and global, the near and far in globalised places are blended and entangled then the local becomes less a matter of a bounded, limited site, and more a network or area mapped out on the basis of relevance to the purposes at hand. For example, the fixed quality of localities is challenged by the extended networks of diasporic communities of immigrants. For those who travel and those in exile, locality is no longer necessarily proximate neighbourhoods but transnational networks of family, alimentary and discursive exchange. This 'glocalisation' is carried along by a variety of means: specialty video rental stores, satellite telecommunications firms, 'ethnic' grocers, not to mention the international scope of the construction and operation of most urban transportation projects. No longer is the local a sign of withdrawal from the global but an essential node concretising a rhizomatic network. In this, the global is only an abstract concept. Imported commodities, practices, tastes and beliefs are never 'global' but of some other *place*, a context they signal and symbolise virtually. At the same time they are, even if only slightly, now materially of 'this' place – the improvised settings, jury-rigged utensils, and alien machines which make up the surroundings in which they are now practised.

The mapping of the boundaries of place, locality or context involves the adjudication of relevance. Although architecture and planning continue to rely on administrative districts to establish regions and property lines to bound sites, practitioners are aware of the challenges to these conventional notions of 'context'. This is a matter of the purposes at hand and a matter of political debate. Thus context and context-dependency are much more strongly marked as outcomes: they cease to be a fixed and traditional range of factors which are merely 'natural'.[2] What climatic and topographic factors should be given priority? What eras of history are the most significant references for a design or for preservation? Winning project proposals are built by framing architectural and engineering solutions within a *problématique*, a hierarchical statement of relative priority of various problems and issues which a project must negotiate. Advocates of sustainability have thus found it difficult to persuade others of the need for a climatically context-dependent built environment despite the 'obviousness' and efficient performance of these design solutions. This is because buildings are also cultural gestures, solutions to a far wider range of factors and 'moves' in ongoing cultural games and debates.

The parochial quality of place thus begins to dissolve into the geographically extended networks which make up the globalised locality. However, this may contribute to the erosion of strong, place-based standpoints, identities and points of view which are an important reference point when it comes to thinking critically about globalising trends. It creates a world of hybrids, of *partial adaptations*. If it is difficult to identify the qualities of the 'local' and hold it up against the 'foreign' as an antidote to a feared globalisation (the early 1980s approach described above), it is because the foreign is also transformed into a 'naturalised' or '*creolised*' element of the local.[3] Ethnographers almost unanimously see

[2] Nor is 'Nature' a pure and authentic referent. It is heavily shaped by human action such as in the phenomenon of global warming. As a realm of the pre-social it no longer exists. Historical studies of the conduct of scientific research reveal the constructedness of Euro-American notions of 'nature'. This phenomenon and the results from social studies of science suggest that a shift toward an unexpected 'harmony' between society and nature is taking place in the approaches and underlying preconceptions in the development of advanced technologies and risk management approaches. The two blur together into a nature–social singularity, no longer a dialectic nor a hierarchy but a complex coupling where everything is in the details, not in totalities such as 'nature' or 'society'. Ironically, we might have 'harmony' between society and nature to the extent that the two blur together.

[3] 'Post-colonial theorists' (Hall, 1996; Bhabha, 1992; Cavell, 1995; Gilroy, 2001; King, 2000) have appropriated the Caribbean heritage of Creole slaves born in the New World (often with mixed Euro-African parentage) who created a new, hybrid culture. Fittingly, the *Oxford English Dictionary* derives 'Creole' from the Spanish *criollo* 'native to the locality' or country. It is believed to be a colonial corruption of *criadillo* (diminutive of *criado*, past par-

culture as in-contact rather than as islands; not as place-bound but at the heart of global flows. Notions of purity and authenticity have been widely challenged and discarded in anthropology despite their continued popularity in racist rhetoric and structural functionalism. Nonetheless, people will continue to speak from the basis of the new locality, the hybrid will be naturalised, creolized and celebrated in due course as indigenous. And each place and each culture will enshrine and celebrate its own unique history and path of development.

Architecture and globalisation

From the nineteenth century, architecture has played a strong role in globalisation. In the twentieth century, architects prescribed standardised models of urban development and housing, under the auspices of the Congrès Internationalaux d'Architecture Moderne (CIAM). European colonies, such as Algeria, provided architects such as Le Corbusier with a canvas on which to draw up plans for Westernised civic life they had not had the power to impose on European cities (Rabinow, 1989). At the same time, architects such as Le Corbusier also adapted industrialised building materials and technologies, such as the concrete slab, to local climatic and cultural conditions. The emergence of an 'international style' based on standardisation, the technology of the curtain wall, steel and concrete technologies and post and slab systems, as well as the convergence of planning approaches to cities, suggests that architecture might figure highly in surveys of one-way globalisation.

However, at the close of the twentieth century, many architectural theorists espoused a distinct disdain from the functionalist orthodoxies and forms of the international style, taking more licence to experiment formally, on the one hand, and to engage with a critical regionalism and local histories, on the other. Rather than nostalgia, critical regionalism would 'mediate the impact of universal civilization with elements derived indirectly from the peculiarities of a particular place' (Frampton, 1983, p. 21). This included intangibles and virtualities such as 'the range and quality of the local light, or in a tectonic derived from a peculiar structural mode,

ticiple of *criar*, to breed) 'bred, brought up, reared, domesticated', and from the Latin *creare*, to create. According to some eighteenth century writers, the term Creole was originally applied by Blacks to their own children born in the Americas as distinguished from Blacks freshly imported – kidnapped – from Africa. The postcolonial critics' sense challenges the tendency to refer to Creole as 'descendants of European settlers born and naturalised in those colonies or regions and more or less modified in type by the climate and surroundings' and thereby erase the interbreeding with and contribution by African slaves in the Caribbean.

or in the topography of a given site' (Frampton, 1983, p. 22). However, there is an important caveat for regional architecture: it

> 'cannot be simply based on the autochthonous forms of a specific region alone . . . [It] has to "deconstruct" the overall spectrum of world culture which it inevitably inherits [and] . . . it has to achieve, through synthetic contradiction, a manifest critique of universal civilization.'
>
> Frampton, 1983, p. 22

The problem is that the 'autochthonous', the authentic and natural is not such a simple matter. Rather it is derived from often forgotten historical exchanges. Who would today understand that the North American suburban bungalow is indebted not only to the long horizontal lines of Frank Lloyd Wright's 'Prairie Houses' (and to North American wood stud and brick veneer construction techniques), but also to the teak house forms of South East Asia and the South Asian bungalow (King, 1984)? Over the long run, cultures and localities participate in systems of exchange with other localities.

The end result of Frampton's critical regionalism is precisely a range of hybrids, although admittedly not all critical ones. However, all of these hybrids might be characterised as facing both the global (or 'universal') and the local. Such a liminal or threshold quality betwixt and between the two scales is not a long-term status. Eventually, these hybrids become naturalised (creolised, if you will). They are understood as part of a continuum of the local itself. This is essential if 'the local' is not to be reified as an unchanging nostalgic identity, an untouchable 'autochthonous' form. Despite decades of the International Style, Western capitalist property regimes and the dominance of the automobile, and standard mass transportation technologies, the greatest similarity of major global cities is found in the predominance of the high-rise office building. Cities nonetheless retain unique characteristics which distinguish them. These distinctions are socio-cultural as much as they are climatic or environmental. Despite the important call for heightening our critical awareness, critical regionalists in architecture neglect the social. Frampton (for example) overshoots the social. He counts too much on an even more ideological, culturally unstable and difficult to reproduce *metaphysics* of place requiring concrete boundaries that isolate one locality from another to create 'a domain for an architecture of resistance and a basis of real community' (cf. Heidegger, 1968; Frampton, 1983, p. 25). As a result, a generation of architectural writers were sidelined in debates over globalisation and the geopolitics of built environments. These writers do not figure in the literature.[4]

Globalised buildings

Where traditions and forms do not accommodate new uses and activities, new forms are created or adopted. Thus it is that specific built forms characterise the emergence of new circuits of global mobility, transportation and communications. These facilities service the very processes of globalisation which have been so heavily critiqued, including transportation and travel, telecommunications, tourism and international spectacle. Other such facilities are types of infrastructure which support contemporary standards of health, density and service delivery such as roads, urban mass transit systems, sewer and electrical systems, not to mention telecommunication cables. The relevance of these facilities to the question of sustainable architecture is that they often include the most environmentally damaging projects and those that draw upon international expertise in terms of design services, engineering technologies, materials and project management.

Angé (1995) has commented that many of these projects amount to 'non-place spaces': total environments dominated by a devotion to mobility and movement, to the exclusion of any sense of fixity, place or local identity. While he originally wrote about the Paris Metro, such spaces are even more strongly exemplified by airports and aircraft interiors, shopping malls, suburban and 'edge-city' box-stores, sports stadia, hotels, vacation condominia and spas, and even urban loft accommodation which has achieved a remarkable level of stereotype for both its re-use of industrial/commercial real estate and the image of its tenants. The range of scales runs from the pocket- and kiosk-sized environments through automated banking machines to warehousing complexes. These buildings and engineering projects are ahistorical and unconcerned with identity. Hence they provoke a crisis in understandings of the spatialisation of buildings, of the 'fit' between function and location, of built project and site.

[4] Nonetheless buildings and redevelopment projects figure highly as examples of globalisation and contemporary cultural change used by cultural theorists who provided the critical understanding which architects and theorists of the built environment were unable to provide. See, for example, Jameson's discussion of the Bonaventure Hotel in Los Angeles, or Soja's discussion of Los Angeles (Jameson, 1984; Soja, 2000).

Buchanan (1999) argues that globalised building forms offer a kind of anonymous space that cannot be owned, that cannot be invested in emotionally, but which is nevertheless able to make one feel modern, important, and even at home:

> 'Frequentation of non-places today provides an experience – without real historical precedent – of solitary individuality combined with non-human mediation (all it takes is a notice or a screen) . . . between the individual and the public authority.'
>
> Buchanan, 1999, p. 396

Communication devices stand in for human contact.

For critics, where 'the local' is present in globalised built environments, it is often in the frozen form of historical arts and traditions or as 'staged authenticity' carefully organised to give tourists an impression of colourful ritual without the inconvenience of leaving the artificial and controlled environment of the building. Local inhabitants are often delighted with the construction of globalised facilities not only as a mark of modernity but also as signs of the organisation and control of intrusive tourists and as a tangible improvement in communications, in leisure facilities and in public spaces. Nonetheless, local inhabitants are more often than not excluded on the basis of class, caste and consumer lifestyles while bearing the impact of these facilities on the local environment and on the availability of scarce land, services, and resources.

Branded spaces

Such environments are often *branded spaces.* Restaurant franchises, airport terminals and sports stadia all involve copyrighted designs. They are governed by explicitly extra-architectural and non-local rules of play or economic interaction, of security or of forms of sorting and processing. They are serially produced commodities. Although there are differences between, say, 'Australian rules' and Canadian football, at the heart of football stadiums the world over are similar sized and recognisable pitches, baseball diamonds and rinks. Yet the interaction between systems for regulating information and knowledge such as copyright and patent is rarely considered in relation to local environmental knowledge, globalised environmental standards (e.g. lighting levels) and politicised environmental struggles. We need to study more fully the interaction between systems and scales of information and knowledge which inform major projects.

Fig. 3.1 Beams supporting the roof at the Ulsan World Cup Stadium (Photo: Kevin West)

A simple example is the stadium built for the 2002 World Cup soccer championship in Ulsan, South Korea. World Cup soccer is a brand, and teams are franchises which sell their names as brands for endorsing other sports products. The stadium roof is carried on Japanese-designed Kevlar-reinforced beams (Fig. 3.1) and built by a consortium of a local contractor and a Korean global conglomerate, yet rubble infill and concrete is placed by hand. Slipper-clad workers with little safety protection carry cement and stone and are paid on an informal, daily basis (Fig. 3.2). Is this a 'high tech' building or not? If soccer is globalised, is it any less significant to local cultures the world over? The reaction of Western construction and project management researchers to such projects is that they have little to learn from, for example, construction in Korea. But what firms and researchers stand to learn is precisely how globally sourced products and practices are integrated with local traditions and conditions (Shields and West, 2000).

Buildings as interfaces

Like a sports stadium which will host a global game, welcome international teams and originate global television signals, many globalised built environments are *interfaces* from the local to the 'global society'. Globalised built environments display distanciated elsewhereness and cosmopolitanism of a social world beyond any fixed locality (Urry, 2000). These buildings relate different places, they are in-between, conduits,

Fig. 3.2 Ulsan Stadium: manual placement of concrete and rubble infill

liminal zones (Buchanan, 1999) which are designed to keep the local distinct from the global. Like previous forms of quarantine, globalised buildings are architectural and engineering strategies in the management of flows between scales. Branded spaces and other copyrighted intangibles are virtual aspects of built environments. In the case of 'globalised buildings', the virtual and the concrete are often fused together. Whether it is a matter of franchised chain stores, outlets for specific brands or a copyrighted retractable roof design, these projects can be understood as hybrids not only bridging scales but actualising the virtual (as in environments which attempt to express a brand identity) and virtualising the actual (turning the material form of a project into a sign signifying, for example, a brand or a place). Again this might be described as a form of liminality (described above), or transition, bifurcation. Thus these are not only environmentally significant but social symbolic 'crossroads' projects which are essential symbols of the direction that construction is headed in – toward or away from sustainability.

Generic design and infrastructure

Are these projects not an imposition of repetitive and manipulative environments – such as the pink and grey decor of chain restaurants tested to maximise familiarity and sales? Critical Regionalists limited their concerns to the expressive dimensions of individual architectural commissions. The generic and globalised does have its place:

> 'We have been taught to welcome the inhuman, to feel at home in its known estrangement. And as every overseas traveler knows, the famil-

> iarity of even so soul-less a generic space as an airport can be very comforting. Even though you may be in China and cannot speak or read Chinese, you can still negotiate your way around an apparently intricate and dense space like Shanghai's extremely busy international airport because its primary features are the same as every other airport you've been to . . . no matter how unfamiliar a place may be, if you simply follow an already all too familiar itinerary you will get through . . .'
>
> Buchanan, 1999, pp. 396–7

But the concept of hybridity pertains to infrastructure as well as buildings. Attempts to fit imported infrastructural systems (such as water purification or sewage treatment) into localities without the required support (availability of electricity, chemicals, not to mention expertise) and inputs have failed. Generic design is not only a matter of predictability but also a 'portal' to globalised and standardised components and systems. In addition, it is a way of meshing with mobile environments such as aircraft or container ships. Generic design (and the environments constructed from generic elements) is a form of 'switch' between different velocities of mobility, communication modes, networks and types of commodities. A continuum of branded, generic spaces can be identified which interface velocities of movement and transmission from the desktop operating systems of computers (which relate the electronic speed of the virtual to the sedentary) through to container ports and airport terminals (which translate the Mach speeds of air routes to the automobilised or light rail speeds of ground transportation).

Conclusion

Globalisation has come to be seen as a vehicle spawning the creation of hybrids, a shifting mass of reconfigurations, not as a wave of cultural imperialism (cf. Cappeliez, 2001, p. 6). In architectural terms, however, globalisation signals globalised generic and branded environments, which have been characterised as 'non-place spaces' populated by stereotyped and unreflexive conceptions of the users who frequent these facilities. Yet as a type of standardised infrastructure, generic design forms a portal for flows between localities, and offers the potential to deploy innovations from one place in another location or jurisdiction. Local identities are framed within a global context. The 'local' comes to be either what should be properly called a 'local hybrid' (for example, a building in a historical local style retrofitted with double-glazing for energy efficiency), or a preserved and 'heritagised' building, neighbourhood or culture which is often commodified for tourist consumption.

I have contrasted the virtual with the concrete in order to argue that globalised products and processes are only abstractly so. In reality, they are virtually foreign but taken up and integrated – naturalised – so that they can be concretely integrated into the material surroundings of a different locality. They lose their liminal status between here and elsewhere in a manner similar to the example of Creole cultures. A class of so-called 'globalised buildings' persists because they function as interfaces in flows between localities. For example, airport runways and baggage handling are standardised. Branded spaces offer the most non-local of any environments, proffering generic experiences which nonetheless remain associated with particular cultures and places – restaurant chains such as Planet Hollywood and sports stadia need to be understood as part of the flows between places.

While globalisation presents challenges to cultural understandings of the world as a space of distance and difference, people will continue to appropriate, creolise and celebrate local hybrids. They will demand opportunities to participate in flows of cultural and economic resources from and to other places, diverting and applying them to meet their own ambitions. No culture is an island. Both anti-globalisation protesters and national political debates have taken up these questions. There is no doubt that the most 'global' quality of globalisation is the widespread concern amongst populations and a search for knowledge and understanding. As often as not, national resources and efforts have been put into resisting a global homogenisation. However, although rhetoric champions the local, the results appear often to be hybrids, as I have argued above.

More research is therefore needed on the interaction between scales of knowledge and of action. Manufacturers need to understand the local contexts in which their products are taken up and the hybrids in which they must function rather than assuming standardised conditions. Regulators need to understand the implications of unregulated imports, and the impacts that exports will have in new settings. Managers and designers need to understand the implications that local cultural, biotic and economic jurisdictions have for the use and deployment of practices and products and the actualisation of virtual, intangible products and assets in concrete projects. Above all, we need to see globalisation as something broader than a process of Westernisation.

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4

Trading Places – Sharing Knowledge about Environmental Building Techniques

David M. Gann

The motivation for this chapter stems from the need to share knowledge about environmental building techniques between professionals from different cultures and across disciplines. This need has become a priority because of growing pressures to design buildings that perform in a sustainable manner and that are sensitive to the local context within which they are used. The chapter explores two dimensions of knowledge exchange: the *regional* dimension – how professionals from different cultures learn from one another; and the communities of *practice* dimension – how knowledge can be shared between professionals from different disciplines. It presents concepts that contribute to a framework for understanding knowledge exchange at a national, sectoral and firm level. The chapter explores how these might be used to analyse knowledge exchange in project-based environments. It concludes with the suggestion that built environment professionals should be well placed to exchange knowledge because they often work in teams in which they need to share technical knowledge in order to integrate systems. However, there are many structural impediments to realising this because of the nature of the organisational processes found in many construction projects and a weak understanding of whole-life value. This may well present significant barriers to exchange in situations of cross-cultural and interdisciplinary practice.

Introduction

Concerns about global climate change, its causes and effects, are increasing (Hadley Centre, 2002; Hulme *et al.*, 2002; IPCC, 2002; Tyndall, 2002;

UKCIP, 2002). As a result, there are growing pressures on professionals to design buildings that have a lower impact on the environment and that can withstand the possible longer term consequences of changing weather patterns.

The production and use of buildings and structures has historically been a local affair. Location and place have defined the nature of the product and its use. Building techniques have evolved through local know-how, the use of local materials and craft labour. Specialisation increased as markets expanded for particular knowledge about building techniques. Modern construction practices developed with codification of this knowledge, and the sector became highly regulated, with most regulations based upon governing regional practices – often interpreted in different ways at a local level. An international construction system emerged, involving trade in design, engineering and project management services and in materials and components (Drewer, 1990; Linder, 1994). This system overlaps, and works in tandem with regional and local craft practices (Gann, 2000). It is therefore not surprising that a variety of environmental techniques and approaches to sustainability have emerged in different locations, whilst there is also a growing interest in exploring how lessons from one region can be understood, contextualised and acted upon in another.

Human and physical geography is important for those involved in designing, making and managing buildings, in terms of settlement patterns, culture, climate and geology. But while place and context remain important, a number of factors are creating new requirements for international exchange of knowledge about how and what we build. These factors include the following:

- Globalisation of markets and production – particularly across OECD countries and in rapidly developing regions, such as China.
- Development and exploitation of technical opportunities – for example through the diffusion of information and communication technologies, increased access to international research and the emergence of new technologies (biotechnology for smart, green buildings, nanotechnology, etc.).
- Demographic, social and economic changes – including new migration patterns, an ageing population in OECD countries, competition for scarce resources, and issues of development in the poorest regions.

- Global environmental change – and the emergence of pan-national regulations and protocols for dealing with its impact and mitigation.

These forces for change are challenging traditional approaches to design and construction based on craft and precedent, and there is evidence that the validity and use of technical precedent is in decline (Groák, 1992). Groák argues that over the years, tried and tested building methods, which gave rise to a repertory of 'robust technologies', are now being pushed to the limits and beyond. They have become sensitive to errors of design, manufacture, assembly and use. The reason he gives is a breakdown in traditional feedback mechanisms. This relates closely to changes in training processes and difficulties in sharing knowledge because of the ways in which work processes are organised. The forces identified above are likely to increase the rate of change with a loss of robustness.

In order to respond to these factors, design organisations, construction firms and research institutions need to develop better approaches to the exchange of information and knowledge across cultures and regions.Issues concerning the environmental impact and performance of buildings have their own specific requirements, because this area is likely to be subject to increasing international, regional and local regulation in future.

This chapter contends that improving the cross-cultural exchange of knowledge is no easy matter. It makes recommendations for systematic research on some of the impediments and concludes with a defence of variety and pluralistic outcomes. The chapter is organised in five sections. The first sets out the terms of reference, scope and definitions. The second focuses on exchange of knowledge in project-based environments. Section three presents a case study of engineering design in which different cross-cultural sources of knowledge were used to resolve unexpected problems. This is followed by a discussion of general concepts of knowledge management and exchange, citing ideas from the innovation literature. The chapter concludes with a summary of the main argument and key factors concerning cross-cultural knowledge exchange.

Terms of reference and definitions

Two matters need to be clarified before exploring the exchange of knowledge in relation to environmental building information: first, the difference between the concepts of knowledge and information; and second, the definition of sustainability and the environment. In addition, the term *exchange* is preferred to that of *transfer* because it implies the possibility of mutual learning processes rather than a one-way flow.

Knowledge and information

A central question in this book is the appropriate transfer and application of information. It is necessary to distinguish between the transfer of information and exchange of knowledge. The terms are not simply interchangeable. For example, knowledge entails capabilities such as judgement, interpretation and understanding. It involves categorisation, synthesis and evaluation in order to make decisions about actions. Knowledge, therefore, brings with it the capacity to act and react within particular parameters. It involves the use of information for particular purposes. There are obviously links between these concepts and the development and use of information and communication technologies (ICT) to support information and knowledge processes. However, issues concerning the use of technologies in this way are beyond the scope of this chapter. Whilst the capabilities of today's information systems are astonishing for searching, retrieving, switching, distributing and storing data, they cannot provide the deeper levels of understanding needed to act. Even with the most sophisticated processing capabilities, warehouses of information cannot guarantee that the users of that information can deploy and analyse it effectively and employ it for specific reasons.

Knowledge is typically accumulated through education and experience. There are management routines and techniques that can help to share what people know – knowledge management has become a fashionable buzzword. There is a burgeoning literature on this, dealing with issues at the level of the firm, across disciplines and sectors (e.g. Leonard-Barton, 1995; Nonaka and Takeuchi, 1995; Fruin, 1997; Pfeffer and Sutton, 1999; Nonaka and Teece, 2001).

Knowledge is context specific. A distinguishing feature is whether it can be communicated and written down – *explicit* knowledge – or whether it is difficult to pass on to others. This second type, *tacit* knowledge, is often the most crucial, because it is acquired through practice and it can form a distinctive advantage for individuals and organisations, leading to variety of approach and outcome. This 'sticky' tacit knowledge cannot easily be picked up and imitated by rivals. Neither can it be easily transferred or exchanged. By contrast, documented knowledge can more often be assimilated, distributed, copied and used. To be transferred, tacit knowledge requires person-to-person contact and individual learning and experience. It is not just a matter of 'copy and paste'.

Another important aspect of the concept of knowledge is that it needs a *knower*. While some forms of knowledge can be made explicit and stored, it is how it is applied in practice that often matters. Knowing how to do something is subtly different to having the knowledge available somewhere. Knowledge that is not used can become outdated. Knowledge is, therefore, often most useful in the context of *actions*: practices, processes, routines and initiatives. In commercial environments, too much attention is often paid to the passive storage, possession and protection of knowledge, when the best protection is often the barrier of learning needed to acquire it.

Sustainability and the environment

The second set of terms that require definition are *sustainability* and the *environment*. A review of the literature in this area shows that there are many different ways of defining these terms, particularly in the context of development. This was already apparent as long ago as 1989 (cf. the 'gallery of definitions' of sustainable development put forward by Pearce, *et al.*, 1989). The concepts are heavily contested by academics working in environmental policy, political science, economics, international relations and development studies. Six core themes emerge from the literature: *environment–economy integration*; *futurity*; *environmental protection*; *equity*; *quality of life*; and *participation* (Jacobs, 1999). The sustainability label therefore applies in different ways to both the natural and social worlds, depending upon the context and questions addressed. Whilst definitions are not universally shared, Jacobs's six core themes provide a useful set of over-arching terms of reference. National governments, firms, and non-governmental organisations have developed their own definitions around these as they seek to put environmental and sustainability policies into practice. The fact that approaches differ proves the point about regional difference and the challenge of cross-cultural knowledge exchange.

One important area of debate focuses on technology and its role in development and underdevelopment. Technology can be defined as 'know-how', including human skills, capabilities and interface with hardware. It can be transferred as such, raising questions about *technology transfer* and *appropriateness* (Stewart, 1977). Moreover, rapid advances in generic technologies have been shown to be central to transformations in local and global markets (Freeman and Soete, 1997). The most important current example of this is the way in which ICT is affecting patterns of economic growth and social change in OECD countries, transitional economies and developing countries. Research shows great differences in the potential benefits and risks to societies, organisations and individuals, associated with the development and adoption of these technologies (Mansell and Wehn, 1998). This sometimes causes and often exacerbates uneven development and, in consequence, has become a major focal point for policy makers in organisations such as the United Nations.

These examples illustrate some of the potential problems and pitfalls in examining the issue of cross-cultural knowledge transfer, where sustainable development and the environment are concerned. As with most definitions, the reference point depends upon what problem is being tackled, why it is being addressed, who thinks it is important, and how it might be resolved.

Exchanging knowledge in project-based environments

The design, engineering, construction and refurbishment of buildings usually takes place in a project-based environment. The structure and use of knowledge in projects has particular qualities that make knowledge exchange different from that found in other modes of production. There are two main issues: first, in terms of the nature of knowledge used and developed in project-based activities; and second, the flow of knowledge between project teams and project-based firms (Gann and Salter, 1998; Gann and Salter, 2000; Salter and Gann, 2003).

Construction projects usually involve a particular approach to technical development and problem solving, in which participants are often involved in integrating and optimising systems made from many component parts. To do this, they use information from many different disciplines and sectors, searching for solutions that represent the best fit within particular constraints of cost, time and quality. Designers, engineers and project managers usually carry out these searches on the job through project processes. Groák and Krimgold (1989) referred to this combined role of action and research as that of the *practitioner-researcher*. Integrating environmental building systems requires people to work in networks with other professionals, cutting across different disciplines and communities of practice. Thus, project team working can promote the exchange of knowledge. Figure 4.1 illustrates some of the core networks and allegiances held by a project team member. It shows that the com-

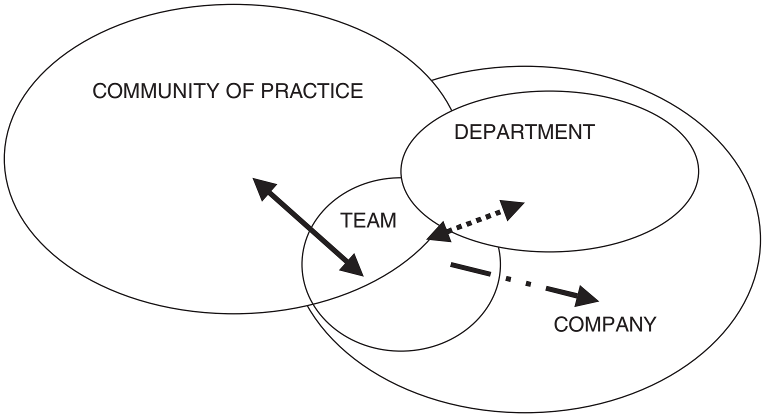

Fig. 4.1 Knowledge exchange in project-based environments (Source: Sapsed *et al.*, 2003)

munities of practice may represent stronger linkages for sharing and exchanging knowledge than internal departmental or company-wide networks.

Managing and exchanging knowledge is particularly difficult in project-based firms that are typical in industries like construction. There is a problem in project-to-project (P2P) knowledge transfer, as well as project-to-business (P2B) transfer.[1] P2P problems are caused by the discontinuities between projects and the teams that work on them. Any new knowledge that is created through the course of construction on a specific site or designing a specific building may be simply lost or forgotten when the contract is completed and the team dispersed. There is rarely the time or space to ensure that the lessons of a project are genuinely learned by the organisation at large. Scheduling and business pressures often dictate that people are immediately redeployed on fresh projects and are quickly engrossed in new problems. The different flows of knowledge in a project-based environment are shown in Table 4.1.

The P2B problem involves the distance between the projects and the central organisation of the firm. This distance may not be solely geographic. It may also be to do with culture and identity. *Ad hoc* organisations that are put together for projects have a different purpose and atmosphere to the firm's central headquarters and services. A typical

[1] The terms P2P and P2B emanate from work on the nature of project-based firms by Gann and Salter, and were coined by Salter and Sapsed during work on a construction knowledge management research assignment.

Table 4.1 Knowledge exchange in a project-based environment

- **Project-to-Project (P2B)**
  passing experience and ideas from one project to another
- **Project-to-Business (P2P)**
  movement of experience from project teams to the central business function
- **Business-to-Project (B2P)**
  dissemination and development of new skills and competencies in central departments to project teams

Source: Sapsed *et al.* (2003)

effect of project-based organisations may be a stronger affinity with other project partners than with the project team's own business. Communities of practice may arise in the project, despite cross-functional or even cross-business differences.

It is often the case that, in the world of projects, teamworking within and between projects and departments is not easily achieved. The traditional idea of teambuilding through cohesiveness and 'team spirit' is insufficient to deal with the differences in what people know. While there are certainly benefits of cross-functional diversity, attention is required to cope with the lack of understanding between people from different functions or business areas. Such diverse teams need to create and establish 'boundary spanning objects' that recognise the distinctions, but achieve agreement that is intercommunal. Examples of such tools can be project architectures or work breakdown structures. The key task is managing interfaces between people in different communities efficiently, rather than trying to impose uniformity. Such analysis leads down several avenues that require further exploration in understanding cross-cultural knowledge exchange. These relate to knowledge and boundaries of the firm (Brusoni *et al.*, 2001), and problems in the development of organisational memory in project-based firms.[2]

Analysis of knowledge exchange

There are several general concepts that together provide a framework for understanding knowledge exchange and technology transfer. On the regional dimension, these include national systems of innovation and networks of innovators; on the communities of practice dimension, they

[2] The issues of organisational memory emanate from work done by E. Cacciatori in her Doctoral thesis at SPRU, University of Sussex.

include absorptive capacity. These concepts (discussed below) are drawn from the innovation literature and can be applied to the question of cross-cultural exchange.

The built environment forms a platform for particular culturally determined activities. Its social meaning and relevance are multi-layered because of the different functions that buildings enable and support. It therefore has a particular symbolic quality that depends to some extent on place and region. The cultural dimension relates to the type of economy and varieties of social and institutional structures, for example, found in different forms of capitalism (Trompenaars and Hampden-Turner, 1997; Hall and Soskice, 2001).

National systems of innovation

Descriptive and analytical work on *national systems of innovation* provides a useful reference point because it relates issues of learning and knowledge creation with technical and economic development in the context of particular socio-cultural and governance structures (Lundvall, 1992; Patel and Pavitt, 1994; Freeman, 1995). The concept provides a framework for discussing some of the reasons why different countries and regions are able to develop at varying rates, or tackle problems in different ways. For example, the structure of national and regional institutional arrangements makes a difference in how organisations develop, become aware of, adopt or act upon new ideas. Such institutional arrangements might include the education system, the role of development agencies, or government support for R&D, as well as for regulatory processes.

Networks of innovators and communities of practice

The concept of *networks of innovators* refers to how intellectual communities are connected through social and information networks (DeBresson and Walker, 1991; Freeman, 1991; Bessant, 1995). It explains the ways in which communities emerge, coalesce and develop, focusing on specific areas of knowledge, research themes and problems to exploit opportunities to innovate. This may involve relationships between suppliers and users, or research institutes and businesses.

The concept of *communities of practice* is slightly different from the network systems approach. It is helpful in describing ways in which knowledge flows within and between different networks and groups of practitioners (Wenger, 1998; Brown and Duguid, 2000; Wenger and Snyder, 2000). This can shed light on particular aspects of cross-cultural knowledge transfer, whether within a single organisation which has different operating divisions and areas, or between groups of players working across national boundaries. Practitioners often ask why it is that there are areas of good practice in their organisations, yet they cannot seem to diffuse this throughout other departments. The answer is often that the nature of knowledge is tacit, and therefore not easily transferred to those who do not share the same understanding.

In recent years, the term *communities of practice* has been used to describe groups of people who share much of the same understanding of knowing how to achieve particular goals. These communities can arise from the shared experience of working on a project, a particular line of business, within disciplines, or in tackling particular problems. The worlds of academe and of professional practice (such as law, accountancy, medicine or architecture) provide many examples of how disciplines operate as communities of practice (Becher, 1989, 1999). They also demonstrate the difficulties of transferring knowledge between professions.

Communities of practice can spread across a sector as like-minded practitioners meet and exchange experience through associations, institutions, conferences, newsletters, and online message boards and websites. This may occur through informal networks which bypass formal structures within and between organisations (Cross and Prusak, 2002). Some of these can be based on technical or functional disciplines, which reflects the shared education and training that those people have in common. If an organisation is structured on functions and disciplines, there is sometimes an effect that best practice is transferred more easily outside of the company than into its own departments. This is because knowledge is more difficult to transfer *across* different functional communities of practice, hence 'sticky' knowledge, whereas it can transfer more easily *within* communities, which may mean knowledge 'leaking' outside the firm or institution.

Nevertheless, the nature of knowledge within a community of practice can and should be a contested issue. It is possible for two built environment professionals from the same discipline to articulate completely different professional judgements about the sustainability of, for example, the redevelopment of an inner-city housing scheme. People within similar communities can also disagree because they have different perspectives, values and interests. Such differences may be greater when issues are dealt with by professionals working across national cultures. In some cases this may exacerbate decision making processes; in others, it may introduce new ideas that offer innovative ways of solving problems.

Research and absorptive capacity

The third set of concepts help to articulate the role of research and related activities of design, engineering and technical support, within organisations, in terms of their capacity to learn. Cohen and Levinthal argue that R&D has two faces: one side is the development of new ideas for innovation and problem solving; the other is the capability that allows organisations to absorb ideas from elsewhere – *absorptive capacity* (Cohen and Levinthal, 1990). Investment in research can, therefore, be beneficial, even if it does not result in directly exploitable outcomes, because it also maintains and builds capabilities that allow an organisation to engage in debates and adopt new ideas. This point seems particularly important in coming to terms with the perceived need to transfer knowledge about environmental building methods – those organisations that invest in research on the subject are more likely to be able to understand and use lessons from other cultural contexts.

There are debates in industrial economics as to whether firms should carry out their own research or subcontract out to third-party providers. For example, a transaction costs approach sometimes suggests that it is more cost efficient to buy in research services, rather than set up internal systems. Mowery's pioneering work on intra-firm location of research functions in American manufacturing firms in the late nineteenth and early twentieth centuries shows that in-house and independent research laboratories complemented each other (Mowery, 1983). More recent studies in the pharmaceutical sector show that there is often no substitute for R&D that is carried out internally, because the process of participating in research helps to build the knowledge about what R&D to do in the future (Gambardella, 1992). This principle can be applied to many types of research and knowledge exchange, particularly where the level of technical content is high. In the context of knowledge about environmental building methods, it implies that firms which carry out their own research are more likely to have the capabilities to define new issues to explore and exploit.

Discussion

The framework presented in the previous section provides a means to assess the possibilities and limits to cross-cultural knowledge exchange between built environment professionals.

The example of design of the London Millennium Bridge (Fig. 4.2) illustrates how these concepts might be used to understand issues in the cross-cultural transfer of knowledge. This was to be the first footbridge across the river Thames to be built for more than 100 years, linking the Tate Gallery and St Paul's Cathedral. Whilst the project was not explicitly about the practice of environmental building techniques, it embodied some of the principles of sustainable development – it is a car-free bridge, creating little pollution in use, and its slim design implies reduced embodied energy and pollution.

The bridge design was awarded through a competition aimed at producing an innovative, modern approach. The winning team involved collaboration between Arup engineers, Foster and Partners architects and the sculptor, Sir Anthony Caro – the team spanned at least three different communities of practice. Working together, they created a minimal design to give pedestrians a view of London, free of traffic and high above the river. The bridge spans 325 metres and is an innovative, complex structure, only 4 metres wide, with an aluminium deck flanked by stainless steel balustrades, supported by cables to each side so as to not infringe

Fig. 4.2 Millennium Bridge, London (Photo: Arup / Thomas Graham)

upon important, protected views within the city. The bridge span to depth ratio is 63 : 1, around 6 times shallower than a conventional suspension bridge.

The design team used modern design technologies in order to achieve this. They drew upon lessons from the design of other bridges from around the world, and they built sophisticated computer simulations to test the design.

The result was heralded as a beautiful architectural/engineering and sculptural contribution to London. The bridge opened on 10 June 2000, when between 80 000 and 100 000 people walked across it. However, when large groups of people were crossing, greater than expected sideways movements occurred. A decision was taken to close the bridge only two days after its opening in order to investigate the problem fully and take remedial action. This led to embarrassment for the design team and incurred costs for their company. Their reputations were at stake and they were castigated in the press and media for not checking for the 'footfall amplification problem', which occurs when groups of people walk across bridges.

But the engineers had tested for these potential problems and were puzzled as to why the bridge had moved. Arup communicated the problem to their worldwide network of design offices, using the Internet. A cross-cultural search was undertaken for a diagnosis and solution to rectify the problems. Arup needed the flexibility to find an answer as quickly as possible, with the focus and expertise to test, measure and analyse the problem. Three research units were set up and worked together simultaneously. The first was brought to London from offices around the world and was instructed to test the bridge and discover where the problems lay with the original computer model (they found no problems with the model). The second group was selected from external organisations judged to have the best expertise to assist in diagnosis and problem solving in bridge design. The external team played an important part in finding the solution, working in tandem with the Arup teams. University research groups from Cambridge, Sheffield, Imperial College and Southampton were commissioned to run tests on crowd behaviour patterns on bridges. The third team worked on the design of new dampers to be installed to absorb shock and reduce lateral movement. Young engineers were encouraged to think laterally about the problem, and the team came up with a potential solution two months after their exploration began.

During this process, Arup's Japanese office found a paper which described qualitatively the phenomenon that occurred on the bridge. The paper had been published in a seismic engineering journal not widely read by practising bridge engineers, published in Japanese on the 'lateral excitation of bridges'. The paper showed the mathematical principles concerning the emergent properties exhibited by the bridge. Other searches found similar problems on bridges of a very different structure such as a heavy road bridge in Auckland, New Zealand, which moved in exactly the same way when crossed by a large crowd in 1975.

One of the main lessons from the experience was that the existing engineering knowledge from Japan had not been accessed by the original UK design team. Recognising the need to inform the bridge engineering profession of this previously unquantified phenomenon, Arup set up a website to communicate the results of their investigation, placing their findings in the public domain for others to use.

This case illustrates the important process of learning by failure ('to engineer is to be human' (Petroski, 1985)) and how a construction consultancy can benefit by developing an innovative response through exchanging knowledge between different communities of practice. It also illustrates how the organisation's dynamic capability (discussed more fully in the conclusions) is used and maintained.

Future analysis of knowledge exchange might begin with an understanding of the backgrounds, histories and approaches to professional development found in different countries. Research to analyse national systems of development through education and professional practice would indicate similarities and gaps in knowledge. The form of professional education and the extent to which it leads to specialised or interdisciplinary thinking has important consequences in the development of capabilities to communicate and share knowledge (Gann and Salter, 1999). In many countries, knowledge exchange is moderated by the presence of institutional frameworks in the form of learned societies and professional associations, which assist communication within and between different communities of practice.

At another level, analysis of particular design and engineering practices in different cultures might reveal the extent to which networks and communities of practice have formed and are active in knowledge exchange. Practitioners need a rigorous understanding, grounded in a particular discipline, if they are to be able to access and absorb the results of new research on environmental building techniques. However, they need more than this. They also require a work environment in which there is a critical mass of like-minded, qualified practitioners capable of accessing findings from research and interacting with those in other communities of practice (Gann, 2001). This environment needs to be structured and resourced in such a way that encourages new ideas to be tried and tested. One might expect that firms and organisations that exhibit dynamic capabilities are better at both generating new knowledge and absorbing ideas from elsewhere. These firms are likely to be acquisitive in terms of their search for new knowledge, and they may scan global networks in order to gain access to new ideas.

With regard to the specific issues of knowledge about environmental building techniques, one might expect to observe different practices in different regions. These practices might be classified in terms of approaches taken in the context of particular climate, geology and social and economic conditions. There are many unknowns in this area of research and practice, and it is unlikely that the notion of single 'best practice' knowledge transfer is relevant. Under these conditions, differences in approach and outcome are essential, and a healthy tension between approaches may give rise to the kind of creative abrasion that leads to new ideas.

The project-based nature of work in the design and production of the built environment makes it necessary for professionals to work in teams and act as systems integrators, sharing knowledge with other team members. They should therefore be well placed to share and exchange knowledge with other professionals. However, there are many structural impediments to realising this, because of the nature of the specific organisational processes found in many construction projects. There are often few incentives and many obstacles to knowledge exchange, particularly in adversarial processes, although some work environments – such as those based on alliances and partnering – may be more suited to knowledge sharing (Barlow *et al.*, 1998).

A number of research questions develop from the ideas presented here. In particular, it may be of interest to explore how designers and engineers learn through working on projects and what skills they have developed for problem solving in areas associated with environmental building techniques in different regions.

Conclusions

This chapter has argued that it is not possible to identify commonly agreed definitions, let alone strive for commonly defined actions and solutions relating to sustainability in the built environment. However, plurality is important because it stimulates discussion, innovation and exchange as well as providing for specific contextual circumstances. There are different definitions of and approaches to environmental building techniques. The common issue is the need to tackle social and environmental sustainability whilst encouraging economic activity. This integration implies developing new ideas to help people to make and implement decisions. Wider participation in decision making, involving those who will live in and use the built environment, is one commonly agreed feature of response around the world. All of this, in turn, implies that more knowledge exchange will occur at a number of different levels (project, organisation and communities of practice) and scales (local, regional and international).

This must be achieved within regulatory regimes, using available skills and capabilities created by particular national systems. Moreover, knowledge exchange has to be realised in a project-based environment where there are many discontinuities in information flows between projects and professional groups, and within and between organisations. More systematic research is needed about how project-based organisations develop and use knowledge and, in particular, how they acquire, capture, assimilate and act upon ideas from outside their normal mode of operations. This is likely to raise further questions about the education and capabilities of individuals within local and regional communities of practice to acquire, filter, test and adapt 'foreign' information and technologies.

Much can be learnt from exploring ideas and approaches found in different cultures. To do this, organisations need their own technical capabilities in order to understand knowledge developed elsewhere: *absorptive capacity*. But they require more than this if they are to keep abreast of changes in environmental building techniques. They will need the capacity to act upon new knowledge, changing technical, organisational and managerial practices: *dynamic capabilities*. This concept was developed to explain the methods by which firms and organisations create and capture new ideas and use these to their strategic advantage in environments of rapid technological change (Teece and Pisano, 1994; Teece *et al.*, 1998).

The capacity to adapt to new knowledge is shaped by firms' assets, resources and routines. However, such assets and routines can lead to path dependency and lock-in, particularly where conditions of increasing returns exist. Dorothy Leonard explains this in terms of core capabilities and core rigidities (Leonard-Barton, 1995). She argues that firms can become locked in to outmoded practices when external conditions change. What were once core capabilities (for example, the ability to design complex variable air velocity air-conditioning systems) become core rigidities, because demand has changed towards buildings with passive ventilation to meet growing concerns about environmental impact. The challenge for those involved in environmental building techniques is to maintain the capability to acquire, assimilate and apply new knowledge without creating such rigidities.

There are increasing pressures driving the need for cross-cultural exchanges of building and design knowledge. These are not solely based on requirements to design and produce buildings that are sensitive to the environment. However, issues relating to global environmental change may have nuances that create additional problems for knowledge exchange – for example, those associated with particular local climate, geological conditions, the nature of national regulations and their local interpretation, local user acceptance, appropriate technologies, management capabilities, etc. Designers, planners and developers need to rediscover the significance of working within the limits of their 'bio-region' and use local feedback loops. It is not yet clear how much of this knowledge can be transferred out of the context that created it.

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5

Green Buildings – Reconciling Technological Change and Occupant Expectations

Raymond J. Cole

Introduction

The emerging interest and development in green building design since the early 1990s has been supported by an increasing number of conferences and publications that continue to define the state of the art, clarify priorities and offer guidance to design professionals. A consistent feature of these developments is that most discussions are *technically* framed, i.e., emphasising technical systems and their attendant potential reduction in resource use and resultant ecological loadings. This focus makes scant reference to how users interact with technical features and systems or, more generally, to the cultural acceptance of green buildings. In practice, however, a building designed with excellent 'green' performance standards can be severely compromised because the specification and technical performance fail adequately to account for the inhabitants' needs, expectations and behaviour. Moreover, long-term, broadly based solutions to environmental problems will depend on major changes in human values and actions. Roslin (1996, p. 8) argues that an ecologically aware society '. . . has as much, if not more, potential for the conservation of resources than technical innovation', and that this potential is 'culturally bound'.

Although redefining technical performance goals is an essential part of green building design, the absence of a parallel understanding of users' engagement with environmental technologies is potentially problematic. More significantly, the current debate may be detracting from what Guy and Farmer (2000) characterise as a 'situated, contextualised and social understanding of the environmental problem'.

This chapter provides a countervailing view to the current bias toward technical performance, and argues that significant and sustained progress in green buildings will only result from an understanding and reconciliation of technological change and occupant engagement with it. Clearly, the plethora of contextual influences that shape occupant expectations and actions, and differences between individual and group actions, are both complex in definition and interpretation. However, the emerging experience from built projects since the early 1990s, together with relevant ideas from the social and behavioural sciences, offer considerable potency and guidance for reframing current design strategies. The primary objective is not to provide a detailed understanding of the way that building occupants engage with technical systems, but to identify aspects of human expectation, behaviour and culture that can usefully inform clients and design professionals when making strategic design decisions.

Adapting to change

Creating a context where people are receptive to environmental issues is an essential prerequisite to improving the environmental performance of buildings. There are two key, yet interrelated, human characteristics that are of relevance to this discussion – those that influence our ability to acknowledge the significance of environmental issues, and those that influence our ability to change and adapt to new conditions. The first relates to both the demand for higher performance standards created by building users and the willingness to commit building owners and designers to deliver such buildings. The second takes on greater significance for building users and their acceptance of any new environmental conditions or innovative green design features. Within this context, the extent to which clients and designers understand the needs and expectations of current and future building users assumes considerable importance. Guy and Farmer (2000) argue that the debate around green buildings no longer simply focuses on the question of whether there is an environmental crisis, but rather on how it can now be 'visualised as a landscape of often fragmented, contradictory and competing values and interests'.

Moreover, they suggest it 'has become a site of conflicting interpretations in which a complex set of actors participate in a continuous process of defining and redefining the meaning of the environmental problem itself' (Guy and Farmer, 2000, p. 73).

Declaring *shared* environmental performance goals within the full design team and *collectively* aspiring to achieve them, and their subsequent acceptance, comprehension and sustained commitment to the resulting design strategies by building occupants, are clearly important. However, Shove (1995) argues that it is insufficient to search for closer, more collaborative relationships between the various players '. . . in pursuit of more and more sustainable ways of providing what has now become reified standards of indoor comfort'. Instead, she suggests '. . . we need to recognise the malleability and negotiability of those seemingly fixed requirements' (Shove, 1995, p. 166).

Values and world-views

Education is clearly part of creating awareness and demand for green buildings and the ability of design professionals to deliver them. If education is critical in creating this shift, a logical argument would suggest that reliable information and knowledge are therefore key. However, Bazerman *et al.* (1997) identify that '. . . most people have pro-environmental attitudes, yet engage in environmentally destructive behaviour', and that more or improved knowledge about the physical state of the environment will not solve this 'attitude–behaviour gap'.

Moreover, confronting people with 'well-reasoned persuasive' messages and arguments often has little impact, especially if they hold strongly ingrained attitudes (Eagly and Kulesa, 1997). If a sense of importance is *value dependent*, then users of new information and knowledge must be predisposed to the issue to which these values relate. Sustainability and ethical judgements stem from an ecological view of knowledge that 'respects the moral standing of non-human entities, necessarily extending beyond anthropocentric concerns to encompass a moral concern for the integrity of the natural world' (Guy and Farmer, 2000, p. 77).

The 'world-view' held by a society operates silently to

> 'channel attention, filter information, categorize experience, anchor interpretation, orient learning, establish moods, secrete norms, and legitimate narratives, ideologies, and power structures' (Gladwin *et al.*, 1997, p. 245).

World-views have, historically, embodied different notions of the relationship of humans to the natural world. They have also taken centuries to mature and become manifest in the shaping of human settlement and building practices. Western societies remain entrapped in the dominant Cartesian–Newtonian mechanistic world-view of the mid-seventeenth century, one that implicitly places human enterprise dominant over and essentially independent of nature. Indeed, Gladwin *et al.* (1997) argue that human minds have evolved in ways that render us unable to comprehend, let alone begin to address, the challenge of sustainability. These now ingrained biases that favour notions such as simplicity, certainty and immediacy, they suggest '. . . serve to impede adaptive learning deemed essential for sustainability' (Gladwin *et al.,* 1997).

It is reasonable to postulate that a future sustainable built environment will be different from what currently exists and that we will be using buildings in different ways than at present. Presumably this will also exist within the context of a mature and prevalent environmental ethic. In the current early stages of a transition, new design strategies and new conditions will be introduced that may be qualitatively different from that with which building occupants are familiar. This raises issues regarding the extent to which building users or those who commission buildings can anticipate the benefits or attributes of a different kind of building, and the extent to which occupants will adjust or accept these conditions.

The supply side of the construction industry is generally conservative and reluctant to introduce new features into buildings it commissions. Although industry is fundamentally risk averse, this tendency is not evident in either recognising or responding to larger environmental issues. Individually and collectively, we tend to 'underestimate larger uncertainties or unknowns' and display 'imprudent risk aversion and under-invest in precaution, preemptive safeguards, reversible actions, safety margins, and preparation for perceptual surprise' (Gladwin *et al.*, 1997, p. 243).

Despite powerful arguments on the importance of environmental issues and evidence on the multiple benefits of early adoption of higher performance standards, most national construction industries procrastinate in making changes that are perceived to increase initial cost until convinced of the 'facts'. The exact nature of these facts is often unstated and, even when the industry is convinced, progress typically occurs through modest incremental advances rather than more comprehensive leaps.

The economic issues related to selling or leasing buildings typically rely on features that offer immediate and visible attraction, and the building development mind-set is more often reactive to the market rather than offering it direction. The implicit assumption is that users will not accept or adapt to new circumstances. Loewenstein and Frederick (1997) identify several human traits that suggest otherwise:

- People 'not only underestimate how their psychological experience of a given situation will likely change over time, but also underestimate their ability to alter the conditions they may experience.' (p. 59)
- People are 'remarkably good at adapting to or coping with deficiencies or inconveniences in the circumstances of their life' (p. 56). Moreover, rather than simply getting used to a new condition, they 'may take active steps to mold their preferences or their material circumstances to deal with such changes.' (p. 59)
- People may 'underestimate' their own tendency to adapt to change and 'overestimate' the impact of any *one factor* on their future quality of life. (p. 66)

This last point implies that when attention is focused on only one possible future aspect of building performance, its importance is typically exaggerated. Clearly the experience of a building depends on a wide variety of qualities and attributes, and unless any one particular environmental feature is completely debilitating, it is unlikely to sway users' preferences and engagement. The reuse of existing buildings, for example, is often dismissed as an 'environmental' option because of their perceived inability to meet specific contemporary needs, e.g., accommodating information and communications technologies. Yet occupants show a remarkable ability to adapt to seemingly constraining interiors because of other qualities inherent within some existing buildings. Similarly, comfort is not just an outcome of the physical environment, but as Brager and de Dear argue in Chapter 11 '. . . it is our very attitudes about comfort – both on an individual and cultural scale – that influence our basic need for (or aversion to) mechanical heating and cooling'.

An alternative and proactive mechanism for the incorporation of new environmental features into buildings is to *create* a market demand for those features. Targeted advertising and other forms of promotion are effective mechanisms for shifting 'consumer' opinion, and larger developers often have the resources to make use of this option. Such strategies, however, typically pander to current human desires for greater convenience, luxury and status and other attributes of the prevailing consumer cultural paradigm. It is uncertain whether similar marketing techniques will have the same potency in communicating environmental values and attributes and, moreover, also raises concerns regarding advertising's potential abuse as 'greenwash'.

Operating within any prevailing 'collective' value set, there are obviously widely varying personal points of view on the significance of environmental issues derived from one's education and experience. Moreover, a host of specific building-related contexts such as management strategies, relationships with co-workers and dress codes, also shape individual occupant priorities and actions to environmental conditions and systems. More interestingly, many contemporary Western countries continue to experience significant immigration that creates rich and complex collages of diverse cultural and ethnic groups. New immigrants bring prior values and experiences and, with varying degrees, reinterpret, adapt to, influence and change the new situation, making the idea of defining cultural values and expectations increasingly difficult.

Whereas whole subsets of environmental strategies do not engage the user – improved insulation levels, improved windows performance, etc. – neither do they *challenge* the status quo or nurture new attitudes. By contrast, strategies that potentially affect the appearance of buildings, the comfort conditions experienced by occupants, the comprehension and use of controls, and fundamental changes in use patterns, require greater thought and consideration as to their potential conflict with prevailing social and cultural norms.

Visual expression of environmental strategies

The appearance of buildings is a powerful expression of values and priorities, and represents a critical part of architectural discourse. However, the Modern Movement demonstrated how quickly visual qualities of buildings can be coopted without necessarily being respectful of philosophical underpinnings that initially generated them. In its search for universal principles, the Modern Movement jettisoned vernacular environmental strategies in its quest to further technological innovation. Indeed, the ease with which local architectural traditions succumbed to the universality of modernist vocabulary was a defining characteristic of twentieth century architecture. Green architecture, by contrast, represents an ideological shift that acknowledges the need to accommodate local conditions, expectations and ways of life.

In his essay 'Architecture as Pedagogy', David Orr (1999) comments on the building in which he teaches. This building communicates nothing whatsoever that reflects its locality, offers no clue about the origins of the materials used to build it, resonates with no part of human biology, evolutionary experience, or aesthetic sensibilities and reflects no understanding of ecology or ecological processes. In sum, he argues that it teaches that 'disconnectedness is normal'. A measure of successful green architecture in its broader role of educating a public may well therefore lie in its ability to capture the public imagination by communicating new values in explicit and engaging ways.

Surprisingly, much of contemporary green design involves too literal a transfer of technical strategies from fundamentally different climatic and cultural contexts *without* any serious critique of either their validity locally or their acceptance and engagement by building occupants.

Passive solar strategies

Since any transition toward sustainability is likely to parallel our shift to renewable energy, solar technologies – passive systems, and photovoltaics – will become increasingly and widely used design strategies. Depending on how they are accommodated, these can have a significant impact on the exterior appearance of buildings that is contrary to existing norms. For example, the eight-unit Kitsun Townhouse project in Vancouver represented the most advanced residential passive solar design in Canada when completed in 1979 – south facing Trombe walls with insulating curtains, skylights fitted with solar activated insulating shutters, high performance windows and above average wall and roof insulation. Annual heating energy use for the units initially varied from 1.5 GJ/year to 30 GJ/year according to their occupant's lifestyle and their engagement with technical operation.

Since the Kitsun project's completion significant modifications have been made to the building's original design – all diminishing its passive solar emphasis (see Fig. 5.1, a, b and c). In particular, the original dark walls necessary to absorb winter solar gain have been repainted in varying pastel colours. Although technical failure of several innovative systems was a factor, the majority of modifications were a result of changes in occupant understanding, expectation and their desire to bring their home's appearance in line with more conventional norms. Moreover, the facility is a housing cooperative and, although its original members were committed to solar technologies, only two currently reside in the complex.

Use of salvaged materials

The use of salvaged materials and components to reduce both resource use and waste presents a host of technical, regulatory and design challenges, and more significantly challenges the current prevailing cultural preference for the 'new'. Such concerns clearly depend on the roles the

a

b

c

Fig. 5.1 Changes in Kitsun Townhouse complex from 1979 to 1999 salvaged components serve (e.g., whether exposed or concealed), their quality and the extent of their use.

The City of Vancouver Materials Testing Laboratory (Fig. 5.2) is constructed of approximately 80% salvaged materials, components and equipment, including the reuse of salvaged structural timber and insulation, the reconditioning of used heating equipment and sanitary appliances and the re-manufacturing of double-glazed window units from salvaged single glazed windows. The initial reservations by the prospective occupants regarding having to occupy a building 'made of garbage' were understandable given that they were expecting a 'new' building. These quickly diminished when the result was a building with materials and furnishings of far greater quality than would have been attainable with a new building within the allowable costs.

Elimination of finish materials

The elimination or selective use of conventional interior finish materials as a means of reducing materials use (Malin, 2000) profoundly challenges occupants' expectations of interior spaces. The use of finish materials has evolved to solve technical and human requirements – protection, concealment, acoustics, fire resistance, ease of maintenance etc. – and clearly these must be resolved with any alternative approach. Similarly, a whole

Fig. 5.2 Use of salvaged materials (City of Vancouver Materials Testing Lab. Busby + Associates Architects, 1999)

industry of trades and subtrades has evolved, each with specific roles in constructing buildings, and eliminating finishes places greater responsibility for the final quality of appearance on those not historically trained to ensure this. More significantly perhaps, interior finishes along with furniture provide the opportunity for occupants to instil their own personality and taste within a building – qualities that alter over time and with changing occupants. The elimination of finish materials, by contrast, speaks of a 'permanent' aesthetic, one immune to changes in fashion.

The Strawberry Vale School in Saanich, British Columbia (Fig. 5.3, a) raises several issues related to the elimination of finish materials. The design consists of a meandering circulation spine that provides access to the classroom pods and support spaces. Interior finish materials gypsum wall board and floor coverings have been eliminated within this space, exposing the wood and steel structure and concrete floor (Fig. 5.3, b). By contrast, white-painted gypsum has been selectively used in the classroom and support spaces to enhance the distribution of natural light (Fig. 5.3, c). These strategies offer the benefits of visually exposing structure to provide occupants with some comprehension of the 'making' of buildings and demonstrating the importance of *selective* rather than the unthinking use of resources. It is uncertain whether the absence of continuous surfaces to display student work and difficulties experienced in cleaning the exposed surface will, over the long term, compromise this approach.

a

Fig. 5.3 Elimination of traditional finish materials (Strawberry Vale School, Saanich, BC. Patkau Architects, 1996)
a. Exterior

b

c

Fig. 5.3 *Continued*
b. Elimination of finish materials in circulation spine
c. Selective use of finish materials in classrooms. (Courtesy of James Dow, photographer)

The finish materials in the C.K. Choi Centre for Asian Research (1996) (Fig. 5.4, a) and the Lui Centre for the Study of Global Issues (2000) (Fig. 5.4, b) at the University of British Columbia in Vancouver have been eliminated to reduce materials use and expose thermal mass to assist natural conditioning. The difference between the 1996 and 2000 projects is insightful. Whereas no attempt has been made to mask structural and service elements such as sprinkler lines in the Choi Centre (Fig. 5.5, a), screening elements have been selectively deployed in the Lui Centre to create a more controlled and visually 'quieter' ceiling plane (Fig. 5.5, b).

Key lessons emerging in the use of these strategies are that the architectural handling of visible environmental strategies must be carefully evaluated against time-honoured human expectations, and that the robustness of any technical solution is limited by and must accommodate changes in tenure over time.

Revisiting the definition of 'comfort'

Whereas visual appearance may offend or delight, thermal, luminous and acoustic conditions may more directly impact on occupants' performance. Building users undergo widely different thermal and luminous conditions when moving through and between buildings, so variable environments can be positive and evoke levels of arousal, attention and effort appropriate to the occupant's activity. However, contemporary design goals are qualitatively different. The prevailing notion is that internal conditions should be constantly held at some 'optimum' level both spatially and temporally. The optimum condition is typically defined as reducing the sensations of discomfort and producing an unnoticed environment in which work or pleasure tasks can be carried out unhindered physically or mentally. Design conventions have institutionalised tightly controlled conditions as a universal performance goal. These developments are primarily founded upon physiological research and the emergence and dominance of mechanical conditioning of buildings. Shove (1995) suggests this has '. . . fueled particular forms of technological development' and has consequently engendered 'new and converging expectations regarding comfort and control' (Shove, 1995, p. 164). Further, she argues (p. 166) that this tendency has been instrumental in promoting '. . . science, rather than the culture or anthropology of comfort, and has supported and reinforced unsustainable trends toward standardisation.'

The successful performance of naturally conditioned buildings relies on the provision and acceptance of varied internal environmental conditions.

a

b

Fig. 5.4 a. C.K. Choi Centre for Asian Research, University of British Columbia, Vancouver, Canada (Matzusaki Wright Architects, 1996) b. Lui Centre for the Study of Global Issues, University of British Columbia, Vancouver, Canada (Architectura, 2000)

The indoor environment is a 'creative achievement' shaped by the interaction of building users with control systems in response to changing external conditions. Unlike conventional centrally and mechanically controlled buildings, the performance of naturally conditioned buildings

Fig. 5.5 Elimination of finish materials. a. C.K. Choi Centre for Asian Research b. Lui Centre for the Study of Global Issues

is ‘not a foregone conclusion’ (Shove, 1995, p. 164). These conditions will likely be less predictable, less reliable and differ from what occupants might be typically accustomed to, but should not necessarily any less desirable. Brager and de Dear demonstrate in Chapter 11 that people working in naturally ventilated office buildings in fact ‘prefer a wider range of conditions than occupants of buildings with centrally controlled air-conditioning systems’.

The key issue here is not that individual occupants can, and often do, make profound lifestyle and behavioural changes, but the extent to which these changes mature into broader, durable cultural traits.

Complexity in building controls and operation

It is widely known that actual building performance often differs markedly from that anticipated or predicted during design. This ‘mismatch’ primarily results from the differences between assumed and actual patterns of occupancy, the use of controls, and building operation and management. Based on a wealth of experience in evaluating actual building performance, Bordass and Leaman (1997) point to *overly complex* building systems as a major deterrent to efficient and effective building operation (see also Bordass, Leaman, and Willis, 1994).

The Post-Occupancy Review of Buildings and their Engineering (PROBE) studies in the UK provide feedback on the performance of many buildings which have been the subject of much academic study and illustrate the differences between anticipated and actual performance (Cohen *et al.*, 2001). In particular, they show that the actual performance of buildings is compromised by the complexity of the systems built into them and, interestingly, the performance of some modest projects is far superior to many celebrated architectural works. High-tech buildings are relatively complex to operate, so dedicated management is essential if they are to achieve optimal performance. Indeed, the operation of the vast majority of current buildings is typically too demanding for the available management resources. By contrast, in addition to reduced energy use and environmental impact, low-tech/low-management naturally conditioned buildings offer the promise of simpler, more robust control strategies that provide greater occupant satisfaction. To enable occupants to solve operational problems, however, such systems must be readily accessible and comprehensible to building users and clearly accompanied by a willingness to use them. A key lesson is, therefore, that the environmental success of a building depends on matching technological and management sophistication. In addition to paying particular attention to the ergonomic issues associated with strategies that require user involvement, the PROBE work raises a host of critical questions:

- Does the strategy require the user to participate actively in the operation of the building?
- How robust is the operation?
- How visible is 'failure'?
- Is the (facilities) management equipped to manage the complexity and systems inherited from the design team?
- Does the design team know the capabilities of the facilities manager?

The issues raised above may have more fundamental roots in the way that contemporary design conceptualises and provides for the interactive process between users and building systems. The dominance of seemingly universal features of human need and 'viewing users as the passive beneficiaries of designers' decisions' (Shove, 1995, p. 165) provides little scope for alternatives and does little to encourage the need for understanding the culture of specific user groups.

The importation of 'foreign' techniques has become an increasingly common phenomenon within the supply side of the construction industry. One example is North American practitioners who are increasingly exposed to information on emerging European naturally conditioned buildings as a major emphasis in 'green' design, and are beginning to incorporate related environmental strategies and technologies in their own work. The centre of the debate and practice of the natural conditioning of buildings has been northern European countries – the UK, the Netherlands and Germany – that had never committed themselves entirely to mechanical conditioning. Statistics related to resource use and air emissions *per capita*, more stringent environmental regulatory requirements and commitments to international environmental initiatives, suggests that there is a greater culture of environmental responsibility in northern European countries than in North America. As geographic and cultural boundaries are transcended in the importation of technical strategies to North America, it seems reasonable to ask if potential difficulties may arise regarding their acceptability by users who are not accustomed to more variable interior conditions and direct engagement in building operation. Given that sealed buildings, mechanical conditioning and the use of electric lighting dominate conventional practice in North America, the introduction of such strategies originating in Europe poses potentially considerable challenges to the engaging of users.

A qualitative strategic difference in natural ventilation strategies is currently evident between Japan and Canada and is centred primarily in the way that automated and personal controls are provided and accessed by occupants. The Catalog House Company building in Tokyo is the 5347 m^2 headquarters for a mail-order company with a declared corporate environmental policy (Fig. 5.6).

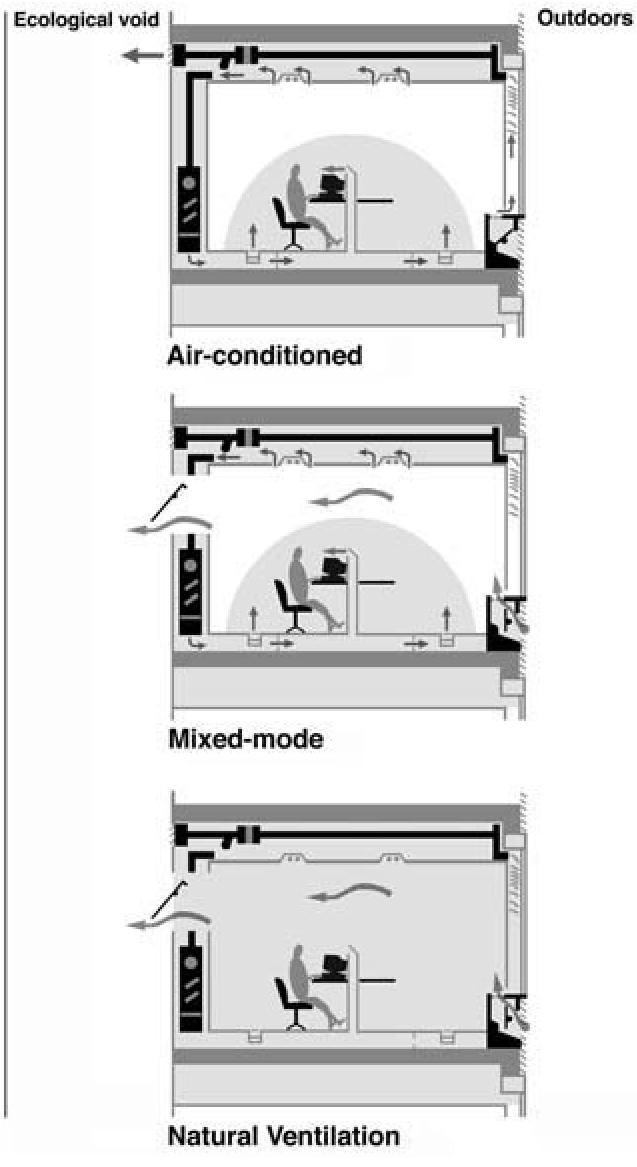
The building can operate in one of three ventilation modes: full natural ventilation, full air-conditioning or a combination of both (Fig. 5.7,a). Natural ventilation is admitted through a series of vents around the perimeter of the building. A central open atrium space or 'ecological void' provides the necessary stack-effect to draw air through the occupied spaces and exhaust it back to the exterior (Fig. 5.7,b). Both the near floor-level vents at the perimeter and the ceiling-height vents into the atrium are automatically regulated in response to continuous monitoring of both outside weather conditions and the interior thermal environment (Fig. 5.7,c).

In the Catalog House Company building, mechanically conditioned air is supplied through a raised floor and admitted into the interior spaces via floor diffusers and interior partitions (Fig. 5.8). Occupants can directly

Fig. 5.6 Catalog House Company, Tokyo (Ishimoto Architectural and Engineering Firm, Inc., 1999)

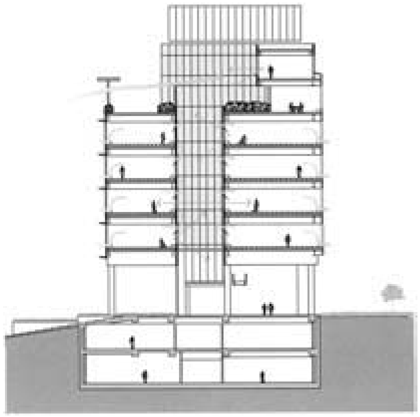
adjust the airflow at their workstations through outlets at the top of the chest-high partitions without compromising the overall airflow pattern.

By contrast, recent naturally ventilated building projects in Canada show a desire on the part of their designers to engage occupants much more comprehensively in building operation. The C.K. Choi Centre for Asian

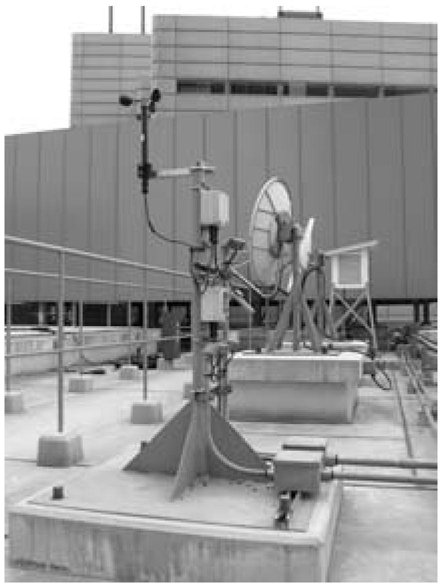


a

Fig. 5.7 Catalog House Company building. a. Ventilation modes b. Ecological void c. Weather monitoring on roof



b



c

Fig. 5.7 *Continued* (Courtesy Ishimoto Architecture and Engineering Firm, Inc.)

Research and the Lui Centre for Global Studies, for example, expect and require occupants to manually open and close inlet vents and windows, and to initiate the opening and closing of outlet vents. Moreover, continuity of the airflow path through the interior spaces to maintain cross ventilation requires permanent openings in cellular offices that compromise acoustic privacy.

A building occupant's pleasure, comfort and productivity are closely linked to their real and perceived control over interior environmental conditions (Heerwagen, 2000). Such knowledge has typically translated into guidelines that specify strategies and systems to provide users with adequate control, that are comprehensible, simple to manage and use and

Fig. 5.8 Adjustable ventilation supply in partitions

that provide quick responses to user induced change. However, simply *providing* operable windows, for example, is clearly insufficient in designing naturally conditioned buildings. The location, ergonomics and extent of opening and their distribution profoundly affect performance and use. For example, in contrast to simple, generalised models of occupant behaviour assumed in design, Leaman (1999) presents a list of 'real' building user reactions and responses that indicate occupants tend to:

- act in response to random, external events;
- take decisions to use switches or controls only after an event has prompted them to do so (rather than in advance of it);
- often wait for some time until taking action and typically when they reach a 'crisis of discomfort';
- overcompensate in their reactions for relatively minor annoyances;
- operate the controls or systems that are most convenient to hand rather than those that would logically be the most appropriate;
- take the easiest and quickest option rather than the best for their immediate benefit; and

- consciously or otherwise, leave systems in their switched state, rather than altering them back again later, at least until another crisis of discomfort is reached.

With regard to the points above, the qualitative difference in the design of the operable windows in the C.K. Choi and Lui Centres is instructive. The operable windows in the C.K. Choi building have simple trickle vents at their base designed to provide required background ventilation during the winter; they are 2.15 m tall, bottom pivoted and open approximately 11 cm at the top for increased natural ventilation (Fig. 5.9,a). They are not particularly easy to operate and do not offer direct and immediate gratification to users when opened. By contrast, the windows in the Lui Centre, built on the experience of the C.K. Choi building, are partitioned into distinct sections: a fixed clerestory window, a top-hung window that provides and directs ventilation immediately to the occupants during overheating periods, and a refined trickle-vent system for greater control of ventilation at other times (Fig. 5.9,b,c).

For the Catalog House Company headquarters, the C.K. Choi building and the Lui Centre building all have chosen to provide 'user manuals', giving information on their respective innovative design principles, what users can expect and how to interact effectively with the buildings. The efficacy of this distribution of user manuals, as with the success of the technical systems themselves, will become apparent with the passage of time as occupants and management change.

Change in use patterns

In addition to providing different environmental conditions within buildings, more fundamental changes in how buildings are used may yield greater environmental benefits, and certainly challenge current social and cultural norms.

Many contemporary buildings are under-utilised. For example, if 365 days a year and 24 hours a day represents a building's total *availability*, then with a five-day week, holidays, an eight-hour day, lunchtime and illnesses, typical office workstations are only used some 16% of the time (Lloyd, 1993). Social functions and meetings further diminish this figure. Irrespective of their environmental attributes, it will be necessary to get greater utility out of buildings, either wholly or in part, by sharing of spaces or overlapping complementary programmes.

a

b

Fig. 5.9 a. Openable window in CK Choi Building. b. Openable window in Lui Centre. c. Detail of window opening in Lui Centre

c

Fig. 5.9 *Continued*

Intensification

'Shared' spaces that allow for the coexistence of two or more complementary programmes within a bound space, or 'mixed-use' spaces that place several programmes within a common facility, are well established notions. They are typically economically rather than socially or environmentally motivated and, for the main part, their programmatic elements are separate from each other and are conceived to remain so. If environmental performance became a more explicit concern, a wider range of possible ways of sharing facilities, resources, and incorporating closed-loop systems is possible, but would require a 'blurring' of the distinctions between use requirements.

Alternative work arrangements

Alternative work arrangements (AWA) is a catchall phrase for strategies that make use of temporary desk space, laptops and cellular phones to eliminate or reduce the daily commute and the need for a permanent desk space at the workplace (Hasan and Cole, 2002). Examples of AWA include *hotelling*, which can result in 30 to 40% reductions in office space (Weil, 1994), and *teleworking*, which generally involves an average of 1–2 days of telework per person per week (Handy and Mokhtarian, 1995). Alternative work arrangements allow a more effective use of office space, eliminate the need to commute to work *daily*, and open new opportunities to reduce energy use and related greenhouse gas emissions. What is uncertain is the way that teleworking influences other habits and life-style patterns; in fact, a household's overall amount of automobile travel as a result of teleworking may actually increase for social and domestic chores that were previously accommodated in the daily commute to work.

Conclusions

This chapter has identified and explored the current gap between technical and sociocultural issues in green building design. While almost all current building environmental concepts are *universal* in their validity, a central concern here is their *specific* interpretation and manifestation in design.

Addressing the environmental agenda clearly requires significant improvements in building performance beyond current practice and indeed will continue to require technological change. However, the supply side of the construction industry has been increasingly engaged in the transfer of technology and design standards across regional and cultural boundaries, typically without understanding local context. A key factor in the success of green building practices may lie in developing supply-side capabilities that critically assess and adapt global information to local cultural expectations and habits and patterns of living, coupled with local climatic conditions, materials and technologies.

It is unlikely that improved environmental performance will be achieved by technological solutions that do not challenge currently accepted norms or involve building users. A key part of the discussion in this chapter has centred on the willingness of building users to both accept and engage in green building strategies, and the extent to which such requirements are recognised and successfully accommodated by design professionals. Although comprehensive feedback on users' engagement in green buildings is currently sparse, evidence suggests that occupants may make changes to realign these buildings to more conventional expectations, thereby reversing most environmental benefits (Cole and Steiger, 1999). In particular, although an initial group of tenants or building occupants may commit to qualitatively different conditions, through time new occupants unfamiliar with the initial design precepts may reject them. As such, it appears that the time frame over which adaptation occurs is critical.

Sustained occupant commitment to environmental strategies is clearly critical for successful performance. Extending the short-term success of green buildings requires a transitional period enabling users to undertake the necessary learning, reassessment and becoming accustomed to different conditions rather than feeling compelled to revert back to old expectations and habits. Strategically this is linked to the way that designers distinguish between those technical strategies that impact directly on and engage building users and those that do not. If green buildings place greater responsibility in the hands of occupants as a necessary part of their operation, then supplementary techniques such as greater user education are probably necessary to encourage this engagement.

Finally, the introduction of new environmental emphases to building design that challenge existing norms can be set within the broader notions presented by Shields in Chapter 3 regarding the way that 'foreign' strategies are transformed into 'naturalised' or '*creolised*' elements of a local context. We are in the early stages of a transition toward sustainability and redefining approaches to building design. Within this transition, technical environmental strategies that have been successfully deployed elsewhere must be thoughtfully assimilated within building design to a local context, and evaluated carefully in terms of nurturing user engagement. Above all, it is clearly important that we take a longer and more comprehensive view of building performance and change and how we judge the success or failure of environmental strategies.

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6

Cultural Issues for a Sustainable Built Environment

Niklaus Kohler

Introduction

The thesis of this chapter is that regional culture and sustainability are complementary components, each essential for the other's existence. The prevailing technocratic approach to the creation of 'green' or 'environmentally progressive' buildings will ultimately fail because it is too narrowly defined. In order to succeed, the transfer and acceptance of technologies and techniques has to be based on a sound knowledge of regional culture. It must be recognised that the existing building stock and urban fabric form an essential aspect of regional diversity and culture.

Although the abstract notions of culture, sustainability, life style and environment are used almost universally, through language and context they refer to specific realities. Cross-cultural exchange has to be carefully constructed by considering the specific context. The views in this chapter represent a European point of view, i.e. of a society which is strongly marked by centuries of common history, intense cultural exchange and the resulting large cultural diversity. There have been approximately 200 years of identification with national states in Europe. A European approach has come to assume the necessity of strong public policies, the importance of public service and active state intervention, especially in the realms of the built environment, 'green' issues and cultural heritage.

This chapter is composed of five parts:

- A critical review of cross-cultural transfer in an increasingly globalised society.
- A short definition of the main components of sustainable development.

- An overview of the EU policy in the field of environmental assessment.
- A proposition for an alternative approach to the cultural and environmental long-term strategies for the built environment.
- Strategic conclusions on cross-cultural exchange and on new planning paradigms.

Cross-cultural transfer and the built environment

The problem of the natural environment, its carrying capacity, the limits of resources and therefore the limits of growth have been acknowledged to be global problems. However, we are still a long way from efficient coordinated international action. Governmental and commercial interests are still successfully blocking even such timid attempts at global environmental strategies as the Kyoto Protocol.

As a reaction to the high energy consumption in the building sector, new construction techniques have been proposed to considerably limit the environmental impacts of new buildings. These are sometimes referred to as 'green buildings' or 'environmentally progressive buildings'. Whilst green issues are discussed in international congresses and publications and toolboxes, checklists, life cycle assessment tools, etc. are produced worldwide, their impact in the industrialised world is negligible and for the rest of the world non-existent.

A more general framework of sustainable development has been in discussion for some time (Kohler, 1999). The issue of cross-cultural transfer of information on environmentally advanced design and building techniques has gained in importance since 1998, on the level of both scientific communication and international consulting activity. The recognition that cultural issues need to be considered in conjunction with environmental issues is an eminently positive initiative. 'Green buildings' and the newer expression 'environmentally progressive buildings' are often seen as positive and universal objectives. Yet, without consideration of cross-cultural variables, there is only partial and insufficient understanding of the complexity of the built environment. In the 1990s, the debate on the nature of what is progressive related to the debate on 'ecological modernisation' (Beck, 1992). This has been replaced by the more critical discussion on realising sustainable development in a globalised economy and the underlying theoretical concepts of a globalised economy which militate against this.

There is no conflict between regionally appropriate and environmentally appropriate building practice. Because of the shortage of resources, traditional vernacular building practices have tended intuitively, through trial and error, towards economically and environmentally optimal solutions (Fig. 6.1). Some modern forms of vernacular architecture, the architecture of the slums and *favellas,* are examples of forced long-term use of exogenous resources and an expression of popular culture. The conflict is only present in the 'international style' of the Modern Movement and its 'high-tech' successors, involving high resource consumption, large environmental impacts on one side, and regional cultural traditions (for which modernism had only contempt) on the other side.

The expression 'environmentally progressive buildings' implies a rather simple notion of progress and further suggests it can be brought to less progressive regional cultures. Does this imply that 'progressive' European 'cutting-edge green technology' should be brought to Africa, or North American 'progressive' energy saving techniques to Asia? Or should there be a categorical imperative 'to assess and adapt global information to their specific regional context'?

Cars can be produced in one place and exported over thousands of miles, whereas buildings still are largely one-of-a-kind products. Designing, con-

Fig. 6.1 Traditional villages situated in the vineyards along the lake of Geneva in Switzerland are the result of a high degree of resource conservation of materials, energy and (productive) land. Houses, places and the landscape are cultural artefacts that have lasted hundreds of years

structing and maintaining buildings are social processes predicated on the constraints of local climate, local resources and regional traditions. There are no implicit regional cultural limitations to environmentally progressive buildings, but regional culture and protection of the natural environment must be seen as complementary.

Sustainable development

Sustainable development is generally considered as something positive but rather vague. Perhaps this is why no one is explicitly opposed to it. The diffuse origin and the lack of a unique definition are therefore both a disadvantage and an advantage. There will always be multiple views of sustainability; they are not only equally legitimate, but also absolutely necessary to the health of the debate:

> 'Sustainable development can be successfully implemented only if each view makes its unique contribution to the solution. Since each represents only a part-truth, there is no single solution to a given environmental problem. In other words, sustainable development strategies cannot be attained through the dominance of a single view or by the exclusion of others; instead they require continual evolution and balance.'
>
> Samson, 1995

The historical (and etymological) origin of the term varies from language to language. The English term *sustainability* was created in the 1970s. The corresponding French expression, *développement durable*, is also a recent fabrication. The German term, *Nachhaltigkeit*, derives from a traditional notion used in the nineteenth century timber industry that was marked by shortage (Bächtold, 1998) and meant: '. . . not to cut more wood annually than the forest could give each year', i.e. not to take more than nature could provide. In the following decades the economic interpretation (taking money as an equivalent for value) became dominant. In the mid-twentieth century the complex functions of the forest as a climatic regulator, source of biodiversity and space for recreation became apparent, and a new definition of the long-term value of forests and of sustainability was established. This definition included four components:

- *Long term*: the effects had to be assured in the long term.
- *Social concern*: restriction of individual user rights in favour of the community.

- *Economy*: use of resources taking into account economic principles.
- *Responsibility*: towards a larger community and future generations.

Today the different aspects of sustainable development are generally recognised:

- *Ecological aspects*: linked to resource conservation and carrying capacity.
- *Economic criteria*: taking into account long-term conservation of natural and man-made capital.
- *Social aspects*: taking into account intergenerational equity.
- *Cultural aspects*: taking into account the conservation of cultural diversity.

The ethical need for sustainable development is highlighted in the first paragraph of Agenda 21 (United Nations, 1992):

> 'Humanity stands at the defining moment in history. The world is confronted with worsening poverty, hunger, ill health, illiteracy, and the continuing deterioration of ecosystems on which we depend for our well being. The disparities between rich and poor continue.'

For Bächtold (1998), the ecological, economic and social components are completed by a fourth *ethical* aspect. Other approaches (Hassler and Kohler, 2001) stress the cultural aspect as a fourth component of sustainability. Figure 6.1 combines the two approaches. Sustainability is a multidimensional concept (Fig. 6.2), and overemphasising one aspect would diminish other aspects.

The 1987 Brundtland Report (WCED, 1987) and the Rio Earth Summit in 1992 marked the development towards a more comprehensive and integrated assessment of sustainability. The pre-Brundtland situation was influenced by environmental assessment methods, which did not adequately address the questions of resource conservation, environmental capacity or sustainable development. Environmental impact assessment (EIA) was developed as a method concentrating exclusively on environmental aspects. Since the Brundtland Report, the practice of environmental assessment has been challenged both by the green movement and by other scientific or social communities (e.g. the cultural heritage community, third world movements, etc.). Critical distinctions have been drawn between eco- and anthropocentric techniques of analysis.

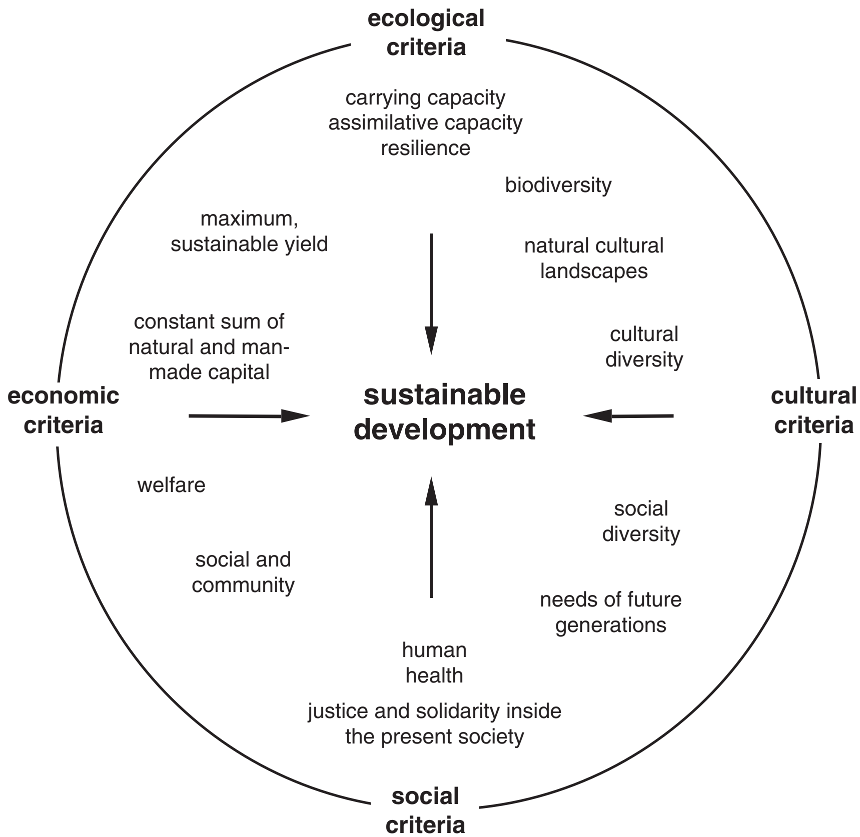

Figure 6.2 Different aspects of sustainable development (Translated and adapted from Bächtold, 1998)

Germany's Enquete Commission for the protection of man and nature linked the notion of sustainable development not only to the environment, but also to economy and society. In this approach, sustainable development encourages the conservation and preservation of natural resources and leads to a reduction of energy consumption, waste production and transportation impacts. It is based on patterns of production and consumption that can be pursued without degrading the human or natural environment. It involves the equitable sharing of the economic benefits across all sections of society, to enhance the well being of humans, protect health and alleviate poverty. It argues that, if sustainable development is to be successful, the attitudes of individuals as well as governments will need to change with regard to our current lifestyles and their impacts on the environment.

The human settlement, with all its economic, social and institutional arrangements, forms a complex system which needs to be respected. The Rio Conference not only initiated the Commission on Sustainable Development (CSD), which prepared the Kyoto Conference (1997), but also directed attention to the environment and its capacity to support the urbanisation processes and the 'city of tomorrow'. In Europe this idea is of particular importance as the majority of people already live in cities. The broader focus of assessment methods now encompasses economic structures and cultural heritage, and reflects their close relationship with ecological issues. As a result, attempts have been made to use environmental assessment methods to initiate a more sustainable development of cities considering environmental aspects (ecological integrity, equity, participation and futurity) as well as cultural heritage.

Environmental and cultural issues in EU building-related projects

From energy to environment

Numerous building-related energy and environmental projects have been undertaken in the European Union since the early 1990s, involving many teams, research alliances and consortia from member countries. The energy perspective has been at the forefront and continues to dominate for both production and consumption (demand-side management, etc.). The development of renewable energy sources has been the objective of large research programmes and has provided considerable impetus to European industry.

In the field of energy consumption, regional and local climatic differences have been taken into account, but other aspects were generally ignored. The question of the existing building stock and the growing refurbishment activity has also been of minor concern, reflecting the predominant conscience of the European construction industry as a new building production-oriented sector. This is also true for most of the research on 'building ecology', 'green buildings' and the 'sustainable building industry' (CIB, 1998). Energy research was primarily directed towards new buildings, with the development of some technologies such as insulation, higher burner efficiency, active solar devices, etc., which could be employed throughout Europe. Building refurbishment has been a minor issue (at least until now) and therefore the specific problems of regional and local construction techniques, architectural forms and user behaviour have not yet become important considerations.

Consequently, the most important changes in the (common) understanding of environment and culture have derived from the general environmental policy, from the definition of cultural (and above all architectural) heritage and from attempts to define sustainable management strategies for the built environment rather than energy-related research. All these issues have been introduced in the ongoing EU 5th Framework Research Programme, in particular: *Environment and Sustainable Development, Key Action 4: the City of Tomorrow and Cultural Heritage.* The major urban challenges considered in this programme are:

- social exclusion;
- loss of cultural identity;
- changing employment patterns;
- deteriorating infrastructure and built environment;
- insecurity and criminality;
- urban sprawl;
- traffic nuisance;
- bad air quality and noise;
- poor water and waste management.

Environmental impact assessment

Environmental impact assessment (EIA) was first developed in the late 1960s. The initial purpose was to encourage a productive and enjoyable harmony between mankind and our surrounding environment, prevent or eliminate damage to the environment and biosphere, stimulate health and wellbeing and enrich the understanding of the ecological systems and natural resources. An example of a more technical definition is provided by the UK Department of the Environment (1989):

> 'The term "environmental assessment" describes a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgement on whether the development should go ahead.'

The EU adopted EIA in 1985 when the Directive on the assessment of the effects of certain public and private projects on the environment (Directive 85/337/EEC) was established, with a further amendment added in 1997 (Directive 11/97/EC). An EIA provides scientific data for decision-making processes. In addition, it is considered a public documentation system as well as an environmental management tool for the developer. The notion of environment has gradually extended from the biosphere to encompass larger cultural and social issues. These include the Environmental Health Impact Assessment, a cultural assessment in environmental assessment projects required by the World Bank (1994). Strategic environmental assessment (SEA) is becoming a new comprehensive procedure. SEA is defined as:

> 'A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climate factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors. [And] This description should cover the direct effects and any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects of the project.'
>
> Directive 85/337/EEC, Therivel *et al.*, 1992, SEA, 2001

In conclusion, cultural aspects have now become an integrated part of the notion of environment in a defined procedural sense.

Culture and the subsidiarity principle

Article 151 of the Treaty of the European Union (formerly Article 128) states that:

> 'The Community shall contribute to the flowering of the cultures of the Member States, while respecting their national and regional diversity and at the same time bringing common cultural heritage to the fore.'
>
> European Economic Community, 1967

The remarks in this section are partially based on ongoing work of the author in the EU project: Sustainable development of Urban historical areas through an active Integration within Town (SUIT, 2001).

However, Article 151 adopts a very cautious approach with respect to the subsidiarity principle. Point 5 of this Article explicitly requires that the Council's activities are limited to incentive measures, excluding any harmonisation of the laws and regulations of the Member States. It also states that the Council shall act unanimously in cultural matters. Point 4 of Article 151 of the Treaty thereby states:

> '. . . the Community shall take cultural aspects into account in its action under other provisions of the Treaty, in particular in order to respect and promote the diversity of its cultures.'

This provision is significant in placing culture amongst the major objectives of the European Union. The EU has recently adopted its first framework programme in support of culture (CEC, 1998). Some of these incentives will specifically deal with the built heritage and material assets. Given its broad definition, culture is likely to be affected by a number of other EU policies.

From cultural heritage to architectural heritage

Traditionally, conservation policies of the built heritage have mainly concentrated on the preservation and renovation of listed monuments and individual buildings. One of the weak points of this policy is its limited ability to protect heritage buildings from damage caused by inappropriate developments located in their close surrounding. In response to this threat, conservation was extended beyond individual monuments to create a buffer zone. The risk is in the progressive transformation of historical areas to vast open-air museums (or even worse, their 'Disneyfication'). This process leads to increases in rent and subsequent gentrification, with a reduction of social diversity. An alternative is to consider the architectural heritage in itself, and to develop strategies to foster an appropriate long-term development of the urban fabric, integrating ecological as well as economic, social and cultural aspects. This has sometimes been referred to as 'active conservation' (Dupagne, 2002).

The conservation of urban settings and the protection of the surroundings of monuments have progressed slowly over a very long period of time beginning in 1964 with the Venice Charter. The Amsterdam Charter (Amsterdam, 1975), adopted by the Committee of Ministers in 1975, considers that architectural heritage conservation depends strongly upon its integration into citizens' living environment and it has to be taken into consideration in urban planning policies. The Council of Europe Resolution (76)/28 (Council of Europe, 1975) enlarges again the definition of the built cultural heritage, insisting strongly on architectural groupings defined by a series of criteria. It gives also a more precise definition of the integrated conservation of the built cultural heritage. This concept includes all rehabilitation and revitalisation measures designed to:

- assure the durability of the built heritage;
- maintain it within the frame of an appropriate environment (built or natural); and
- allocate and adapt it to the present needs of society.

In 1985, the Council of Europe adopted the Granada Convention:

> 'By contrast with the [previous activities of the Council], the Granada Convention contains statutory measures to be adopted by signatories, among which the requirement to adopt integrated conservation policies (art.10).'
>
> Granada, 1985

Practically it means:

> 'to include the protection of the architectural heritage as an essential town and country planning objective and ensure that this requirement is taken into account at all stages both in the drawing up of development plans and procedures for authorising work.'
>
> Granada, 1985

The launching of the Krakow Charter in 2000 has recently reinforced the process. The Krakow Charter (Krakow, 2000) acknowledges the vast cultural diversity of Europe with a concomitant risk of conflict of interests induced by the various (and sometimes opposed) values and meanings attached to heritage assets. Conservation of cultural heritage is also seen as one of the ways to contribute to the sustainable development of society, and so should be an integral part of the planning and management processes of a community.

This enlargement of the notion of cultural heritage from individual (listed) buildings to the architectural heritage of historical urban areas (i.e. of a significant part of the European urban building stock) has not yet found many applications. One of the first is the Danish SAVE (Survey of Architectural Values in the Environment) method. This has been enlarged to an international version in InterSAVE (InterSAVE, 1997), and to a Danish prototype called ReSAVE, which takes into account not only architectural heritage values but also the resource value of buildings. Traditional methods of historic building research have been combined with resource conservation and life cycle analysis methods (Hassler and Kohler, 2000). The SUIT project will encompass several dimensions of sustainability applied to urban historical areas (urban fragments) which are threatened by large-scale developments, or by progressive decay (dereliction).

Buildings, building stocks and cities

From the perspective of a sustainable built environment in urbanised Europe, the emphasis is shifting away from the design of new buildings to the long-term management of the existing building stock. The maintenance and improvement of the existing building stock as the largest financial, physical and cultural capital of industrial societies signifies that the building stock itself is becoming understood as a basic resource.

In 1991, the European Commission established the Expert Group on the Urban Environment. Originally, the task of the group was to work on the integration of urban problems into environmental concerns. Today, the focus has widened. It embraces the large field of sustainability questions. The Sustainable Cities Project comes from the same background (EC Expert Group, 1996). The first phase of the project ran from 1993 to 1996, having four major goals:

- spreading the idea of sustainability around Europe;
- exchange of experience;
- sustainability at local levels, with long term perspective; and
- influence on policies at all levels.

The Sustainable Cities Project respects the individuality of European cities and is not intended to provide a general tool for application everywhere. The city is considered a complex mechanism with many internal relations which cannot be treated with a single instrument. The agenda was extended at the 1994 Aalborg conference, where the Charter of European Cities & Towns Towards Sustainability (Aalborg Charter, 1994) was passed. Part III of the charter is the Local Agenda 21. Eighty European cities and communes signed the Charter to develop individual measures to further sustainable development in their own cities.

A central point in the Charter is the requirement for public participation, as the inhabitants are acknowledged to be best acquainted with the problems of the environment surrounding them. Cities are 'living' systems, involving social dynamics, technical and building networks and the presence of people living in them. The human settlement with all its economic, social and institutional arrangements forms a system of its own, which needs to be respected. Historical evidence suggests that for their sound conservation cities must be kept within sustainable development activity cycles. Sustainable development emphasises: 'the city as a complex system which is characterised by flows as continuous processes of change and development' (EC Expert Group, 1996). This defines a political process, implied in planning which has an impact on urban governance.

Several EU research programmes have been devoted to the question of sustainable urban development. The BEQUEST project (Building Environmental Quality Evaluation for Sustainability through Time) is a 'concerted action' involving 14 partners from six EU countries between 1998 and 2001 (BEQUEST, 2001; Brandon *et al*., 1997; Curwell and Deakin, 2002; see also Chapter 12). A key aim of the project was to lay the foundations for a common understanding of sustainable urban development via a multi-disciplinary network, the BEQUEST extranet, which includes representatives from a wide range of actors and groups involved in the provision, use and maintenance of the built environment. This kind of integrated approach will help reduce the environmental uncertainties facing decision makers and policy makers in development and infrastructure industries.

In conclusion, the current broader European approaches to assessment methods include economic structures and cultural heritage and reflect their close relation to the ecological dimension. As a result, attempts have been made to use environmental assessment methods to develop sustainable cities considering not only sustainability issues as traditionally defined (ecological integrity, equity, participation and futurity) but also including cultural heritage and social questions as well. How the process of urbanisation consumes natural resources, whether it produces emissions that pollute the atmosphere and the effect development has upon biodiversity, all must be considered. Economic questions relate to the financing of the infrastructures, transport and utilities which are required to support the development of urban structures. Social issues concern the safety and security, human health and general wellbeing in our cities. The long-term perspective must never be neglected, as long-term stable conditions are necessary to assure general comfort and secure wellbeing for all social classes.

An alternative approach to cultural and environmental long-term strategies for the built environment

Threats

There is one main difference between a green approach and a sustainable approach. In the former, cultural and social problems are considered as obstacles to the realisation of green objectives. In the latter, the traditional green objectives are considered as equivalent to the economic, social and cultural objectives. In a green approach the emphasis is on limits and obstacles, whereas in a sustainable approach the emphasis is on synergy.

In the attempt to implement a sustainable approach two major problems have to be faced:

- how to find central objectives or 'values' which allow this synergy (Hassler and Kohler, 2001); and
- how to find compatible objectives for variables which must be measured on different scales (building/town, individual behaviour/ collective interests, short-term/long-term, etc.)

The proposed thesis is that there are two central values, which allow synergy: enlarged resource conservation and conservation of diversity. The problem of scalability can only be resolved through a parallel top-down and bottom-up approach.

As discussed above, the issue of the cultural value of buildings has been associated mainly with the conservation of individual monuments and historic urban fragments. However, since the early 1980s significant urban qualities in Europe, which are independent of monument and site protection issues, are disappearing. There are threats to urban ensembles, urban spaces and structures which do not include outstanding buildings/monuments. The main risks come from the loss of density, historic nature, complexity and quality of urban fragments. Speculative developments, driven by financial interests, menace the substance and identity of European towns by trying to take advantage of their historic nature as 'context' or as 'background'. The (historic) town has to be considered as a rare and endangered resource that is in need of protection (Johansson, 1996).

The issue of environmental protection has been associated mainly with individual (new) buildings. Analysis of the evolution of the European building stocks indicates that the critical issue for sustainable development does not reside in the standards for new buildings. Instead it is in the management of existing buildings and refurbishment of the post-World War II buildings as well as the conservation of the complex qualities of historic towns (Kohler *et al.*, 1999).

Despite the conservation action covering monuments (which embraces only a very small part of the building stock) and despite efforts to realise green buildings, the general trend now seen in building production is shorter life spans and higher material and energy consumption. In Europe this tendency is not yet fully visible, due to the generally long life span of the bulk of the existing building stock. The slow accretion of the building stocks can be advantageous because they are resistant to the tendency of short life spans and architectural fashions. At the same time 'slowness' is a danger when wrong decisions are taken. The undesirable effects become apparent when it is too late to correct the momentum of policy, strategy and production (lock-in) (Hassler and Kohler, 2001).

In a long-term perspective, the minimisation of the impact of the anthroposphere on the biosphere will be the central issue. Minimisation of impacts will mainly result from the conservation of resources. In economic terms, this means a steady-state economy, i.e. the continuous increase of quality with a minimum throughput (Daly, 1992). Similar principles were also prevalent in the pre-modern world for reasons of resource scarcity.

Intergenerational management and the production of long-lasting objects have survived in the building sector despite industrial production and against the architectural theories of the twentieth century. Theory and practice of building lags behind broader social movements. The size, the cost, weight, immobility and the one-of-a-kind character of buildings result in conservative trends. Buildings and building stocks follow a slow dynamic of change: the built environment reflects changes in design paradigms with a large delay. Even the perception of real changes is subject to a deceleration process: the changes also enter the collective consciousness only relatively slowly (Halbwachs, 1980; Boyer, 1994).

Principles and chances of a stable long-term development

The extensive modelling of energy, mass and financial flows in national building stocks in central Europe displays an enormous disproportion in the input flow over the output flows (approx. 5:1). This results in a non-stable situation (Kohler *et al.*, 1999). The only possibility for reaching a long-term stable, sustainable development is by massively reducing the input. In the future development of the building stock, the basic resources should not be continually drawn from nature but rather the building stock should become the principal resource. This is not a new idea; it has been the common practice for centuries. A steady-state development would need integrated value systems, which could be based on different indicators expressing the speed and scale of transformations.

The development of such indicator systems and decisions methods is necessary but not sufficient. A comprehensive strategy with guiding long-term stability principles is also needed. Research on ecosystems indicates that long-term stability resides in the capacity of a system to absorb and incorporate shocks (robustness). This stability seems to result from the relationship between system components that have different change rates and different scales of size. Instead of breaking under stress (brittle systems) they yield as if they were malleable:

> 'Some parts respond quickly to the shock, allowing slower parts to ignore the shock and maintain their steady duty of system continuity. The combination of fast and slow components makes the system redundant. Fast learns, slow remembers.'
>
> Brand, 1999

A similar pattern appears if we look for stability of urban systems. Johansson shows that urban culture is intrinsically sustainable and has a high stability:

> 'History provides surprisingly few examples of cities that have ceased to exist. The strength of sustainability of cities is thus the result of the accumulated investments of generations in the urban environment. The better we understand how to administer and develop these investments, the stronger the environment will become.'
>
> Johansson, 1996

The tendency towards a monoculture of cities, favoured historically by the town planning ideologies of CIAM (Congrès Internationaux d'Architecture Moderne), furthered by the development of private car traffic and supported today by the installation of shopping malls in the urban sprawl, makes cities unstable systems. Ruthless exploitation of natural resources is combined with growing social exclusion. The tendency towards monoculture is characterised by a growing reduction in the age of buildings that comprise the urban building stock. All buildings have a similar age; the decay process is self-inducing. Historic towns (not necessarily medieval towns or what remains of them) have preserved continuity and gain a stability through the existence of buildings from different periods which allow a differentiated appropriation by urban society. Johansson (1996) notes:

> ' . . . In short, workshops, small shops, local restaurants, in general small business so popular today, belong in old buildings. Subsidised theatres and art museums belong in the new buildings. Thus old ideas go along with new buildings and new ideas with old buildings.'
>
> Johansson, 1996

An alternative framework: scaleable indicators of sustainability

The principle of using different types of indicators (pressure, state, and response indicators) to describe the degree of sustainability has been established internationally. However, indicator systems exist on macroeconomic levels (national statistics), on regional and town planning (in particular indicators for local sustainability) and on the level of buildings and their life cycle.

Ecological indicators (EI) take into account resource consumption and impact on the ecosystem. Hofstetter (1998) presents the state of the art for life cycle analysis (LCA) and the complexity of evaluation methods. Crucial problems for building stocks are the operation energy related impacts, the evaluation of the ecological resource value of the existing stocks, and the local impacts of buildings which fall between LCA and EI system limits. Economic indicators for sustainable development exist mainly on a macroeconomic level. In environmental economics, three principles are generally advanced:

- the value of the environment (of nature);
- an extended time horizon; and
- the equity between human beings and between generations.

The economic valuation of ecological and cultural resources in the form of non-use values is the subject of international research (World Bank, 1994). Crucial issues are the discounting rates to be adopted, external costs and accounting for long-term risks. While economic aspects are already being discussed (Lichfield, 1988), the problem of the urban life cycle is just emerging.

Social indicators for sustainable development of large groups of buildings and sections of cities are often linked to social problems and population changes due to physical decay in housing estates. The deprivation of housing leads to social segregation and tends to concentrate low-income groups in specific regions. The succession cycle of changes in physical condition, population, organisation and economic factors is described by Madanpour *et al.* (1998) and MacNaghten (2001). New indicators, such as health burden, have been developed by Murray and Lopez (1996) to investigate health consequences of environmental impacts along with other factors.

Cultural indicators of sustainable development are based on a wide definition of cultural (architectural) heritage. The principal challenge is to develop indicators for a long-term cultural management of building stocks accounting for the architectural and cultural qualities of individual buildings and neighbourhoods, including spatial configurations. As a cultural resource, the building stock comprises not only the individual buildings but also the urban context. It is a main factor in the preservation of cultural memory and social knowledge and it ensures urban continuity (Lowenthal, 1985).

Through their historic diversity, quality and continuity the building stock and urban context constitute non-renewable resources (Johansson, 1996). The knowledge about buildings (how to design, build, maintain and use them) cannot be separated from the objects themselves; it takes the form of technical solutions as well as (artisan) tacit and explicit knowledge on how to realise them. As a cultural resource, the building stock constitutes in itself a long lasting, continuously understandable, materialised memory.

Cultural and natural resources

Cultural resources, in particular the architectural heritage, require protection similar to natural resources or safeguards similar to those for economic and social resources. This issue becomes predominant in a situation where cultural production is beginning to eclipse physical production in world commerce and trade (Rifkin, 2001). Access to cultural resources becomes as important as holding on to property. The commodification of human culture is leading to the risk of overexploitation and depletion of cultural resources just as natural resources were and are still depleted through industrial development. In this context, the notion of sustainable development is the most powerful, internationally discussed idea aiming at a harmonious long-term development and equity between different parts of the world, different social groups within society and for future generations. Globalisation, in the form of the internationalisation of markets, particularly the 'cultural market', does not provide a satisfactory development framework.

The idea of 'green buildings' reflects the state of development of industrialised societies. Originally the method of creating and assessing green buildings and the synonym 'environmentally progressive buildings' represented a means of market differentiation. The current assessment methods, proposed for international application (BRE, 1993; Cole and Larson, 1998; Cole, 1999), were conceived as an attempt to distinguish green buildings from other new constructions and to associate a supplementary (non-monetary) value with these buildings. This notion is perfectly understandable in local real estate markets. However, these measures are not linked to sustainability and even less to the preservation of the cultural value of the architectural heritage. The so-called 'cultural obstacles and limits' are in many cases very legitimate apprehensions about a development (even one that is well intentioned as the protection of the environment) which negates local and regional cultural aspects.

The advantage of placing the whole discussion within the framework of sustainable development is that there could be a real cross-cultural discussion in linking ecological, social and cultural objectives, and in placing them in a long-term, inter-generational perspective.

Perspectives

What can we learn from each other?

The discussion initiated at the Green Building Challenge Conference in 1998 (GBC'98) comparing green buildings from different countries can be extended. Every comparison needs to account for absolute quantities of mass and energy flow as well as local targets (how far from the average or best local solution). The advantage of using absolute flux data is that the ecological footprint of buildings and cities can be calculated. Through this method large international differences in impacts for comparable functional units will become apparent (Kohler, 1999). The comparison of buildings in their national context (in relation to the 'average' building) hides the fact that the specific environmental impact of one human being can vary enormously according to the society in which he or she lives. Models of the urban metabolism by Wolman (1965), Baccini and Brunner (1991) and Moffat (2000) have produced significant insights into these large differences. There are interesting attempts to define trans-disciplinary approaches to the study of development, in particular urban sprawl, regional development, urban and rural mass-flow and cultural issues (Baccini and Oswald, 1998). Furthermore analogies between urban development and wild ecosystems have become a promising object of research recently:

> 'Energy and material flows through human settlements are conceived as urban metabolism, in which material inputs are transformed into useful energy, physical structure, and waste. Principles of ecosystem succession are used to explore ways in which city development differs from that of wild ecosystems.'
>
> Decker *et al.*, 2000

Figure 6.3 shows a comparison of material flows between the Neolithic period and the present day.

These considerations are based on physical flows and situated at a relatively high level of abstraction through the complex mass flow (Adriaanse *et al.*, 1997) and LCA (life cycle assessment) models. This work highlights how difficult comparisons can be. In some cases, the mere concept of 'environmentally progressive' seems to be both physically and culturally inappropriate.

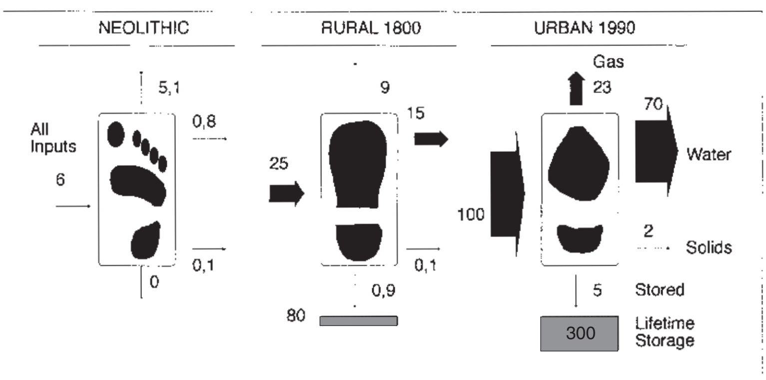

Fig. 6.3 Material budget (tons per year) for an individual human from the Neolithic to the present. Lifetime storage includes built structures and artefacts (Decker *et al.*, 2000)

Of course, there are certain internationally developed research methods and tools like life cycle assessment (ISO, 1997) which can be successfully applied to a range of situations, independently of the local and regional traditions. Much of the fundamental ecological research (Odum, 1983) uses examples of different social production systems to illustrate how efficiently and cautiously natural systems are dealt with by certain non-industrial societies. In the same way, economic and ethnographic research can be applied to different cultures, producing results of high scientific and social interest (Bourdieu, 2000). Productive cooperation can only be situated on a high level of abstraction of common methods and heuristics, not on the level of assessment tools, design tools, construction techniques and even less on the level of architectural forms of individual buildings. The management of building stocks, the evolution of urban fragments and towns, the future development of urban networks (Baccini and Oswald 1998) will be the crucial discussion points, at least in Europe, in the coming years.

New planning paradigms

The built environment and (historic) cities are key domains in sustainability. The objectives of intra- and intergenerational equity may be realised through different strategies.

> 'It is uncertain whether current economic processes are the problem or the solution to unsustainable ways. Are "win–win" solutions . . . possible here? Or are there inescapable trade-offs that have to be made?'
>
> Davoudi, 2001

There are basically two options: growth (expansion) or non-growth (steady state). The debate exists on a theoretical level between tenants of the ecological modernisation (Weal, 1993) and tenants of a risk-society (Beck, 1995). These questions are also being discussed in the planning context (Davoudi, 2001).

Sustainability certainly marks a turning point in the planning discussion after the Second World War. In most European nations, town planning emerged from reformist ideas on how to improve the social urban situation of the nineteenth century. Rapid industrialisation, hygiene, health and social problems should find their solution in a planned and designed town, while the culmination of the modernist theories was the reconstruction of towns after World War II, especially their adaptation to private mobility (cars). The very determinist planning techniques (masterplans as blueprints for the town and the society) began to be questioned from 1960 onwards and were gradually replaced by process-oriented, 'rational comprehensive' planning (based on computer simulations and managerial competence of the planners). The advocates of neo-liberal deregulation theories saw planners as unnecessary bureaucrats, while the 'pop-stars' of the architectural profession considered urbanism as an unnecessary ideology. Deconstructivist design was seen as the only way to restore 'meaning' to the city, which had been reduced to an urban sprawl as the historic city was declared dead. The economic recession in the 1990s showed the short-term failure of deregulation politics rather than the probable long-term consequences. Even developers demanded stronger government intervention, in particular through public–private partnerships. Inside the planning professions the need for a new vision became apparent at the same time as the sustainability debate reached the built environment. The basic antagonism between ecological modernisation and risk society inverts the question of sustainability objectives. Can the avoidance of environmental degradation be reached automatically through a reasonable growth policy, or is there an irreconcilable conflict between development and ecological needs? 'Environmental risks are produced industrially, externalised economically, individualised judicially, legitimised scientifically and minimised politically' (Beck, 1992).

In the risk society, the planning task has a pro-active dimension. It is ideological, socially responsive and interventionist. The planners' role is to defend the environment and the local identity (-ies) against the risk associated with contemporary economic processes. Planners should acknowledge the unintended consequences of development options in a long-term perspective. Ensuring against future uncertainty requires drawing on all kind of knowledge, expert and non-expert and sharing risks with a wide range of stakeholders (Davoudi, 2001).

Conclusions

Regional culture does not limit progress in the reduction of environmental impacts of buildings. Traditional design and building techniques resulted both from response to local climate and limits of natural resources. The protection of regional built culture and protection of the natural environment are therefore complementary. Globalisation, in the form of internationalised markets, and particularly the 'cultural market' does not provide a satisfactory development framework. Regional cultural traditions may counteract the homogenising tendencies of globalisation.

In Europe, the long-term maintenance and management of the existing stock of buildings and infrastructure determine evolution of the built environment. This stock is also the principal physical, economic and cultural capital of European societies. Through their historic diversity, quality and continuity the building stock and the urban context constitute non-renewable resources. Urban culture is intrinsically sustainable and has high stability. It is the result of accumulated investments of generations in the urban environment. The notion of sustainability comprises several dimensions in a perspective of long-term responsibility. It cannot be considered as a simple supplementary attribute to globalisation of markets, but rather, as an alternative framework. Relating cultural to environmental objectives cannot be realised through a simple improvement of information or technological transfer, but only though new paradigms for planning and management of towns, groups of buildings and finally individual buildings.

Productive cooperation can only be situated on a high level of abstraction of common methods and heuristics and *not* on the level of assessment tools, design tools, construction techniques and even less architectural forms of individual buildings. A different approach is needed by policy makers, architects, planners and urban designers, clients. The successful use of any technological and design strategy will depend upon improved contextual knowledge. Furthermore, the educational curricula will need to provide a grounding in regional culture and identity to enable future professionals and others involved with the built environment to base environmental, social and economic decisions on regional values. The management of building stocks, the evolution of urban fragments and towns, the future development of urban networks will be the crucial discussion points at least in Europe in the coming years.

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7

What is the Problem?

Ian Cooper

Despite their differing perspectives, the four chapters in this first section share a common concern. Expressed at its most basic, their authors' anxiety is about the continuing opposition or clash between the 'local' and the 'global'. More specifically, they are concerned about the impacts of externally imposed internationalised design guidance and standards for buildings on the continued existence of local identity, cultural heritage and diversity. Shields is concerned with globalised built environments that impose standardised international solutions regardless of local conditions and so act as portals for flows between localities. Gann shares this concern for the design of buildings that are sensitive to their local context. He questions how designers, planners and developers can (legitimately) transfer expertise, acquired within the limits of a specific bioregion, cross-culturally beyond the context that created it. Cole expresses the same concern using slightly different language. For him, while the principles underlying the design of green buildings may be universal, designers need to cater for the specific values and world views of those who will use and occupy them. Kohler agrees on the need for a sound knowledge of host regional cultures, but decries the (Western) imperative to export 'progressive' environmental practices as a form of cultural imperialism incompatible with Europe's commitment to sustainable development. Although Kohler does not make this explicit, such exportation can occur both within Europe and between OECD members, as well as between them and developing countries. Globalisation, as the internationalisation of markets and increased flow of information, is seen as disregarding cultural diversity and so is dismissed as inimical to the achievement of a stable, long-term framework for developing the built environment.

Box 7.1. Scholte's core theses on 'globalisation'

1. Globalisation is a transformation of social geography marked by the growth of supraterritorial spaces, *but* it does not entail the end of territorial geography; territoriality and supraterritoriality coexist in complex interrelations.

2. Although globalisation made earlier appearances, the trend has unfolded with unprecedented speeds and to unprecedented extents since the 1960s.

3. Globalisation appears today to have acquired certain juggernaut-like qualities, but it need not retain its present momentum indefinitely and could, in principle, reverse (though the chances of such a contraction seem remote at present).

4. Although globalisation has touched almost every person and locale in today's world, the trend has spread unevenly, being most concentrated among propertied and professional classes, in the North, in towns, and among younger generations.

5. Globalisation has had multifaceted causal dynamics, with the principal spurs having come from rationalist knowledge, capitalist production, various technological innovations, and certain regulatory measures.

6. Globalisation has not replaced deeper social structures in relation to production (capitalism), community (the nation and communitarianism more generally) and knowledge (rationalism), *but* it has prompted important changes to certain attributes of capital, the state, the nation and modern rationality, *and* it has encouraged the growth of additional loci of governance besides the state, the spread of additional forms of community besides the nation, and the development of additional types of knowledge besides modern rationality.

7. Contemporary globalisation has had some important positive consequences with respect to cultural regeneration, communication, decentralization of power, economic efficiency and the range of available products, *but* neoliberal policies toward globalisation have had many negative consequences in regard to increased ecological degradation, persistent poverty, worsened working conditions, various cultural violences, widened arbitary inequalities and deepened democratic deficits.

8. Globalisation is not inherently good or bad; its outcomes are largely the results of human decisions that can be debated and changed, *and* a host of alternative policies could avoid the ills associated with neoliberal globalisation, *but* the political challenges of achieving full-scale reform most not be underestimated.

Source: Scholte (2000)

Globalisation remains a much contested issue. As Scholte (2000) has remarked:

> 'What is globalization? Why has globalization occurred? How, if at all, has globalization generated social change? . . . if asked to specify what they understand by "globalization", most people reply with considerable vagueness, inconsistency and confusion. Moreover much discussion of globalization is steeped in oversimplification, exaggeration and wishful thinking. In spite of the huge deluge of publication on the subject, our analyses of globalization tend to remain conceptually inexact, empirically thin, historically and culturally illiterate, normatively shallow and politically naïve. Although globalization is widely assumed to be crucially important, we generally have scant idea what, more precisely, it entails.'
>
> Scholte, 2000, p. 1

Despite this vagueness, Scholte (2000) has tabled (pp. 8–9) what he sees as 'core theses' on globalisation. These are detailed in Box 7.1.

As Scholte's list indicates, perhaps the four authors in this section are right to be concerned. But what precisely should they be worried about?

The local versus the global

In the West, at least, a longstanding division exists between:

- the *local* – seen as particular or unique to a specific place and so often characterised as 'authentic' and 'organic', and
- the *universal* – seen as 'inorganic' and hence categorised as 'artificial'.

This division can, for instance, be traced back to the Enlightenment (Williams, 1999). Since then, Europeans and North Americans have laid claim to universal principles based on reason – such as scientific and technological progress, rights, egalitarianism and democracy. While these principles have not been held to mean that local cultures should be dismissed, liberal democracy has typically been viewed as a universally valid system that the West has a duty to help others achieve. Not surprisingly, others have begged to differ – see, for example the work of Burbach *et al.* (1997) and Germain (2000) on globalisation and its critics.

From a variety of anti-globalisation perspectives, the West is seen as forcing 'the other' (developing or transitional countries) to submit to Western (capitalist) ways of running an economy or ordering political affairs. To express the same concern in words more pertinent to the context of this book, the West is exporting inappropriate economic, cultural and environmental standards and practices for buildings and infrastructures, both within (and beyond) its borders. Much of the discomfort expressed by the four authors in this section can be traced to these kinds of roots. Consequently, their uneasiness appears to be as much political and economic as it is architectural or environmental. Political economy is therefore a useful starting point to begin to explore the underlying reasons for their unease. As Hutton has commented (Hutton and Giddens, 2000, p. 3):

> 'The argument has to be that the changes [brought by globalisation] are of such a degree that there has been a fundamental challenge to the operation and our understanding of capitalism.'

The production of the built environment is not immune from these changes. Prompted in part by the spread of the Modern Movement, the twentieth century saw an increased commodification of buildings which are now widely seen as interchangeable units of production capable of being conceived and built anywhere. There is now a growing cadre of architects and engineers willing to practise anywhere in the world, regardless of their understanding of local economics, culture, or climate. To combat this tendency, we now require architects and engineers explicitly dedicated to regionally and locally sensitive design, who are capable of recognising, protecting and enhancing the significant economic, environmental and social traits and characteristics of the locations in which they are asked to operate.

Internationalisation of production

According to Dicken (1992), the impact of globalisation was already profound a decade ago. He observed (p. 3) that the most significant development in the world economy since the early 1980s had been:

> 'the increasing globalization of economic activities . . . Few, if any, industries now have much "natural protection" from international competition whereas in the past, geographical distance created a strong insulating effect. Today, in contrast, fewer and fewer industries are oriented towards local, regional or even national markets.'

Internationalisation is a strategy being pursued by firms seeking to maximise, increase, or at least sustain, their profitability (Dicken, 1992, p. 145):

> 'An internationalization strategy can contribute to both parts of a firm's profit equation. On the one hand, expansion and increased penetration of international markets through direct investment can increase revenues. On the other hand, location of production in countries where some, or all, of the factors of production can be acquired at lower relative cost contributes towards the minimization of the cost element in the profit equation.'

For Dicken, a perquisite of international production is the presence of enabling technologies – such as transport, communication and organisation. Dicken gave no attention in his detailed examination of the processes of globalisation to the role of the construction industry worldwide. But to his list of enabling technologies should be added the availability of support services to provide a sufficiently productive built environment – at least at the point of immediate production, if not elsewhere in the general catchment area for employees.

Hertz (2001, p. 33) has commented critically on such internationalisation because of her concern about its impact on democracy:

> 'Corporations think nothing nowadays of breaking up their chain of production and locating the links all over the world wherever seems most advantageous. Designing their products in one place, entering into production alliances in another, outsourcing components and service activities somewhere else, sourcing their inputs, capital, raw materials and even labour from wherever costs of production are lower, tax benefits more favourable and access to raw materials or skills cheaper, and marketing in yet another place. Even firms previously comfortably situated within their home territories and relatively domestically oriented have recently disembedded their production and main operations from the parent state, seeking to lower production costs and expand in developing markets.'

And she has questioned (Hertz, 2001, p. 35) the outcomes of this process:

> 'What is the net result of global capitalism, of a world in which people's economic well-being and physical safety are determined primarily by

> the strategies and actions of international financial investors and multinational corporations? A world in which the primary service that national governments appear to be able to offer their citizens is to provide an attractive environment for corporations or international financial investors?'

She notes that such 'environments', while economically attractive to business, can be socially and environmentally unsustainable:

> 'In such circumstances . . . "pollution havens" are created as environmentally unfriendly policies are allowed far below socially desirable levels, human rights abuses, a blind eye turned to illegal acts, all in an attempt to attract foreign investment. . . .'

Shiva (2000, pp. 112–13), a founder member of the International Forum on Globalisation, has taken this criticism further. She suggested that, since the 1950s, a 'non-sustainable industrial paradigm in the name of development' has been exported:

> 'In a world of globalised, deregulated commerce in which everything is tradable and economic strength is the only determinant of power and control, resources move from the poor to the rich, and pollution moves from the rich to the poor. The result is environmental apartheid.'

Such apartheid can be explicitly marked by the kind of 'globalised buildings' that Shields describes in his chapter. These often stand, particularly in the form of hotels and airports for international travellers, in stark and insensitive opposition to local cultures whose values or traditions are much less ecologically demanding. Nor are these stark impositions restricted just to developing or transitional countries. Their incongruity can often be encountered in OECD countries too, especially in or adjacent to their cultural heritage sites or remaining 'wilderness' areas.

Consumption versus the regenerative capacity of the Earth

For Rees (2000), the problem is more systemic than the existence of localised pollution havens or even global environmental apartheid. It centres on the unsustainability of the ecological niche that industrial society has carved for itself. As a result, Rees sees humans as a species that has a pathological relationship with its ecosphere, the earth:

> 'Driven by an uncritical worship of economic growth, it seems that consumption by humans threatens to overwhelm the ecosphere from within . . . . The continuous growth of any species in nature is an unnatural condition that can be purchased only at the expense of other species and the integrity of the ecosystem as a whole.'
>
> Rees, 2000, p. 23

Looked at from the perspective of other organisms, humankind resembles an acute epidemic disease. Recognition of this problem is, Rees believes (2000, p. 24), simply the first step in finding workable solutions. Currently the problem remains, if not unrecognised, then unconfronted. Current world development models depend on high-income regions running a massive ecological deficit with the rest of the world:

> 'For example, Japan and the Netherlands both boast positive trade and current account balances measured in monetary terms, and their populations are amongst the most prosperous on earth. Densely populated yet relatively resource- (natural capital) poor, these countries are regarded as stellar economic successes and held up as models for emulation by the developing world. At the same time, we estimate that . . . these countries have an ecological footprint about eight and fifteen times larger than their domestic territories nationally. The marked contrast between the physical and monetary accounts of such economic success stories raises difficult developmental questions in a world whose principal strategy for sustainability is economic growth.'
>
> Rees, 2000, p. 34

It is not just that the ecological locations of high-density regions no longer coincide with their geographical borders but that their survival depends on them appropriating the ecological output and life-support functions of distant regions all over the world by means of both commercial trade and natural flows of energy and material through the ecosphere. As a consequence, Rees argues, development planning has to acknowledge:

> 'No [building,] city or urban region can achieve sustainability on its own. Regardless of the sensitivity of [environmentally 'progressive' buildings,] urban land use or environmental policies to ecological concerns, a prerequisite for sustainable cities is sustainability of the countryside . . . and the impact urban populations and cities have on the ecosphere.'
>
> Rees, 2000, p. 36

This diagnosis has been reiterated by two more recent (and related) studies. First, an international review based in three continents (Wackernagel *et al.*, 2002) has sought to track the ecological overshoot of the human economy globally. This has concluded 'Our accounts indicate that human demand may well have exceeded the biosphere's regenerative capacity since the 1980s' (Wackernagel *et al.*, 2002, p. 1). According to the research team's preliminary and exploratory assessment, based like Rees's on employing natural capital accounting techniques using biophysical units, 'Humanity's load corresponded to 70% of the capacity of the global biosphere in 1961, and grew to 120% in 1999.'

Likewise the World Wide Fund for Nature's latest periodic update on the state of the world's ecosystems (Loh, 2002) depicts this human load as having a severe effect on biodiversity:

> 'The planet is suffering such a rapid loss of its natural resources that we are now eating into its capital stocks of forests, fish and fertile soil . . . . It is very unlikely that the Earth will be able to run an overdraft of this magnitude for another 50 years without some severe ecological backlash undermining future population and economic growth.'

We are being warned that our rate of plundering the planet outstrips its regenerative capacity to support life. This raises an urgent issue. Will the type and level of international exchange of information – promoted, for example, by activities like this book – be able to generate sufficient potential to re-align the consumption generated by the built environment to stay within the planet's regenerative capacity within the short timescale identified? This seems unlikely. Instead our ability to respond promptly and positively to this issue will require much greater investment in efforts to enhance our understanding of the resources flows and environmental impacts arising from the construction, operation and disposal of built environments – not just locally and nationally but at a global scale too.

Industrialisation and the conditions of modernity

From a sociological perspective, Giddens argues in *The Consequences of Modernity* that criticism of capitalism and globalisation as the source of our problems is misplaced:

> 'The rapidly changing character of modern social life does not derive essentially from capitalism, but from the energising impulse of a complex division of labour, harnessing production to human needs

> through the industrial exploitation of nature. We live, not in a capitalist, but in an industrialist order.'
>
> Giddens, 2000, p. 11

Globalisation is simply a prevailing condition of 'late modernity'. For Giddens (2000, pp. 18 and 20), the dynamism of modernity derives precisely from the 'separation of time and space' – the dislocation of the global from the local that troubles the authors in this section of the book:

> 'The advent of modernity increasingly tears space away from place by fostering relations between "absent" others, locationally distant from any given situation of face-to-face interaction . . . . This phenomenon serves to open up manifold possibilities of change by breaking free from the restraints of local habits and practices.'

Such 'dissembedding' (Giddens, 2000, p. 21) lifts social relations from local contexts of interaction and restructures them 'across indefinite spans of time space'. Giddens (2000, p. 27) identifies separation of practice from place as occurring through establishment of what he calls 'expert systems', i.e.: '. . . systems of technical accomplishment or professional expertise that organise large areas of the material and social environments in which we live today.' Ironically, the first example he offers of such a system is the construction industry:

> 'I have no particular fear in going upstairs in a dwelling, even though I know that in principle the structure might collapse. I know very little about the codes of knowledge used by the architect and the builder in the design and construction of the home, but I nonetheless have "faith" in what they have done. My "faith" is not so much in them, although I trust to their competence, as in the authenticity of the knowledge which they apply.'
>
> Giddens, 2000, p. 27

Crucially, all 'professional' expert systems require an attitude of trust. Trust is related to absence in time and space (Giddens, 2000, p. 33) since there would be no need to trust anyone:

- whose activities were continually visible;
- whose thought processes were transparent; or
- whose workings were wholly known or understood.

According to Giddens, 'All trust is in a certain sense blind trust!' Trust in expert systems, he argues, rests upon faith in the correctness of principles of which one is ignorant. Seen from this perspective, the anxieties expressed by the authors of the four chapters in this section are clearly bivalent. They reside not just in the unknown and uniqueness of the nature of the cultural contexts to which information and technologies for environmentally 'progressive' buildings are being transferred, but in the correctness of the principles being applied as well.

Confronting the complexity

Expressed simply, the anxieties given voice by the authors in this section have multiple, complex causes. They arise from the intertwining of a range of factors, shown in Fig. 7.1:

- *globalisation,* with its attendant democratic deficits
- growing *urbanisation* and *industrialisation*
- the continuing *internationalisation* of both production and consumption
- the *overstretched regenerative capacity* of the Earth
- the *dislocation of the global from the local* as a condition of 'late modernity' in industrialised societies.

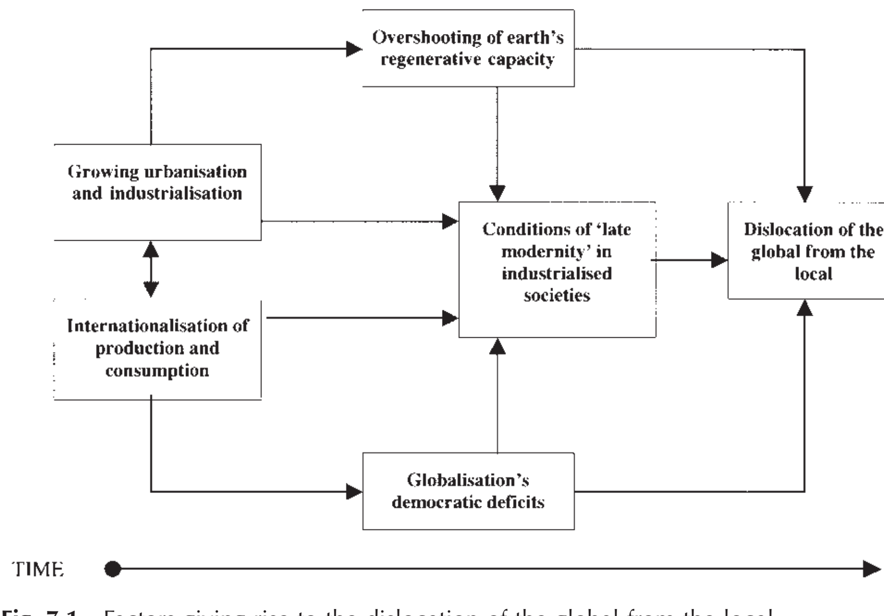

Fig. 7.1 Factors giving rise to the dislocation of the global from the local

A clear understanding of these factors is required if we are to construct a robust framework for taking appropriate actions when transferring information and technologies between cultures. Without this understanding, we risk acting blindly. If we do, our actions are likely to have unintended consequences.

What, beyond tinkering at the margins, can environmentally 'progressive' buildings achieve in developed countries if they are inserted into intrinsically unsustainable contexts and circumstances? Worse still, what will they achieve if they are imported into inappropriate regions and act as local portals through which flow production and consumption practices grounded in unsustainable Western patterns of industrialisation and urbanisation? The opening section of the book raises rather than answers such questions. It spawns many more.

1. What is the continuing impact of globalisation on architecture (A) and the construction industry (C)?
2. What are the current roles of A and C in the complexly intertwined processes of industrialisation, urbanisation, globalisation and modernisation?
3. Are A and C agents for or, at least potentially, anchors on the exportation of unsustainable patterns of industrialisation and urbanisation?
4. Are A and C being dragged along behind (willingly or unwillingly) as essential support services – necessary to providing productive and profitable settings in which advanced capitalist forms of production and consumption can operate?
5. Or are A and C being sent on ahead to put in place globalised buildings and settings that act as symbolic landing craft or concrete bridgeheads for further industrialisation and urbanisation?
6. What space (room for manoeuvre) remains for the creation of environmentally 'responsive' buildings and sustainable development to operate in?
7. Where, when and how will the impact of climate change, overshooting the planet's regenerative capacity, or loss of bio- and cultural diversity intervene in the current trajectory of global industrialisation and urbanisation?
8. Will the predominant architectural and construction practices serve to accelerate or delay, to amplify or diminish, the consequences of this intervention?

9. What capabilities will architects, constructors and clients need to reverse this? What capabilities will civil society need to scrutinise how effectively the built environment is being delivered or managed on its behalf?
10. What aspects of governance need to change to accommodate such a reversal?

To be able to answer such questions, we need conceptual frameworks and decision-support systems capable of simultaneously focusing our attention both broadly and in depth on:

- the political economy of the production and consumption of the built environment in both developed and developing countries, especially as this relates to urbanisation and industrialisation;
- its relationship to the engines and trajectory of globalisation; and
- its local and global contributions to the outstripping of the earth's regenerative capacity.

Critical regionalism revisited – towards an architecture of resistance?

The questions posed above also require a specifically architectural response. Fortunately the issues they address are by no means new to architectural discourse. In 1961, Paul Ricoeur wrote:

> 'The phenomenon of universalization, while being an advancement of mankind, at the same time constitutes a sort of subtle destruction, not only of traditional cultures . . . but also what I shall call . . . the creative nucleus of great cultures. . . . We have the feeling that single world civilization at the same time exerts a sort of attrition or wearing away at the expense of the cultural resources which have made the great civilizations of the past.'

For Ricoeur, this phenomenon was a double-edged sword involving both the eradication of local cultures and the erosion of great cultures by universalisation:

> 'It seems as if mankind, by approaching *en masse* a basic consumer culture, were also stopped *en masse* at a subcultural level. Thus we come to the crucial problem confronting nations just arising from

> underdevelopment. In order to get towards modernization, is it necessary to jettison the old cultural past which has been the *raison d'être* of a nation? . . . There is the paradox: how to become modern and to return to sources; how to revive an old dormant civilization and take part in universal civilization.'

In 1983, Frampton (2002, pp. 77–8) used Ricoeur's paradox as the starting point for his own call for an 'architecture of resistance' to be practised not by an *avant-garde* but an *arrière-garde* (p. 81):

> '. . . which distances itself equally from the Enlightenment myth of progress and from a reactionary, unrealistic impulse to return to the architectonic forms of the pre-industrial past. A critical *arrière-garde* has to remove itself from both the optimisation of advanced technology and the ever-present tendency to regress into nostalgic historicism or the glibly decorative.'

Frampton contended that only an *arrière-garde* has the capacity to cultivate a resistant, identity-giving culture while at the same time giving recourse to universal technique. To label this movement he appropriated the term 'critical regionalism' from Tzonis and Lefaivre (1981):

> 'The fundamental strategy of Critical Regionalism is to mediate the impact of universal civilisation with elements derived *indirectly* from the peculiarities of place. It is clear that Critical Regionalism depends on maintaining a high level of critical self-consciousness. It may find its governing inspiration in such things as the range and quality of local light, or in a tectonic derived from a peculiar structural mode, or in the typography of a given site.'

Frampton saw this 'architecture of resistance', through its emphasis on reaction to place, as waging a guerrilla war (Irace, 1985, p. 7) against 'the ubiquitous, space-endlessness of the consumerist Megalopolis' by addressing itself to 'bounded domains' rather than 'free standing objects'. Frampton (1985) hoped that the resultant architecture would be able to resist '. . . being totally absorbed by the global imperatives of production and consumption'.

Krause (1990) criticised Frampton's critical regionalism as resting on the seemingly innocent (and hence naïve?) assumption that: '. . . for a given region there are appropriate architectural forms. [And that] These place forms will resist the universalising tendencies of modernism.'

Conversely, Herr (1996, pp. 17–18) identified what she saw as the 'provocative potential' of Frampton's region-specific analysis:

> 'This critique can be enormously useful in the pursuit of a more sensitive, environmentally attentive, dialectical, historically challenging, hegemony-resistant [approach] . . . Above all, critical regionalism refers less to a specific kind of building than it does to the resistances that architecture can offer to a totalising environment.'

Critical regionalism shares its focus on place and on resistance with what, in human geography, McGinnis *et al.* (1999, p. 211) have called 'bioregional restoration'. The goal of this is to:

> '. . . re-immerse the practices of human communities within the bioregions that provide their material support. . . . Bioregional restoration can be a therapeutic strategy to expose ourselves viscerally to local ecosystem processes, to foster identification with other life forms and to *rebuild* community within place, as the insights and local information that emerge from restoration activities affect the cultural and economic practices of the human population.'

And, like critical regionalism, bioregionalism is focused on combining 'grounded, place-based knowledge' with scientific understanding (Goldstein, 1999, p. 163) – i.e., on re-integrating the local with the universal or global.

The positions outlined by critical regionalism and bioregional restoration can thus be called upon to give a name and a mode of attack to the concerns expressed in the early chapters of this book. A re-articulation of critical regionalism, drawing on more recent developments in bioregionalism, could begin to provide the possibility of an 'architecture of resistance' that is sustainably aware. Such an approach could directly embrace Cole's desire for an architecture that reconciles technological change with both the local environment and occupants' values and world views. It could also directly confront Kohler's desire for a regional architecture based on a sound (but not unreflective) knowledge of local culture and heritage. It could also begin to address Gann's complaint against designers and developers who work outside the limits of the bioregion in which their knowledge and experience has been acquired. And indeed, if successful, a 'critical' regional architecture could even, in Shields' terms, not just act as a portal for the flow of information between localities, but simultaneously operate as a bastion for the defence of significantly important local economic, environmental and cultural differences.

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Section II

Understanding Expectations

8

Understanding Expectations

Nick V. Baker

This section of the book explores the impacts of expectations from different viewpoints – economic, social, behavioural, and at different scales from personal to global. The word 'expectation' means different things to different people – is it something that might happen, that probably will happen, or that should happen? Is it something to do with 'right' or merely the result of a statistical probability?

In common usage, 'expectation' carries an implicit assumption that, if possible, it is met or fulfilled. Ever since Admiral Lord Nelson's famous 'England expects that every man will do his duty', we associate expectations with justification – we expect a good health service, we expect law and order.

Expectation at a social level suggests momentum for aspects of our way of life – shelter, transport, communications, hygiene, education, entertainment. It may come as a shock to consider that this fundamental trait, which we regard as inevitable as water flowing downhill, as universal as gravity, could be contributing to the global environmental and social crisis which is threatening the next decade and beyond.

Is anything in common between the 'expectation of the Western world to have cheap and plentiful food' and the 'expectation of a person sitting next to an open window to experience draughts', or do the two syndrome simply share the same word? This section brings together four contributions that cover this wide scale. The commentary at the end of this section weaves a network between what may at first appear to be disparate elements.

Seaden (Chapter 9) argues that the construction industry free market should and will respond to clients' requirements and, though he may not say it explicitly, clients' aspirations and expectations. For environmentally friendly solutions, this places a very heavy demand on the education of the client and design team. Other industries are cited as exemplars of innovation promoted through competition. In this context of competition, the supplier hones the product to the consumers' demand in order to gain competitive advantage. But is this comparison applicable to the construction industry? Buildings have long lives and can endure for several generations – their requirements are different from other more disposable consumer goods. In addition, buildings stay still and are rooted to one place. Building design has a notoriously high inertia and a long feedback loop. The timescales for innovation and change brought about by this process may be too slow or otherwise inappropriate to meet the current environmental and social challeges.

The expectation of thermal comfort is assessed by Brager and de Dear (Chapter 11). This chapter traces the history of the growth of demand for air-conditioning, fuelled largely by vigorous post-World War II advertising campaigns. This growing demand is also supported in parallel by the growth of national and international standards, resulting in energy intensive mechanical systems being almost obligatory. More significantly, they also question the science on which the current standards and codes of practice are based. This highlights the danger of international regulation where not only are regulations inappropriate to the context, but may even be fundamentally wrong.

Broader aspects of user satisfaction with buildings are investigated by Leaman (Chapter 10), who refers to results from extensive field studies. Of the many relevant findings, one that relates to expectations is the attitude of users to personal control of their environment – whether via a thermostat dial or a complaint to the building manager. Has this touched on the fundamental nature of expectation – to be, to some extent, in control of one's own environment?

The transfer of technical information between and across cultures is crucial for meeting the global environmental challenge. Moreover, it will increasingly affect built environment designers, clients, educators and researchers. Curwell (Chapter 12) describes BEQUEST (Building Environmental Quality Evaluation for Sustainability through Time), which was a concerted-action research project concerned with sustainable urban development involving different cultures. This provides lessons for the formation of cross-cultural networks and the necessary adaptation of international information for use at a local level.

It remains to be seen if the diffusion of beneficial and well intentioned environmentally friendly technical and scientific knowledge will be sufficient and in time. It may be that the same systems of global communication are far more effective at diffusing the unsustainable expectations of the Western world. This issue is discussed in the section commentary (Chapter 13).

9

The Role of the Client in Shaping the Satisfactory Outcome of the Construction Process

George Seaden

Introduction

The last quarter of the twentieth century was strongly influenced by the rapid expansion of world trade, which in turn created changes in most national and regional markets. This development has been compounded by the fact that consumers have established themselves as a significant factor in defining the nature of production of manufactured goods and services. Customer satisfaction is emerging as an important competitive tool, the impact of which on the construction industry is rendered more complex, given several exogenous driving forces such as financial markets or innovation.

Depicting these trends is very much an exercise of gazing into the rear view mirror while trying to plan the route ahead. While they need continuous adjustment, some of the major factors that are likely to have relevance to buyers of goods or services appear to be well established.

Given that the industry is currently in transition, it is important to consider customer satisfaction and related dynamics when examining possible measures that are necessary to ensure sustainable development of the built environment. This is because such measures need be compatible not only with construction industry practices, but also with the client or the user who will need to agree to such more environmentally compatible solutions and actually pay for them.

The terms 'client', 'customer', 'purchaser' and 'user' are used interchangeably in this chapter to indicate the demand side of construction, and the terms 'builder' or 'contractor', together with architects, engineers and other members of the design team, to indicate the supply side. The issue of who is the 'real' purchaser or ultimate user is not addressed here. In the current competitive context (Halpin and Huang, 1995), with its emphasis on total quality management (TQM), satisfying the immediate as well as the ultimate beneficiary of the construction process is paramount in overall customer satisfaction.

This chapter is primarily based on economic and production practices currently found in industrially developed countries, particularly those with a pronounced free-market approach. More often than not, these countries tend to have strong ties to Anglo-American cultural and democratic governance values. While the populations of these countries represent only a small portion of the citizens of the planet, their share of the global economy exceeds 50%. Perceived and/or real values and acquisition habits of these countries are disseminated throughout the all-pervasive 'global village' communication systems, which have enabled access to a continuous barrage of information promoting purchase of goods and services, with significant marketing content emulating Western lifestyles.

No argument will be presented in this chapter as to the validity of one way of life versus another in a world of inherent cultural, religious or geoclimatic differences. As a matter of record, there are many examples of inappropriate use of 'international' style products or services of construction or manufacturing nature, when more traditional, locally sensitive approaches would be more advantageous. Nevertheless, in much of the world, there has been a growth of middle-class consumers with increasing disposable income. Even in underdeveloped countries, small groups of well-off consumers are present. It is this cluster of clients and their preference for 'world' style of goods and services that tend to set international acceptance standards.

As will be suggested in greater detail, acquisition decisions by consumers take place in a complex context of prevailing supply and demand forces, regulatory regimes, availability of financial resources and many other market factors. Purchaser views of real or perceived benefits to be derived from a specific acquisition decision are particularly important in the open, free-market economies. Ultimately, it is their choice to maximise their immediate gratification or to take into account more regional, social and/or environmental values. To ensure the success of sustainable development a balance is required between quick satisfaction of customers and an investment in the needs of the community and of future generations.

Hence, at least in the countries with free-market economies, 'top-down' government-led sustainability policies are likely to encounter difficulties unless there is also a popular, 'grass roots' level of consumer demand for such product characteristics.

In the context of large global firms' focus on the consumer as the source of competitive advantage, the role of the client is examined, as well as of other factors and relationships that influence the outcome of the construction process. Even though there are indications of dissatisfaction with construction goods and services in many countries, given the influence of local practices and traditions, this analysis and its findings are limited in scope to industrially developed countries with a market-based discipline. It presents a framework of the principal driving forces that shape the outcome of the building process, based on the available knowledge and research regarding construction markets in the United Kingdom, the United States, Canada and some European countries. It also comments on some challenges facing the introduction of sustainability measures.

First, changes in the global manufacturing firms that have led to greater consumer focus are examined and compared to the behaviour of the construction industry. Then various characteristics of this industry and of its customers are reviewed, including some that are likely to lead to less than optimal 'value' solutions. Construction does not operate in isolation; therefore the powerful contextual forces of financial markets on perceived value and on the cost of ownership are assessed. Regulatory regimes as a means of protecting the buyer and expressing societal values are analysed, innovation as a potential driver towards enhanced performance is examined, and results of several recently undertaken construction customer surveys are reported. Finally, the role of the client within the project management process is looked at, with the difficulties inherent to the temporary, virtual, multi-organisational structure.

It is concluded that the satisfactory outcome of the construction process is shaped by several contextual drivers, namely the intrinsic characteristics of the industry, the financial markets and the regulatory regimes. However, in the context of a supply–demand equilibrium, clients' needs and preferences have been gaining in importance. Current trends to move away from the traditional design–bid–build practice into more open, trusting, risk sharing relationships of joint ventures, alliances or partnerships signal a change in the customer–supplier relationship towards greater satisfaction. As an alternative, some clients are choosing not to be involved in the construction process at all and simply purchase the use of constructed facilities.

Consumer satisfaction as a source of competitive advantage

We are well aware of numerous 'world' brands offered internationally in pharmaceuticals, automobiles, food, aircraft, sports equipment, communications, soft drinks, banking or entertainment. There is almost an infinite array of services and products offered by large global firms now perceived as having 'gold' standards of quality, serviceability, functionality and overall satisfactory performance.

With the increasing openness of world trade there has been ever-growing interest in what made these global firms truly competitive. Opinions on that matter have evolved greatly since the mid-1970s and continue to be open to debate. Porter (1998) and others suggest that companies have been responding to the challenge of superior quality and lower prices through continuous improvement in their operational effectiveness. Re-engineering, lean production, investments in information technology, TQM and other techniques of optimising productivity and asset utilisation have now all become parts of companies' efforts to become and/or remain competitive in the global market place. Porter also suggests that continuous improvement in best practice utilisation must now be considered a pre-condition to achieve profitability, and that companies have to create unique competitive positions through integration of all their competencies. To have a truly lasting competitive advantage they need to offer differentiated, value-creating new products to their customers. Quality, durability and serviceability at a reasonable price are now expected as a norm from suppliers of goods and services.

Multi-national and increasingly global manufacturing companies have emerged that are able (Govindarajan and Gupta, 1997) to:

- reduce capital, product development and operating costs per unit;
- use their significant purchasing power to minimize input costs, obtain volume trade terms and reduce transaction costs by standardisation; and
- build a world-class position in specific areas through strategies of core competency.

These companies have been able to expand their international market share by offering to their customers better initial price/quality performance as well as satisfactory after-purchase service.

In turn, these companies require a multitude of accounting, legal, advertising and consulting advice, and global service organisations have followed this opportunity (Nahapiet, 1997). Integrated service firms, with extensive knowledge of local constraints yet linked internationally to share best practices, compete with their expertise pools and high degree of responsiveness. Until recently, it had been generally assumed that local firms have certain natural advantages of a better understanding of regional or national preferences, regulations and cultural differences as well as greater facility with local sourcing and distribution channels. But increasingly, global firms are able to promote internationally desirable goods and services or, when necessary, to customise their production to suit local requirements.

An underlying theme of this global evolution is to gain competitive advantage over the 'commodity' type suppliers by offering a differentiated product or process that provides unique long-term advantages to the customer. Global firms that have been successful in this game enjoy higher margins of profit while continuously investing in new ways to meet or exceed their clients' expectations.

Accordingly, customers' needs and wishes are continuously probed and investigated through satisfaction surveys and focus groups and are shaped by carefully designed marketing campaigns. New product or service launches are designed and then fine-tuned, with variable approaches for different cultural or socio-economic groups. However, the main purpose is to create a perception or an image in the mind of the buyer (supported by a measure of reality) of an improved and better offering. International companies seldom make radical changes to their core product lines but there is continuous effort to make marginal adjustments in the functionality, utility or packaging in order to deliver 'new and better'. Feedback is actively solicited and complaints are responded to. Retaining current customers is considered essential, and adding new ones a priority for ongoing success.

Increasingly, customers and suppliers of goods and services, particularly those of a more complicated nature (aeroplanes, communication systems, enterprise data management), look beyond the immediate commercial transaction at a reasonable price. They wish to enter into an extended, mutually beneficial relationship where the total service provided is the key deliverable.

It should not be forgotten that even in the most industrially advanced countries, a significant portion of the industrial output is still being delivered by small and medium size enterprises (SME) with a local focus. Repair shops, medical clinics, educational institutions, specialised manufacturers or food processors continue to cater to local tastes or preferences, making sure that a satisfied clientèle is the basis of their success.

In contrast with such deliberate client-orientation, analyses of satisfaction with the output of the construction industry shows a different image. An American construction industry group (The White House – Construction Industry Workshop, 1994) noted many deficiencies in construction projects and set some broad improvements goals for both the construction process and facilities use:

- 50% reduction in project delivery time
- 50% reduction in operations/maintenance costs
- 30% increase in facility comfort and productivity
- 50% fewer occupant-related illnesses and injuries.

A British study of construction, known as the Egan Report (Construction Task Force, 1998), also focused on delivering value and satisfaction to clients and set continuous improvement goals for the construction process:

- 10% annual reduction in construction cost and time
- 20% annual reduction in project defects.

There is a long history, extending to the present day, of problems in the construction industry. Process issues such as lack of timely delivery, quality issues, uncertain value for money and uneven post-delivery service continue to affect many builders and their clients. These problems do not originate from a single source and there are no simple solutions. As will be described in the following sections, construction is a complex industry subject to many powerful driving forces. Some are external to the production process, others are inherent to the very nature of the output. However, some improvements can and are being made to enhance the level of satisfaction.

Characteristics of the construction output

Buildings, bridges, roads and other constructed works almost always intrude on the physical environment and tend to impact on the surrounding community. Once implemented they are complicated to change, and are made to last many decades, sometimes even centuries. To remain functional they require continuous repair and upgrading. Every constructed project is essentially unique (Carassus, 1998), primarily because of the particularities of different locations and the influence of the weather on the site work. Even in the case of highly prefabricated residential projects consisting of identical units, every home is likely to be somewhat different. The above-mentioned characteristics have often led to the suggestion that construction is different from other industries and is simply not amenable to comparative analysis.

Nevertheless, from a purely production perspective, particularly when it concerns new construction, it is essentially an assembly-oriented industry, with a reasonably complex supply chain, operating mostly in a project mode. Most construction output consists of putting together standard prefabricated modular elements or sub-assemblies. There is still a great amount of variation from project to project but, based on the recent experience of new approaches to offshore platform construction (CRINE, 1995), greater use of standard sub-modules could lead to improved performance. A certain amount of customised, project-specific work still exists, but prefabrication of structural elements, wall panels, HVAC ducting, piping and many other assemblies is now common. In some countries, production of even more complex sub-modules (bathrooms, kitchens, major service bundles) is undertaken in a quasi-manufacturing mode, with all the benefits of prototyping, consumer evaluation and quality assurance. There is also production of complete homes (predominantly in North America) that are fully manufactured off-site and then only require a foundation and a service connection before being ready for delivery to customers. Using techniques common to the manufacturing industries (e.g. limited production runs with some customisation) has allowed this sector of the industry to deliver reasonably satisfactory results. Although construction is less amenable to mass production techniques, it could take advantage of current computer assisted advanced manufacturing processes with precise tolerances, continuous quality control and fewer defects.

Only a limited number of construction projects have truly unique features because of their location (harbours, roads) or dedication to support a very specific service or industrial purpose (medical laboratories, aluminium smelters). Politicians, promoters or buyers of sports arenas, museums and other civic or 'prestige' initiatives will often wish their projects to be one-of-a-kind to a point where the use of standard sub-assemblies may not be advantageous, and may even be contrary to customer desires. All such projects display the typical characteristics of Complex Product and Systems (CoPS) (Hobday, 2001), and unless the appropriate project management and industrial process base have been implemented, including broad representation of all interests, they tend to become subject to cost and delivery overruns, and general dissatisfaction.

Another important aspect of the construction industry is that in most industrialised countries the majority of constructed assets are already in place and need to be maintained. Thus, some 30% to 50% of building activity is dedicated to repair, renovation or upgrade. Many of these projects require traditional skills, methods and materials corresponding to the original work, and advanced industrial approaches may not be applicable.

All transactions between the purchaser and the supplier of construction goods and services are subject to numerous contextual factors that strongly influence the final outcome. Traditionally, locally available building materials were used because of bulk and the weight considerations, cost or suitability to local climatic conditions. However, lighter and stronger materials, advances in modularisation, and improvements in transportation techniques have made long distance sourcing economically feasible. Construction labour tended to be skilled in certain crafts, often associated with local building traditions, but with increasing off-site prefabrication and sub-assembly site workers now appear to be recruited from economically deprived regions with limited construction skills such as Mexico, Thailand and Eastern Europe.

Construction is an industry dominated by small firms undertaking small local projects. In most countries there are few companies with true industrial structure, and market share of such organisations rarely exceeds 2–3% of domestic construction volume. There are even fewer multinational organizations comparable in size and scope to the global manufacturing businesses.

Thus, construction output presents many facets. Some projects are or could be produced by processes similar to manufacturing and thus achieve higher levels of consumer satisfaction. Others are truly of a custom nature and remain in the domain of craftsmanship.

Perceived value and ownership cost

Studies of construction customer preferences (Chinyio *et al.*, 1998; Wong *et al.*, 2000) indicate that clients are mostly concerned with obtaining 'value' through a reasonable balance between initial capital outlay and costs of operation, while also achieving high performance and functionality. Irrespective if the project is of a public or private nature, there is an inherent cost of ownership and an expectation of a positive return on investment, through a flow of earnings or equivalent benefits. By their very nature, construction projects are capital intensive. Since owners only rarely have large surpluses of capital funds, borrowing significant amounts on financial markets and high leverage ratios are typical of the construction industry.

Since the mid-twentieth century, financial markets have been subject to major shifts. However, trends have emerged since the early 1990s with important impacts on the cost of capital and thus on the behaviour of buyers of construction. From 1945 onwards, governments of almost all countries made massive investments in an infrastructure of roads, bridges, schools, hospitals and public housing while at the same time creating a social welfare network, all through deficit financing. As a consequence, borrowing requirements of governments grew, together with increasing inflation. This created an ideal situation for the owners. The demand for buildings and infrastructure increased rapidly with the growth of population thus ensuring that all newly available space was immediately filled. At the same time, the value of their assets grew with inflation while their long-term financial obligations decreased in real terms. Thus, maximum borrowing and rapid construction became the game to maximise the owner's financial benefits. In the face of rapidly escalating values, project quality and user satisfaction became a lesser priority. This scenario of the 'real estate bubble' finally imploded in the late 1980s, though pockets of inflationary excesses and of speculative owners' behaviour continue to exist.

There have also been significant changes in the factors influencing ownership cost since the early 1990s. Most developed countries have become more disciplined with respect to public funds, first reducing and then eliminating deficit budgeting. As well, there has been agreement amongst central banks of major industrial countries to contain inflation to low levels. Furthermore, highly competitive world trade and global financial systems have created opportunities for rapid deployment of funds to the time and place where returns can be maximised (Swyngedouw, 1992). Shorter-term investments in equity financing, particularly of high technology ventures, brought in returns far in excess of those on longer-term, fixed asset investments in construction projects. Institutions and individuals discovered that with inflation contained, constructed assets did not automatically grow in value. In fact, their assets could depreciate, unless they were of high quality and attracted satisfied users to generate positive earnings flow.

At the same time, many private industrial and commercial organisations examined their operations from the perspective of their core competence, and found that ownership of buildings or infrastructure was not essential to their mission. The return on investment of their fixed assets was discovered by these clients to be less than satisfactory, thus precipitating policies of divestment and leasebacks from specialised firms. The public sector also increasingly discovered that it did not need to own constructed facilities. The required space and/or infrastructure services could be purchased through a competitive process, with guarantees of performance and satisfaction.

In this context, perhaps the most important factor is the low level (0–3%) of inflation with an occasional excursion into the deflationary range. With escalating capital asset values not available and no shortage of available space, owners of built facilities find themselves under conventional business pressures. Earnings rather than valuation became important to investors.

Hence it could reasonably be expected that satisfactory return on investment in a construction project would be a good overall indicator of a positive outcome for the client. However, different customers tend to be motivated by a variety of factors beyond overall profitability.

Those who are selling or renting single family houses or apartments/condominiums in multifamily units and/or general-purpose office, commercial and industrial space clearly need to maintain a positive return on investment to remain in business. Purpose, performance and quality expectations for such spaces are fairly well established and easy to compare on a relative basis, although difficult to measure in absolute terms. In many instances builders and developers anticipate the market and undertake such projects on a 'speculative' basis. While demand for constructed space is notoriously difficult to evaluate, in most industrially developed countries (excluding certain areas with rapid urban growth) supply now matches local needs, with an array of offerings at different price/quality points. Under those circumstances, knowledgeable customers are generally unwilling to acquire 'at any cost' or 'at any quality' and are able to obtain satisfactory 'value-based' projects at market rates. Less discriminating purchasers, with little understanding of what they are buying and/or being tempted by bargain pricing, end up at the mercy of market forces, much as in other sectors of the economy.

Clients who depend on earnings directly generated by the constructed facility (toll roads, transmission lines, power stations, etc.) also have a fairly simple value relationship. Such projects are generally very capital intensive, and careful planning of the expected total ownership costs (capital and operating) is an essential element of the decision to proceed. With the exception of overenthusiastic corporate promoters who tend to underestimate the cost and the time of completion, most customers look to positive financial results as a source of satisfaction.

There are also public or private customers (Seymour, 1987) who seek to build more specialised projects, in order to further production of industrial goods (customised industrial buildings, laboratories) or social services (hospitals, educational institutions). The purpose and performance of such capital assets are closely linked to the desired production or service characteristics. At the outset of these projects, many customers have uncertain expectations of the outcome. Their needs and wants are generally modified during the construction period. Furthermore, their budgeting practice tends to treat capital and operating expenditure as separate items, and organisational arrangements prevail where one corporate division will implement the capital project and another will operate it. Under those circumstances optimal purchase decisions are often difficult. In this category of projects two groups of customers can be identified, as follows:

- Those where the operational expenses (labour, supplies, administration) and the cost of installed equipment are considerably higher than of the construction itself. Projects in support of expanded industrial production or services are generally driven by rapidly changing market forces, where being able to provide the facility as rapidly as possible appears to be more important than the financial discipline or the operational functionality. Given the time required for planning, design and approvals, such projects are often completed in great haste, with cost overruns and indifferent quality. Even then, the commercial opportunity may already be gone and major replanning for the next market event will be required. All of the above factors tend to lead to higher than average costs and lack of satisfaction.
- Those where the principal purpose of construction is to deliver services (health care, education). Clients in this group are often in the

public sector or are in associated activities. While cost performance and functionality are generally the stated objectives, the service sector generally has difficulty in implementing objective measurement tools for evaluation of the long-term 'value' of constructed facilities. Thus, the initial cost is most often used (and sometimes legislated) as the project selection tool. Furthermore, there may be civic or political pressures to make a significant physical 'statement' to the community in the form of highly visible projects, often leading to expensive monumentalism and excessive ownership costs. While these projects sometimes manage to be delivered within the original budget parameters they are seldom seen as satisfactory on the basis of the return on investment.

Finally, there are many clients who seek essentially 'standard' offerings of repetitive elements such as buried pipes, streets, lighting, transmission towers, small bridges, repairs or renovation to various buildings or civil engineering works. The purpose and performance of such elements are not only well established but often subject to highly prescribed construction and operating procedures. Often such works are undertaken as parts of larger systems, and their individual features are not explicitly linked to the overall system performance. In turn, relating short-/long-term operational performance of individual buildings or urban systems to ownership cost is difficult, with few total value assessment tools. Projects for this customer group are generally acquired on an initial cost basis, which sometimes leads to future maintenance cost issues.

In summary, financial market forces and supply–demand considerations clearly influence the perception of value received. However, different types of buyers of construction goods and services display a variety of selection criteria.

Impact of regulation

It has been historically recognised that building projects must be undertaken with due regard for the safety and security of the immediate user as well as of the community at large. Thus, most governments have established regulations that set out minimum standards for structural stability, fire resistance, supply of clean water and evacuation of wastes, access and comfort. Beyond such minimal societal values, there are many other characteristics such as durability, energy efficiency, sound insulation, quality of finishes, thermal and moisture resistance, most requiring expert understanding of building science.

Some countries with more liberal *laissez-faire* policies tend to keep regulation of non-essential characteristics to a minimum, in the belief that less regulated markets are economically more efficient and will deliver to the customer the optimum product at the best price through the competitive process. Such *laissez-faire* policies are counterbalanced by the legal remedies available to customers who have not received expected value. Others tend to believe that all constructed products are inherently very complicated, creating 'knowledge imbalance' and placing most customers, who do not have the required expertise, at a competitive disadvantage. Under these circumstances, it is believed that it is the role of the government to step in with appropriate consumer protection legislation (Barrett, 1998) ensuring that the customer receives, in principle, a reasonably well performing prduct.

Different levels of regulation, inspection, enforcement, licensing or prequalification of suppliers and insurance against defects have been tried in various jurisdictions, depending on culture, tradition and socio-economic beliefs. Evidence indicates that very stringent regulatory regimes with rigid enforcement may create potentially safer and more durable structures but do not necessarily result in greater consumer satisfaction. After all, compliance with regulations is mostly invisible since structural instability, spread of fire, poor ventilation or non-performing plumbing systems are rare events. In the industrial countries this minimal level of building performance is generally taken for granted.

On the other hand, timely completion, cost compliance with the budget and the overall quality are all viewed as important indicators of success of a construction project, with the environmental compatibility expected to become an equally significant objective (Ofori, 1992). Environmental issues have been receiving public attention in most countries, and numerous measures have been introduced to reduce pollution, conserve certain resources and protect natural ecosystems. Construction projects, by their very nature, are resource intensive and environmentally intrusive: hence they are likely to be subject of increasing concern at the policy level and by special interest groups.

In the case of large, special purpose construction projects such as power plants, irrigation canals, transmission lines or transportation links, focused environmental assessments are now carried out as a rule and various ecologically compatible actions are traded off against economic benefits. While, in theory, such mechanisms bring the environmental costs into the market-based analysis, actual experience indicates that it is a very complex decision process based on consultation and negotiation, opposing shorter-term defined benefits of a project against long-term, imperfectly known public/environmental values.

For general purpose projects, which represent the majority of construction volume, such onerous and lengthy processes have been found, so far, to be excessive. In these situations environmental compatibility appears to be introduced through progressive regulatory intervention in three stages:

(1) By the use of the best available practice and technology, whereby the purchaser can often obtain an improved product that is less polluting or resource intensive, at a better price. Several energy conservation and/or resource recycling measures now in place are perceived as win–win strategies. This requires the supplier to have access to current technology and the appropriate skills to implement it.

(2) By shifting focus from the initial acquisition cost of a project to the long-term total ownership cost. Various environmentally compatible solutions can thus be introduced without reducing the overall economic attractiveness. This often requires changes in corporate budgeting approaches and in the organisational responsibility structure, bringing together capital development and operating interests. Financial assessment tools such as lifetime costing are now available, and government incentive programmes have been used to create greater consciousness of energy conservation, pollution abatement and/or reduction of waste.

(3) By the introduction of significant sustainability measures and practices that are likely to increase the cost of ownership. There has been much global discussion on environmental threats and values, but the only way such factors can be introduced into market economies is through mandatory and coordinated government action. Few construction customers will voluntarily reduce their competitive position by incurring additional costs. Few countries are willing to impose additional expenses on their citizens for the benefit of the global community. Thus, general consensus and concerted action is required to advance the cause of sustainability in construction. Experience has shown this can happen with urgent and evident global danger from a specific source, such as CFCs. With respect to the broader issues of greenhouse gas emissions (where construction is one of the principal contributors) international allocation of significant economic costs has yet to be resolved.

Sustainability factors are likely to have very profound influence on construction user–supplier relationships for years to come because they reflect the full spectrum of societal values. However, because such measures are being introduced top-down, mostly through the regulatory process, there is little understanding by the customers or the user of how they may contribute to their specific situation. This suggests a parallel need for the introduction of grass-roots or bottom-up approaches originating from customers and users.

Innovation

Innovation is often perceived as a source of new solutions leading to enhanced client satisfaction, particularly in areas such as sustainable construction where traditional approaches often lead to higher costs and uncertain long-term results.

There is a large amount of construction technology available through scientific papers, books, and manuals of best practice. Most of it is non-proprietary and widely available, having been developed by universities and research centres with government funding. More recently, relatively inexpensive communication systems and general use of databases have made these pools of knowledge even easier to access. Yet, globally, construction customers are not getting the full benefit of the existing technology. For instance, the properties of concrete are sufficiently well known to make it last for ever, and design methods allow building under extreme exposure such as deep-sea platforms or in space, yet concrete continues to deteriorate prematurely and structures fail under predictable conditions. The deterministic view, which states that construction technology will automatically flow from its sources to industry practitioners, who then will provide their customers with improved solutions, greatly oversimplifies the challenges of knowledge transfer and innovation.

Johnson and Segura-Bonilla (2001) analysed the issues linked to transferring construction knowledge from industrially developed countries to developing areas. Their findings are equally applicable to technology diffusion issues within national systems of innovation in industrial countries currently attempting to increase the innovation intensity of their construction industry.

While there is ample evidence that advanced technology can enhance process and product innovation, it often requires significant organisational and relationship changes in the value-added chain. In order to transform the encoded knowledge of technology sources into the tacit know-how of construction workers and professionals, there must be a learning capacity and a deliberate management of knowledge. Furthermore, the concept of systems of innovation suggests that firms perform better when they work closely with each other in networks, exchanging ideas and improvements. They also rely on stable, highly qualified work forces and on long-term supply relationships with their customers to take advantage of new ideas and enhance each other's competitive position. However, even more is needed to be innovative. A sustained corporate strategy is needed to gain competitive advantage through change involving all employees and as well as organisations in the supply chain. These prerequisites are not typical of the construction industry in industrially advanced countries and are even less available in developing countries.

Innovation means making significant changes in doing business as well as taking risks. Construction customers appear to be ambivalent towards innovation, wanting higher overall performance yet being unwilling to share the risks or to reward new approaches (Chinyio *et al.*, 1998; Toole, 1998). Nevertheless, some sophisticated and demanding purchasers of construction have established profitable, often stable relationships with innovative suppliers. Time will tell how rapidly this becomes a general practice.

What do customers want?

Several surveys have been carried out since the early 1990s probing relationships between construction customers and suppliers. Most of this research has been carried out in the United Kingdom and some in the United States, though there is no suggestion that these findings are representative of other national patterns.

Chinyio *et al*. (1998) looked at the needs of a representative sample of some 40 of the United Kingdom's building clients and found that their top priorities were:

- functional product with a flexible design, fit for occupier use;
- timely completion; and
- value for money, economical product with low maintenance cost.

Customers also indicated that they want to be involved in the building process, do not want surprises and have low tolerance of risk. There was no significant difference in the priorities of public, private or developer clients. Furthermore, low initial price, on its own, was not considered a significant objective.

This was confirmed by Wong *et al.* (2000) in examining criteria used for the selection of contractors on over 80 civil engineering and building projects in the United Kingdom. While the tender price remained an important factor, the ability to complete on time and project management that could cope with unanticipated problems were judged critical. Value for money emerged as the principal selection criterion, although customers also looked closely at the managerial capability of builders, their skill level, past experience of their key personnel, their human resources and other general indications of satisfactory performance.

In order to determine the factors causing clients to undertake building projects, Kometa and Olomalaiye (1997) carried out in-depth interviews with senior managers of a diverse group of public and private clients and developers. The following were identified as key drivers:

- *A need for additional facilities*: this requirement most often arises from increasing pressure within the client's organisation until a decision to proceed is made.
- *Economic benefit motives*: this is deemed more important for developers who are in the business of providing facilities but is also important for public sector managers. Issues such as corporate status/prestige, preferences of executives and location were closely related to the above.
- *Satisfying the ultimate user or the tenant*: this was ranked high by all respondents.
- *Various other factors*: such as workers' pressure for improved facilities or social expectations of the organisation (environmental issues) received lower ranking.

When some 300 recent American homebuyers were surveyed regarding their satisfaction (Torbica and Stroh, 2001), non-financial 'soft' criteria emerged. This customer group wanted a house with good design and quality characteristics but also expected service from the builder. In the last category, builders were rated as being relatively weak. The authors concluded: 'It is possible to have dissatisfied or at least not satisfied, customers even though explicit time, cost, and performance criteria have been met.'

What do constructors want?

If the above is what the customers want from the builders, what do the members of the construction team want from their customers?

Kometa *et al*. (1994) investigated some of the qualities that project consultants (architects and engineers) expect of their clients. Not unexpectedly, consultants wanted clients to have the financial resources to undertake the project, to state their priorities clearly and to have realistic and feasible objectives. They also felt that clients' past performance in procuring quality projects without cost overruns and their internal organisation were important contributors to the overall success.

A significant difficulty in discussions between the clients and the builders regarding the expected performance is the paucity of known robust metrics that can objectively describe functionality, flexibility, comfort, serviceability and many other factors that enter into the satisfaction matrix. Capturing clients' needs regarding their cultural, social or environmental requirements is even more difficult since an insufficient vocabulary and few agreed benchmarks exist in this area.

The client and the building process

Large amounts of research and documentation exist on the building process itself but much less information can be found on the role of the client at the inception, during the construction and in the post-delivery commissioning stage.

As indicated in the previously mentioned survey by Torbica and Stroh (2001), even in the situation of relatively simple acquisition of a pre-constructed, single-family house, buyers displayed a complex composite of satisfaction with regard to design, quality and service performance. The authors also indicated that builders have become increasingly concerned with consumer preferences:

> 'The biggest shift in the US home building industry that has happened in the last several years is that home builders are extremely interested in gaining consumer input. Satisfied consumers are said to be the backbone of the home building industry. Homebuilders have come to realize that the ability to correctly assess the desirability of their housing units and the quality of service is crucial to their financial viability. . . . More knowledge about the factors that are related to home buyers' satisfac-

tion, or dissatisfaction, would be an invaluable tool in achieving and maintaining a competitive edge.'

When a larger organisation decides to go ahead with a building project, the situation is considerably more complicated than in the purchase of a house. Cherns and Bryant (1984) suggested that that the design brief, the specifications and the contractual arrangements do not fully reflect what the client really wants. In fact, when one looks deeper into clients' organisation and the decision process leading up to the selection of a particular project, many internal tensions remain unresolved when the 'go ahead' signal is given. There is almost always competition for scarce corporate financial resources, and the 'winning' project often leaves certain dissatisfied departmental or individual 'losers' holding a grudge. Complex organisations also have elaborate internal accountability structures, with some departments having a more important stake in the early completion, others in remaining within the proposed budget, and still others in the operating performance, the appearance, the environmental compatibility or the community acceptance of the project. Several of these requirements may be explicitly stated during the design briefing and the construction planning, but others only emerge later or remain implicit. These implicit requirements form part of the overall emerging client satisfaction pattern at construction completion as well as during facility operation.

More comprehensive briefing processes, based on practices and methodologies from the manufacturing industries, could help (Kamara *et al.*, 1999). Elaborate approaches based in the client requirements processing model (CRPM) could capture the complete set of needs, thus facilitating the communication of the client's demands to the builder.

On the other hand, Barrett and Stanley (2001) believe, based on their research with industrial partners, that better briefing is a 'process running through the construction project' that consists of the following steps:

- The client becoming more knowledgeable and having significant involvement in the construction process.
- The project team becoming more stable and business-like in managing constraints, work procedures, assessment of needs, information processing and feedback.
- The user being more involved in the project.

In practice, it is still not uncommon to hear from some construction team members, when facing changes in requirements, delays or new expectations, that 'the client does not know what they want' while builders 'just want to get on with the job' and deliver the project as rapidly as possible.

From the management structure perspective, once a project is initiated, the client and all the parties to the building process (contractor, architect, consultants, trades and various suppliers) form a new, temporary, virtual, multi-organisational (NTVMO) project team. In practice, what we have facetiously called NTVMO is as unwieldy as its acronym: it is new, with all the problems of quickly moving up the learning curve; it is temporary, therefore participants have less shared commitment to each other; it is virtual, and thus seldom receives careful organisational design or configuration of internal communication channels; and it is multi-organisational, with the potential of competing agendas and internal rivalry. Contractual arrangements of the design–bid–build type can cause NTVMO additional problems of functional and physical separation between designers and builders.

While operating under these conditions with the objective of rapidly planning, designing and constructing a project, NTVMO is expected not only to maintain free-flowing internal communication channels to resolve the ongoing issues, but also to be linked to the client's corporate structure for supplementary requirements needed to complete the work in a satisfactory manner.

Using examples of successful, well established, stable, carefully structured and highly integrated industrial or public organisations, management science generally uncovers a high degree of trust amongst employees and partners, an open flow of communication and an ability to anticipate and then satisfy the needs and wants of customers. In comparison, NTVMO almost appears to be created for communication failure, and the construction team's ability simply to complete the project, against all odds, is mostly due to the drive and the leadership of project managers, who are somehow able to get the commitment of various parties to work together.

It is not surprising that many construction customers and suppliers decided that there must be a better way to build and/or achieve a satisfactory outcome. Two major trends have now emerged:

- *Greater customer–supplier cooperation, risk–reward sharing and lasting relationships*: this is achieved through various forms of partnering, alliances, joint ventures and other arrangements that bring the parties to work together towards a common goal. Bresnen and

Marshall (2000) confirmed that such collaborative arrangements can have a positive influence on a client's satisfaction and that there was a marked improvement in budget and schedule compliance. Better quality, lack of disruption, enhancement of safety and resolution of disputes were also observed.

- *Customers not wanting an involvement in the construction process*: these customers only desire to purchase the use or the service provided by constructed assets. This trend finds its expression in various forms of public–private partnership, build-own-operate-transfer (BOOT) formulae and other forms of owner-builder projects. It appears to be primarily applicable to projects of a certain size, given the significant front-end costs of preparation of the service proposal. There are now several large, national and even global firms that offer to finance, build and operate hospitals, water treatment plants, airports, highway systems, parking garages and other types of facilities. In some instances they may hold long-term leases from the customer but often they will operate under a concessionary arrangement, with tolls or fees being used as the source of earnings. Since such ventures are frequently granted quasi-monopoly status in the provision of certain services, market forces may not be sufficient to ensure user protection or satisfaction. New forms of balancing interests may have to be introduced by government.

There is also a broader trend of looking at construction projects from a community perspective. It not just a question of what value they can provide to the owners; increasingly there is public scrutiny in terms of their responsiveness to the spatial, cultural or environmental needs of the society. In the consultation process that takes place there is a fine balance between these societal needs, often represented by special interest groups, and the economic pressures of timeliness and value at reasonable price to the consumer.

Conclusions

The global competitive context for many industries is increasingly based on delivering quality products and services that create a high degree of consumer satisfaction. In contrast, the construction industry continues to display significant underperformance in terms of value, quality and timeliness. There are two facets to this industry. First, it is still firmly based on craft traditions, which it is likely will always be required to maintain the existing stock of built assets. Second, the quasi-manufacturing process involves intricate supply chains, advanced technology and rising performance expectations.

Analysis of the role of clients, and of other factors which guide this more advanced facet of the building process towards a satisfactory outcome, displays a complex array of mutually interrelated driving forces. The construction industry has not taken full advantage of limited run, computer assisted, manufacturing techniques to produce more high quality, customised products, nor to understand the implications of matching technological uses to customer expectations. Given the predominance of small firms in this industry, it will take concerted action by major public and private clients to implement activities required to enhance performance.

Furthermore, global forces outside the purview of individual clients, such as environmental concerns, technology diffusion and innovation or availability of investment capital at low cost, powerfully influence this industry. Regulatory regimes to protect the safety and the security of users and the community at large further limit the ability of a client to affect outcomes. Yet consumers and suppliers must be convinced that such regulatory measures improve and enhance value, otherwise they would resist introduction of new rules. For sustainability concerns, where the cause–effect relationship is not unequivocal, this remains a challenge.

However, there is still considerable scope for customers to take action, exercise their market power, and insist on a relevant performance target. When faced with the complex offerings of the construction industry, purchasers are often not sufficiently knowledgeable or sophisticated. They also suffer frequently from the myopic view of making long-term investments while looking at initial costs. Buyers having greater understanding of construction products and their market characteristics/impacts could help them to inform their long-term investments.

Finally, there is the role of clients in articulating their needs and preferences to the construction team responsible for their specific projects. Organisational dynamics and communication patterns within such virtual, hastily assembled, temporary, multi-organisational project team structures are not conducive to coordinated action, focused on achieving customer satisfaction.

There is growing awareness of performance issues amongst major clients and some construction companies. Two complementary trends have emerged that may have significant impact on the prevailing practice: more stable coordinated customer–supplier relationships within the building process, and/or customers that wish only to purchase the service provided through constructed facilities without being directly involved in the construction or operation processes.

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10

User Needs and Expectations

Adrian Leaman

Introduction

Since the early 1990s, Building Use Studies has carried out 150 studies of buildings, mainly from the point of view of their occupants, but also often including their environmental and technical performance. Some of these, the Probe studies, are in the public domain, so it is possible to read about them (Reference 1). Although most of the buildings are in the UK, the basic methods have been applied to others in Australia, New Zealand, Malaysia, Singapore, Hong Kong, the Netherlands and the USA, and there are more countries in the pipeline.

Inevitably, the question arises about global similarities and differences, especially in building users' attitudes and preferences, but also in comparisons between buildings themselves. For example, British buildings seem to be more 'stressed', with higher occupation densities, more likelihood of open plan layouts and an increasing tendency to 24-hour/7-day operation. Features in offices which occupants like (such as lower densities, cellularisation, natural light and controllability) seem to be less common than they are in mainland Europe. This might mean that British buildings overall compare unfavourably, for instance, with their European counterparts. However, British buildings, at least from their occupants' perspective, seem to be improving, albeit slowly.

Sadly, mary of the answers are unknown, partly because our samples outside the UK are, as yet, too small. There is also the thorny problem of 'controlling for context'. Operating circumstances are so different from one case to the next that it is often impossible to be sure that like is being compared with like. The dilemma to avoid when comparing buildings is to compare unlike with unlike. There is too much 'uncontrollable' (in the statistical sense) variation, and the data are thus too 'noisy' to be able to draw firm conclusions from them. For example, building samples from Australia and New Zealand tend to show that Australasian buildings are healthier, but this may be the result of a healthier lifestyle along with more opportunities for occupants to get away from their desks and go outside during the day rather than intrinsic physical differences in the buildings themselves.

User needs: the wider picture

As well as methodological considerations, there is also the inherent complexity of buildings as total systems. Figure 10.1 gives an idea of the kind of complexity involved. The parts that are most relevant to our subject matter here are:

(1) habits, needs, preferences; and

(2) user strategies.

These refer to the likes and behaviours of 'ordinary' building occupants – the people who use and work in buildings every day, but usually have no active part in designing or managing them. There are also other classes of

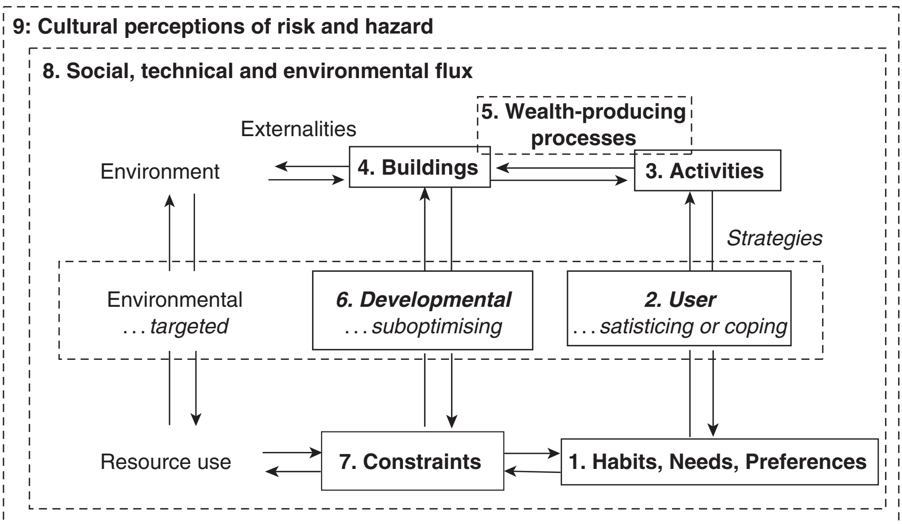

Fig. 10.1 The complexity of buildings as total systems

user, like facilities managers and designers, who have different perceptions of need and different ideas of how to service them. Facilities managers tend to provide services on a 'good enough' basis; designers tend to oversimplify or parody user needs (Reference 2).

Almost all occupants treat buildings as a means to an end. Most are not really interested in design or management matters. They want to carry out their tasks and activities as easily and effectively as possible. They just want to get on with what they do with the least inconvenience, usually to themselves.

This is the main reason why we repeatedly find that building occupants say they are most satisfied and productive when

- thermal conditions are perceived as comfortable and relatively stable; and
- there is rapid response when things go wrong, not just in the thermal conditions, but in all kinds of ways, such as the speed and effectiveness of the help desk (if there is one) or the usability and effectiveness of controls for, e.g. lights and windows.

Buildings which are both thermally comfortable and have 'rapid response systems' are almost invariably well liked by occupants, even if the buildings themselves are scruffy or architecturally undistinguished.

Habits, needs and preferences are to some extent culturally dependent. They are affected by attitudes to health, safety, risk, and fashion as well as regulations, and organisational and social norms. In recent years, expectations about, for example, building-related health have been rising rapidly, so conditions which were tolerated a decade ago are now unacceptable.

Whatever the prevailing norms, most building users have to accept what they find as 'givens'. This is why their behaviour, with the occasional exception, is 'coping' or 'satisficing'. They make the best they can of things because they are rarely able to create conditions which optimally suit them. This applies even to those with seemingly the most power – senior managers, for instance. Although they may be able to commandeer the best locations for themselves (e.g. offices with the best window views at the top of the building), they still rarely go as far as changing things radically for the better.

As building performance studies have found, most buildings (approximately 90% in the UK) suffer from chronic performance problems (e.g. overheating or poor air quality) which ultimately affect users' health and productivity.

As Fig. 10.1 shows, users' needs and preferences are (obviously) linked to user strategies which in turn are connected to (3) Activities.

'Activities' in this case simply means the collective tasks that are being carried out in buildings – office, health, educational or whatever. Users will be almost completely preoccupied with carrying out tasks and activities to the best of their ability. They will often see the building as a hindrance to this, and tend to take a negative view of it. Most of the time they will not know or care about the architecture, services or facilities management. They take it as a 'given' that the environment should support what they have been tasked to do. Similarly, clients also tend to assume that designers will automatically provide them with a healthy, safe, comfortable, flexible, energy efficient and spacious environment.

Referring again to Fig. 10.1, activities are carried out within (4) Buildings (meaning the enclosing physical fabric and spaces), which themselves contribute to (5) Wealth-producing processes. This is what buildings are for.

Surprisingly, this is often overlooked. Buildings are also wealth-producing in terms of their role in property and property-related investments. In Britain, for example, their value as property usually exceeds their 'activity' value.

As well as their value in use and exchange, the power of imagery must not be forgotten. Again, image often trumps use value. Despite what many designers think, image is usually low on users' priorities. Our research has found that users are especially suspicious of famous designers. Users tend not to give famous designers the benefit of any doubt that there might be about the building's image and the way it works in practice. Users often think that too much emphasis is given to how a building looks and not enough to the way it functions and supports users' activities. They are usually right.

Buildings themselves are created by a completely different set of decision-making processes to those used by normal occupants, represented in Fig. 10.1 as (6) Development strategies. These, of course, have to operate within (7) Constraints (e.g. the existing physical infrastructure, planning law and investment market, as well as time, cost and quality criteria).

Development strategies gain utility by seeking out perceived benefits (usually profit) within the boundaries of the perceived constraints. This is summarised in Fig. 10.1 as 'sub-optimising', for want of a better term.

To complete the picture in Fig. 10.1, everything connected in boxes 1–7 operates within a background of (8) Social, technical and environmental flux (the volatility of underlying change) and (9) Cultural perceptions of risk and hazard (how local cultures affect perceptions and behaviours).

The terminology of hazard perception comes from cultural geography based on life-and-death fundamentals. For example, risks of inundation by flood help to explain why the modern integrated urban planning and transport systems in the Netherlands are second to none in the world. Overcoming the threat of winter cold is vital to survival in Scandinavia, so more attention is devoted in Scandinavia to ventilation, comfort and the indoor environment and, perhaps, commensurately less elsewhere. In our (limited) experience with buildings outside Britain, the Dutch seem both to get the basics right and integrate well across disciplines. Ventilation strategies are obviously important in cold-climate countries, which may help to explain why Scandinavian understanding of ventilation seems to be so well developed.

Cultural imperatives like these help set objectives, often non-negotiable, because they are 'embedded'. No doubt readers will be able to think of examples from their own cultures. The British, for instance, seem to be historically fixated with their own political and cultural independence, and threats to it, real or imagined. Such traits are not causes as such, but form a backcloth to decision making and behaviour. This is often 'invisible' from within the culture but more obvious to outsiders; even so, it is still hard to pin down. It is often difficult to escape from cries of 'determinism' when discussing cultures and the environment. Any doubters should revisit Rapoport's classic (1969) anthropological study *House Form and Culture* (Reference 3), one of the few successful attempts to understand comparative cultures and buildings.

Social, technical and environmental flux in Fig. 10.1 represents the volatility of change, including innovation, government regulation, physical change, social mores and political systems, all of which can affect buildings and their use, but often unpredictably. Particular things assume global importance, viz. climate change and energy efficiency, but others, especially national regulations, may be just as significant in their own way. For example, the human and environmental performance of German office buildings may have been considerably improved by building regulation restrictions on depth of space.

Buildings are susceptible to unpredictable events which have have unseen effects: for instance, the sudden obsolescence of 1980s London office buildings that were unable to incorporate raised floors for cabling because floor-to-ceiling heights were too shallow. However, other fashion and cultural perceptions were also at work, which included:

- letting agents' preferences, which at that time tended towards variable air volume (VAV) air conditioning which needed more headroom despite the availability of fan coils which did not; and
- developers, who sometimes liked to declare buildings obsolete because redevelopment allowed them to increase plot ratios.

There are many more examples where real outcomes are not just a result of design intent or rational user requirements, but a much more profound mixture of culture, social change and background constraints operating together in a unique brew with liberal dashes of chance added.

What does Fig. 10.1 say about user needs and expectations? The main point is that the context for users is not really linked to the physical 'building' variables at all; it is dominated by what might be called the 'behavioural' variables on the right-hand side of the diagram. Users give highest importance to:

- the activities or tasks in which they are primarily engaged; and
- their preferences, which have a firm cultural basis (but there are also other factors like physiology which can be predicted independently of culture).

This is a polite way of saying that most users don't really care very much about buildings and their architecture.

Four strategies

Figure 10.2 considers context from a designer's perspective. 'Physical' and 'behavioural' are used in the same sense as just described for Fig. 10.1. 'Context-free' refers to principles, rules and processes that may be applied

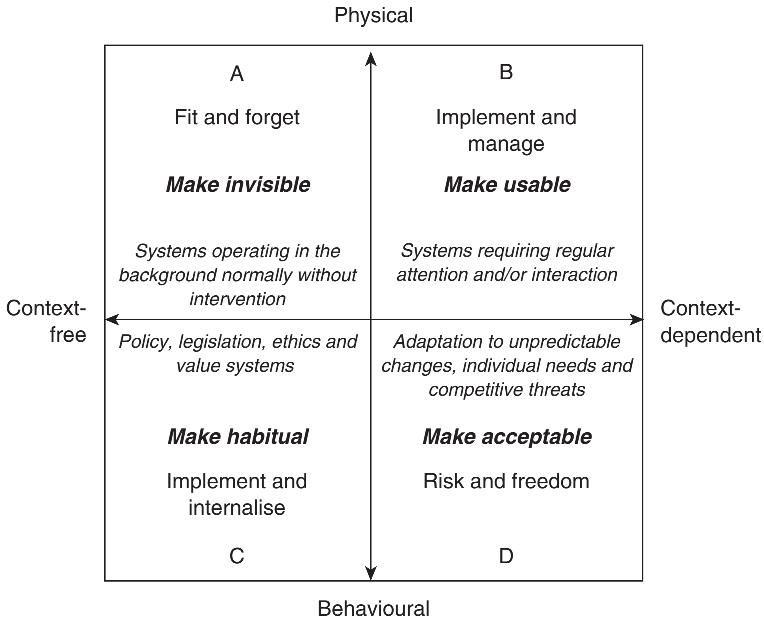

Fig. 10.2 Comparative design strategies

anywhere irrespective of context. 'Context-dependent' are factors locally determined.

The two-by-two matrix of Fig. 10.2 gives four quadrants, implying four design strategies:

- *Make invisible* – those things which are supposed to work only in the background with little or no human intervention.
- *Make usable* – things needing regular attention and/or interaction. Importantly, this is linked into management culture and occupier convenience.
- *Make habitual* – formal and informal rules which help with safe comfortable and smooth running. This is more a matter for individuals.
- *Make acceptable* – things which are not prescribed and covered by the rules but allow scope for individuality, innovation and change.

Our evidence shows that the best buildings tend to perform well in all four quadrants. For example, buildings which can properly be said to be flexible and adaptable will have included consideration of all four strategies somewhere in the briefing, design and operations thinking. This includes issues such as usability, innovation, habit (i.e. cultural norms in the organisation and user etiquette), safety, security, risk, value and uncertainty.

More generally:

- Technology which is intended to work 'in the background' really does, so there is no need for constant management vigilance.
- Where there is need for intervention, interfaces are easy for users to understand, and give clear feedback about their operating status (i.e. whether or not they are working) and their effects (i.e. what change has been induced).
- Users may override systems, so they always have other options, especially in emergencies.
- The system has enough 'degrees of freedom', 'carrying capacity' or 'redundancy' to cope with unpredictable change (e.g. unexpected increase in occupant densities).
- As a result, the building is perceived as flexible and/or adaptable.
- Because of the intrinsic adaptiveness of the system users are more likely to tolerate the flaws that will inevitably exist – they do not feel that the building is forcing them to do things against their will or best interests.

However, the modern tendency is to push as many things as possible into Quadrant A (fit and forget) and leave the consequences of leakage back into the other three for someone else to worry about. Unfortunately for us all, side effects cannot be forgotten, even if they are not immediately foreseeable or included in cost–benefit equations or risk–value payoff calculations.

Globalisation (the context-free, left-hand part of the diagram) occupies quadrants A and C: a combination of 'fit and forget' and 'implement and internalise' – a one-size-fits-all, minimum redundancy approach. This suits a market- and supply-chain-led vision of building provision, but is inappropriate on the demand side, especially in dealing with rapid change, local differences, capacity shifts and locational preference changes. The exceptions are those relatively rare circumstances where user requirements are predictable or relatively simple (as in hotel guest rooms, for example).

From the user needs perspective (see Fig. 10.2) the following observations arise:

(1) Quadrant A (fit and forget) implies that many building functions should properly operate in the background so that the normal user is never aware of them (e.g. structural integrity, fire protection, comfort provision, health and safety provision, ergonomics). However, it is not appropriate to try to place all functions here by, for example, automation or excessive provision of computer-assisted 'intelligence' or standardisation.

(2) B (implement and manage) covers those aspects of buildings where user or management intervention is required and necessary, as with, for example, adaptive comfort control through usable controls, or understandable building management system (BMS) computer interfaces.

(3) C (implement and internalise) includes aspects of user behaviour which ideally need to be habitual (that is, carried out without undue thought), including, for example, response to fire alarms, etiquette in the use of space and respect for colleagues' preferences.

(4) D (risk and freedom) – so named after John Adams' (1998) book [Reference 4] – covers all those aspects of buildings that cannot be legislated for or easily anticipated in the design. This includes unexpected innovations, unusual behaviours, emerging uses, unusual or bizarre circumstances and improbable coincidences. Situations may or may not be risky and/or dangerous. People adjust their reactions and behaviour to cope with the circumstances. 'Common sense' is the byword here.

Emergence

A further aspect within Fig. 10.1 and Fig. 10.2 is 'emergence'. Buildings are usually more or less the sum of their parts. When the parts complement each other properly, the interacting system creates virtuous outcomes which are often delightful to experience and use. Outcomes depend on whether designers understand and utilise the governing constraints to best effect and, subsequently, whether the occupants can manage the building effectively and adapt requirements to it without being unduly hobbled by unnecessary costs or inefficiencies. Excellence in design conjures away onerous constraints (like an inhospitable site or inclement local climate) and makes them seemingly irrelevant to the user. They are still there, of course.

In reality, constraints tend to be both more mundane and less easy to perceive – cost and time are the main ones, vanity and corporate egos are amongst the others. The best buildings from the users' perspective are not necessarily the most architecturally appealing, but comfortable, convenient and capable of rapid response when things go wrong. Astute building management can turn otherwise unprepossessing buildings into a pleasure to use by exercising simple strategies that are understood by all and easy to implement, like 'keep as new'. People like buildings that can support the activities that they carry out with minimal fuss and without getting in the way too much. Such buildings do not have to be aesthetically outstanding, although this can help to make them more forgiving of shortcomings though, in our experience, not much. Indeed, these very attributes can become a source of irritation.

Depressingly, it is more common with modern buildings (at least in our experience in the UK) to experience emergence of the unwanted kind: chronic performance failures, such as overheating and noise, and waste like poor energy efficiency; and worse – sick buildings, or irredeemable vandalism, for example. Trying not to sound too pessimistic, it is much more common to find occupiers who are struggling to overcome the user and management problems caused by chronic faults. In the extreme cases, like St John's House, an office building in Bootle, UK, the end result was demolition (in late 2001). Although this was widely attributed to 'sick building syndrome' the strategic cause was most probably the mismatch between what the building demanded to keep it healthy and what its management was prepared to provide.

Although designers may think they are able to predict and control emergent properties, in reality it is much more hit and miss. Even when an excellent building has been achieved, it is hard to repeat the success. The mix of variables – physical and process – will never be copied twice over so it almost pointless to try and duplicate the exercise with exactly the same formula. Even so, people want to know what the formula is. Fig. 10.3 lists some of the factors for success at the Elizabeth Fry Building, University of East Anglia, UK. Figure 10.4 is a summary of guidelines which help set preconditions for encouraging good emergent qualities. The special emphasis that needs to be given to specific aspects will vary with culture. For example, the author and his colleagues have examined low-energy buildings in the UK and Sweden. While there are many quantitative similarities, it seems that higher levels of robustness, efficiency and build quality are more routinely delivered in Sweden, with less effort from clients and designers. The reason may be connected with requirements for better air-tightness, given the winter conditions, plus better attention to design detail and lower occupant densities.

- A committed client
- A brief with clear targets
- A team which has worked together on the site
- Specialist support (e.g. on fabric insulation and air-tightness)
- A robust design, efficiently serviced
- Enough time and money
- An appropriate specification (and not too clever)
- An interested contractor (and a traditional contract)
- Well built with attention to detail
- Well controlled (but only eventually after monitoring)
- Post-handover support (triggered by independent monitoring)
- Management vigilance

Fig. 10.3 Factors for success observed in the construction of the Elizabeth Fry Building, University of East Anglia (Source: Reference 5)

Findings from user studies

At a more practical level, our research has revealed a consistency in user needs. Building Use Studies' current dataset has 124 buildings, of which 18 are from outside the UK (Reference 9). The last 50 surveyed in the UK/Ireland are used for benchmarking.

For the UK/Ireland dataset, the general findings are listed below:

- Productivity, health and satisfaction variables are almost always linked to comfort – the better occupants think the indoor environment is, the more likely people will say that they are productive, healthy and happy: see Fig. 10.5 (similar graphs can be shown for e.g. comfort and perceived health).
- People usually say they perform better when they have relatively more control over the heating, cooling, ventilation, noise and lighting in their immediate vicinity (often in that order of importance).
- If control is not available to occupants through physical means (e.g. window blinds and radiator controls), then it usually can be made up

- Process before Product
- Product and back to Process
- Passive before Active
- Simple before Complicated
- Better before More
- Prevention before Cure
- 80 before 20
- Robust before Fragile
- Self-managing before Managed
- Efficient before Elaborate
- Intelligible before Intelligent
- Usable before Alienating
- Forgiving before Demanding
- Assets before Nuisances
- Off before On
- Experience before Hope
- Thought before Action
- Horses before Carts

Fig. 10.4 Guidelines for encouraging good emergent qualities (Source: Reference 6)

for by proactive, rapid, or, (in the absence of anything else) honest responses from friendly, diligent facility management staff, and by excellent design and technical performance. This will provide a substitute, so control will seldom need to be exercised. However, at least in the UK, this level of excellence is seldom achieved owing to various cultural and market factors.

- People want things that are usable, manageable and work well for them on demand or without holding them up too much or getting in the way of their task in hand. Despite what designers think, nice-looking working environments tend to be lower down occupants' priority lists.

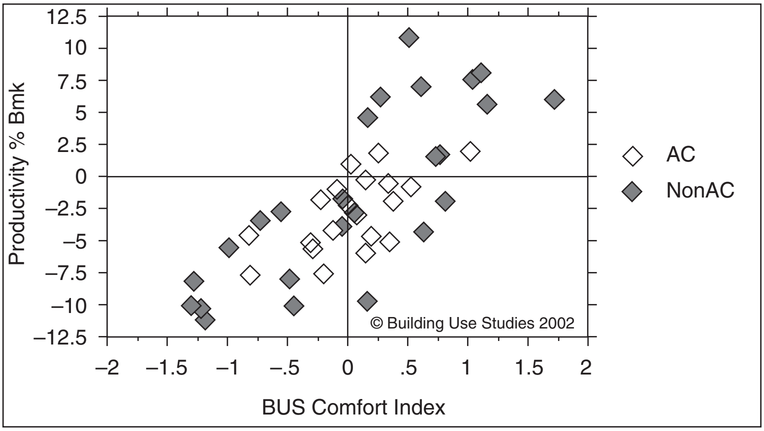

Fig. 10.5 Correlation of productivity and occupant comfort

- Naturally ventilated buildings can give surprisingly good results, mainly where there is simple, good and effective user control, even where the conditions are objectively less good than in many air-conditioned environments. The downside is that 'over-stressed' naturally ventilated buildings (such as those that are too deep in plan form, too densely occupied, or with limited or idiosyncratic user control) can produce dreadful conditions, especially in the height of summer. In Fig. 10.5, the most comfortable and productive buildings (top right) are naturally ventilated, but so too are the worst.
- The more functions and activities people have to cope with, the less likely they are to say they are productive as well. So open plan often scores worse simply because the number of activities is greater. The potential for unmanageable conflicts is also higher (there are always exceptions, though).
- Noise is a bugbear, especially with random distractions created by activities which are perceived as irrelevant to a particular individual's requirements. This, obviously, is worse in open-plan environments.

These generalisations can also be presented as the aspects of buildings which people prefer. Readers will know most of the answers from their own experiences of buildings. The following list is adapted from the Probe studies [Reference 7].

High occupant satisfaction is easier to achieve when all or most of the following features are present in the total system (because they help virtuous processes develop and/or give occupants better control, which ultimately improves their tolerance). These include:

- shallower plan forms and depths of space (usually less than 15m across the building)
- degrees of cellularisation (not necessarily in single-person spaces, but at least laid out so that workgroup integrity is preserved)
- thermal mass
- absence of gratuitous glazing
- stable and comfortable thermal conditions
- absence of distracting noise (what constitutes this varies greatly with context)
- controlled background ventilation without unwanted air infiltration
- openable windows
- views out
- usable controls and interfaces
- a non-sedentary workforce (people are sitting at e.g. VDUs all day long)
- predictable occupancy patterns
- well informed, responsive and diligent management
- places to go at break times inside or away from the building

Published examples of buildings which meet most of these criteria with high levels of excellence are the Elizabeth Fry Building, Norwich, UK [Reference 1] and the Tax Office, Enschede, Netherlands [Reference 1], both in the Probe series.

The tendency for things to become unmanageable, and thus for occupants' tolerance to decline, can be made worse by some or all of the following:

- Deeper plan forms with variable qualities of indoor conditions (e.g. worse towards the middle, better towards the windows).
- Senior staff monopolising the best places, often also leaving them unoccupied while others have to suffer.
- Areas in use for staff workstations which were not originally intended to be so (e.g. converted storage areas, basements and meeting rooms).

- Large open work areas with little variety in them.
- Larger workgroups (above about six people).
- Workgroups where people are not sitting within line of sight and earshot of each other, perhaps with people split between different locations.
- People sitting too close to sources of noise and random distraction like entrance/exit doors, kitchens, photocopiers and touchdown areas.
- People sitting with their backs to colleagues or circulation areas.
- Too many conflicting activities in one area (especially where people needing to concentrate are mixed in with people needing to communicate frequently).
- Higher densities (tolerance thresholds differ in various parts of the world so there is no rule of thumb).
- Longer working hours.
- Presence of complex technology.
- Ineffective, absent or bossy facilities management.

The best results are usually obtained where the indoor environmental conditions are perceived as comfortable, stable and predictable, but when things go wrong (not just with the ambient conditions but with other things as well like office equipment or furniture failures) there is a rapid and effective response system in place. This can be empowered individuals using their initiative and common sense (e.g. with window and blind controls which they can operate themselves), or a management system which works properly. Rapid response is the key: it must be present somewhere in the total system, ideally both in the physically designed components and in the management systems. Anything that prevents rapid response happening in practice will reduce perceived performance.

Wider implications

What have we learned that helps improve buildings worldwide and transfer some of these findings between cultures? Fig. 10.6 comes from overview papers on the Probe post-occupancy studies (Reference 8). It has nine sub-headings, three each under the main headings at the top: 'Ends', 'Linking tools (feedback)' and 'Means'. This is intended to help organise briefing, feedback and design responses, so that emphasis is put in the right places.

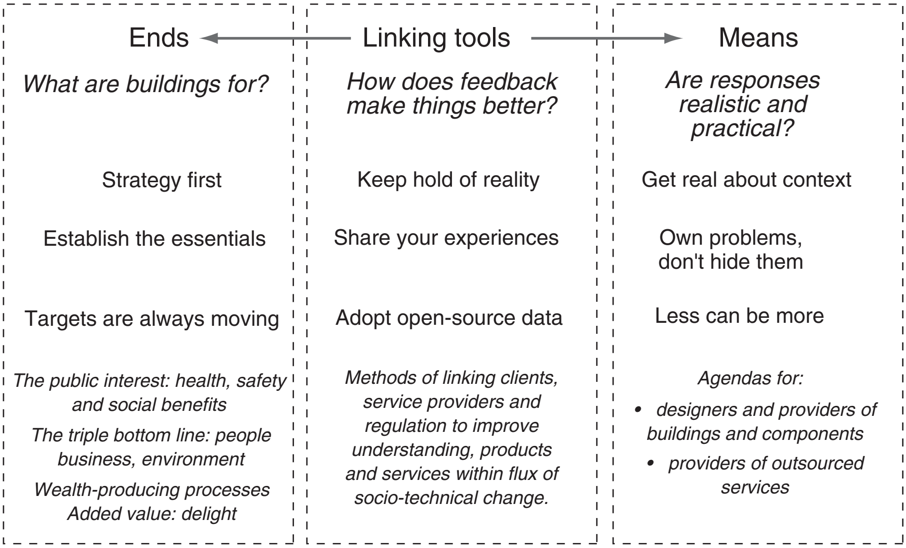

Fig. 10.6 Overview of briefing, feedback and design responses

The current emphasis on means (on the right-hand side) almost always swamps ends and feedback. This is not necessarily a problem in a stable situation where the buildings routinely being delivered suit the occupiers' requirements – as seems to occur quite routinely in Scandinavia, for instance – but causes major difficulties in the UK, where research has revealed quite large mismatches.

Ends: strategy first

As building procurement, design and delivery is a complex and time-consuming process, people often forget what buildings are for. They then find it difficult to evaluate what they end up with because they are uncertain about the evaluation criteria. The best buildings (for occupants, investment potential and environmental performance) tend to be those where targets are always made clear in a brief which is understandable by all the players, users and occupants included.

A clear brief also makes it much easier to test the building in use to see if the expectations have been met. When the brief is muddled, we find that needs and expectations become conflated and people develop unrealistic expectations of what the new building will do. When this happens, the client will always be disappointed because expectations have not been managed properly, partly because no-one really knows what problem the building was supposed to be the answer to in the first place. However, one cannot just prepare a brief and go away; indeed, many briefs prepared like this focus on means rather than ends anyway. As a design develops, so does the dialogue between client requirements and the solutions being offered, so the brief has to evolve.

Ends: establish the essentials

When thinking about the requirements for new buildings, clients tend to forget about – or (rightly) assume that the professionals will deliver – the obvious, e.g. basic comfort, air-tightness and energy efficiency. In the brief, the essentials need to be clearly established, not just wish lists of desirables. Almost invariably, well defined baseline requirements will help to produce virtuous outcomes elsewhere in the system. Most vitally, 'don't procure what you can't manage': that is, do not create a building which is beyond the occupying organisation's skills and resources.

Ends: targets are always moving

Increasingly, targets are not just on the physical side of the building, but on the human. In the UK, there is constant cost pressure to increase densities, reduce 'churn' and cut facilities management (FM) budgets. This can be risky because higher densities increase the chances of functional conflicts (in e.g. open-plan offices), lower costs often mean excessive 'reverse engineering' like fewer user controls (important for perceived productivity), and lower (or contracted out) FM inputs can mean lower response times. On the other hand, pressures (e.g. scarcity of skilled staff) can mean that buildings are used as lures to attract staff. Issues such as density and capacity are especially important where staff numbers are volatile and there are few other options for planners (e.g. alternative locations).

Linking tools: keep hold of reality

For some years we have advocated design brief management (which was run as a post-graduate course at the University of York from 1996 to 1998 at the Institute of Advanced Architectural Studies) as a way of keeping a grip on reality in what otherwise can become a myopic process. By giving the client control over brief management, keeping performance under review through regular reality checks and constantly reviewing outcomes against expectations, there is a greater chance of success, especially for the end-user. But to date few clients give someone the explicit responsibility of Design Brief Manager. It often gets absorbed within a project management activity which focuses on means (particularly resources, cost and time), takes short cuts and ends up losing sight of ends.

Linking tools: share your experiences

This is one of the weakest areas in the construction industry: the ability to both learn on the job and share experiences, for good or ill. The Probe project (Probe, 1995–2002) is one of only a handful worldwide that have placed findings from studies of building performance into the public domain so that clients, managers and designers can learn from the experiences. Probe has not emerged from the professions, government agencies or design practices, but from a group of small consultancies linked with a publisher, part-funded by government. In the UK, there are many more who advocate post-occupancy evaluation than actually carry it out, presumably because they perceive the risks to be greater than the benefits.

Linking tools: adopt open source data

Meaningful feedback is impossible without comparable data. In the UK, professions still have different ways of measuring space in buildings (even though standards are set down by the RICS), which makes it doubly difficult to compare and calibrate. Similarly, there are no *de facto* methods of consistently measuring, assessing and reporting, for example, energy and water consumption (energy may improve within the next few years following a European Union Directive on the energy certification of buildings). It is not just measurement that is the problem, but classification and coding. In the studies described earlier, we are beginning to overcome the open source data problem by licensing arrangements.

Means: get real about context

With buildings, context is everything. It is vital to understand the influences of the ruling constraints, resources, their relative risks and the opportunities they present. One of the more fruitless activities of building research is to make constraints vanish either by controlling for them in simulations or in the laboratory, or by trying to normalise data to fit assumption sets. A ‘real-world’ approach (Reference 10) has many virtues, one of which is that the richness of context shines through. Treat context as a feature, not a bug.

Means: own problems, don't hide them

This is also about realism in problem solving and decision taking. What are the tasks for the professionals and the occupiers' management, and what can reasonably be left to individual users? For example, noise in offices falls across all three, and often becomes chronic because no-one has properly 'owned' the problem during design, handover and first occupation/snagging. Unwanted noise in a building in use is often a symptom of poor design-team and management integration, especially with respect to, for example, telephones and computers (often a source of noise, but often not part of the decision making in a fit out).

Means: less can be more

This is the renowned design dictum: seek simplicity, make intrinsically efficient options the essential features, and beware of excessive technological complexity creating unnecessary and unwanted burdens for users and managers.

Conclusions

This chapter has pulled together some of the threads of understanding user needs and preferences, drawing on evidence from mainly British-sourced studies, and has pointed to some strategic possibilities.

The best buildings from the users' point of view are usually perceived as comfortable, safe and healthy, with the intrinsic capability to respond rapidly when things go wrong or need to be changed. More often than not, the time dimension, especially responsiveness, seems to be just as important to the user as space. For example, if people spend too much time getting from place to place in the building, or the lifts have too much dwell time, then they will complain about it. They particularly dislike not being able to adjust or adapt conditions to suit their comfort preferences, especially when the requirement is seemingly trivial (e.g. the ability to move a VDU screen out of the glare of sunlight). As long as users have enough space, usable furniture and the layout does not interfere too much with what they want to do, then they say remarkably little about the architectural or interior features.

Users also do not like buildings or features that make them look stupid in the eyes of their peers. Overly pretentious or silly imagery (such as might be found in more 'way-out' modern workplaces) or intrusive technology (such as uncontrollable external blinds or automatic lighting systems which cannot be overridden) are almost always disliked.

Wastefulness is also frowned on (users – at least in the UK – do not like conspicuous waste or unnecessary extravagance). They like buildings which support them and what they have to do, not ostentatious corporate or designer gestures.

This information has been assembed mainly from questionnaires using a 'real-world research' approach (Reference 10 and Fig. 10.7). Building performance studies do not thrive well in a 'normal science' research framework because:

- buildings are rarely viewed as 'total' human and physical systems, usually because this perspective does not map properly onto academic disciplines or government research agendas;
- hypothesis-testing usually fails in the face of multivariate complexity (where it is hard to pin down cause and effect, and contexts change from case to case);
- research findings are often too far removed from the practical needs of users, clients, designers and managers.

Examining how people behave (what they do in response to real circumstances) works better than studies of normative requirements (that is, what people might do, or ought to do, given certain circumstances). The Building Use Studies approach is to stick to known facts about actual events.

As well as difficulties with research and methodology, there is too great a divide between the goals and perspectives of the supply side of the construction industry and the demand side. Clients are still too gullible. They often do not really know what they are procuring, especially the human costs and consequences, but also the hidden costs of unnecessary complexity and the extra management required to keep things running smoothly.

Solving problems	rather than	**Just gaining knowledge**
Predicting effects	rather than	**Finding causes**
Getting large effects	rather than	**Relationships between variables**
Looking for robust results and actionable factors	rather than	**Assessing statistical significance**
Developing and testing programmes, interventions, services etc.	rather than	**Developing and testing theories**
Field	rather than	**Laboratory**
Outside organisation	rather than	**Research institution**
Strict time and cost constraints	rather than	**As much time or finance as the project needs**
Often generalist researchers	rather than	**Typically highly specialised researchers**
Litttle use of 'true' experiments	rather than	**Much use of 'true' experiments**
Multiple methods	rather than	**Single methods**
Oriented to the client	rather than	**Oriented to academic peers**
Viewed as dubious by many academics	rather than	**High academic prestige**

Fig. 10.7 Real-world research approaches

The bottom line for many is usually about improving working conditions so that people respond positively and productively in their work. Our research suggests that perceived occupant productivity is reduced by about 20% in the worst buildings and improved by about 15% in the best – a difference of 35% between best and worst. However, only about one-third of the studied buildings have occupants who report productivity gains (Reference 10). So there is still a big job to be done to get the basics right.

Building users already know this. They don't like gratuitous design gestures or tokenism; they just want modest environments that are pleasant enough for them and do not get in the way too much of what they have to do. This is true the world over.

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11

Historical and Cultural Influences on Comfort Expectations

Gail S. Brager and Richard J. de Dear

Introduction

There is often a strong, mutually dependent relationship between technological development and social and cultural expectations, with each having the potential to inform and shape the other. This chapter focuses on how the introduction of air-conditioning technology has dramatically influenced attitudes about comfort and building design. The important influences of advertising and building standards are critically examined as examples of information exchange that have affected this relationship between air-conditioning technology and user expectations. The specific case of the rise of air-conditioning raises further questions for building professionals on the use and transfer of technological information, especially when crossing regional and cultural boundaries.

What is comfort, and why is it important to examine it? The answer is complex and will vary widely when viewed from various disciplines such as engineering, physiology, psychology, social science, or cultural anthropology. Simple or single-dimensional definitions of comfort are almost guaranteed to be inadequate and unsatisfactory. Like an onion of overlapping layers, comfort can be best understood and appreciated when we accept the validity and complementary nature of these different comfort paradigms. The very notion of comfort has evolved through history, responding to various social, technological, economic, and cultural influences. The onion metaphor implies that each new meaning adds a layer to the previous ones, which are preserved underneath (Rybczynski, 1986).

Historically, the very word 'comfortable' has taken on a range of meanings. For centuries, 'comfort' was only a verb and meant simply to strengthen or console. Eventually the meaning of the word broadened to relate to a measure of satisfaction, but meant that conditions were merely tolerable or sufficient, ample but not luxurious. The notion of domestic comfort historically referred to attributes such as privacy, convenience, leisure and ease. In the eighteenth century, comfort was viewed as a generalised feeling of well-being and calm contentment, but it was never considered as something that could be measured or quantified. It wasn't until the nineteenth century that the term was first used to refer to environmental comfort related to light, heat and ventilation (Rybczynski, 1986).

Today, and in the context of this chapter, the term 'comfort' relates to a physical and, in particular, a thermal state of well-being and satisfaction. The historical notion of 'sufficient' is still present, particularly within the engineering view of comfort. The engineering paradigm defines thermal comfort vaguely as 'the condition of mind that expresses satisfaction with the thermal environment' (ASHRAE, 1992). However, the methods for defining a 'comfort zone' or 'comfort range' of acceptable temperatures are based on associating ideal conditions only with a feeling of neutrality, or of being totally unnoticeable. This approach ignores the complexity of comfort and all of its contextual and cultural influences, while the simple goal of creating 'thermal neutrality' in buildings hinders the possibility of creating indoor environments that are richer in their experiential qualities than neutrality, and that have the ability to provide valuable sensory stimulation.

Due to its complexity, comfort is almost impossible to measure directly. As a result, scientists have resorted to measuring only the physical variables that influence a body's heat exchange with the environment, asking questions about thermal sensation (and sometimes preference), and then making assumptions about which of those sensations might be associated with satisfaction or dissatisfaction. (A simple but not so far-fetched analogy would be asking someone what colour the room is, but then assuming whether they like it or not.) Since discomfort is a more straightforward phenomenon to measure, in practice 'comfort' has been operationally defined to as the 'absence of discomfort'. In other words, the engineering view of ideal comfort implies an absence of sensation, where a perfect thermal environment might be one that is never noticed at all. But this doesn't leave much room for anything in between 'neutrality' and 'misery'. While it is certainly a commendable goal to avoid the annoyances of discomfort, is our sense of well-being really enhanced by creating environments that are potentially dull? One would never consider eating the same foods for every meal, every day. Why does the supply side of the construction industry strive to create indoor environments that never vary over time or space, purposely creating a 'sensationless, thermal Nirvana' (Prins, 1992)? Biologists often stress that all human sensory modalities are more sensitive to dynamic stimuli and readily habituated to constant stimuli. This is certainly true in the case of cutaneous thermoreceptors, which typically demonstrate a thermal sensitivity to dynamic temperature stimuli that is at least an order of magnitude greater than that for steady-state thermal stimuli. By deliberately engineering our indoor environments to minimise thermal stimuli, we may well be making them increasingly enervating and soporific.

Many would argue that quality of life is inherently improved in environments that are enriched by a more variable sensory palette of thermal and other experiential qualities. This suggests we should move beyond the engineering definition of comfort, and instead consider the ways in which comfort, and even the physical variables which contribute to it, are influenced by architectural, climatic, psychological, and ecological factors, along with social and cultural expectations.

Comfort is not just an outcome of the physical environment. It is our very attitudes about comfort – on both an individual and a cultural scale – that influence our basic need for (or aversion to) mechanical heating and cooling. Comfort is a complex perception and, as psychologists remind us, perception is a *gestalt* built out of the intersection between objective stimuli with cognitive and emotional processes. People's attitudes have a greater influence on their comfort in indoor environments, compared to outdoor climates with relatively more extremes. This is because the influence of attitude and cognition on human response to environmental stress becomes increasingly important as the severity of environmental stress decreases. Studies of extremes (whether of the thermal environment or of other sensory stimuli) by necessity tend to focus on physiological limits. However, when levels of intensity are below the limits of stress, then personal idiosyncrasy, culture, and socially conditioned value judgements all influence subjective response and preference (Fitch, 1970). Comfort is a complex and dynamic combination of the user's state of mind and experience of space.

The global significance of the seemingly mundane topic of thermal comfort has been reinforced recently. The nexus between the energy consumption for creating indoor climate and the greenhouse gas emissions associated with that energy end-use has become clearer. With escalating air-conditioning market penetration in the rapidly growing economies of the tropics and subtropics, the impacts of thermal comfort technology on global warming seem certain to increase in defiance of international efforts to mitigate climate change.

Marketing comfort and air-conditioning

Perhaps nothing has influenced people's attitudes about comfort quite as dramatically as air-conditioning. While air-conditioning has had significant positive impacts on society, it has also had enormous historical and cultural effects on people's attitudes about comfort, the way in which we design and inhabit buildings, and even ways in which we interact as a society. Reyner Banham's *The Architecture of the Well-Tempered Environment* (1969) speaks at length about the architectural changes brought about by the development of mechanical environmental controls, the most significant of which involves the '. . . manifestation of changed expectations, [which includes] changes in use, changes in user's expectations, and changes in methods of servicing users' needs' (Banham, 1969).

Elements of the mutual relationship between air-conditioning technology and attitudes about comfort are revealed by a historical examination of the marketing of air-conditioning in the USA. In *Air Conditioning Advertising: Imagining an Ideal*, Brett Miller (1992) used post-World War II advertisements to document technological and social change related to air-conditioning and the attitudes of the American homeowner. He successfully argued that advertising is a powerful form of information exchange that can have a profound impact on both individuals and a society at large.

Residential air-conditioning had become available in 1938, but few homes had it because it was too large, expensive and (perhaps more importantly) lacked a marketable image. By 1948, however, window air-conditioners were rapidly finding their place in the American home and, by 1950, air-conditioning was the nation's second fastest growing industry. This growth was in large part due to the success of advertisements that heralded the air-conditioner as the solution to social dilemmas and as a necessity for the ideal home. In particular, the advertisements played on the renewed domestic role of women and the family, the importance of convenience and leisure, and changing attitudes about comfort and nature.

Most post-war advertisements were directly aimed at creating a new position for the modern woman who, as a result of having air-conditioning in her home, would remain elegant, free from the toil of housework, facing a day of leisure and luxury. There was a strong theme of fashion in the air-conditioning advertisements, where middle-class women were well dressed, wearing fine jewellery and with gloved hands, suggesting an association between climate control and social status. The advertisements also directly associated air-conditioning with women's pursuit of and realisation of beauty, by creating a more comfortable environment conducive to rest and relaxation. The advertisements portrayed air-conditioning as a means to diminishing women's domestic work (Fig. 11.1). Although it is questionable whether there were any real labour-saving benefits, the advertisements overtly suggested this, implying that an air-conditioned space made housework easier, that it would actually be a joy rather than a burden. The images used in the advertisements suggested that air-conditioning was a prerequisite to a happy, close family life, where husbands returned from work to a clean, healthy and comfortable home, and to a stay-at-home wife who was liberated from work and had time to

Fig. 11.1 Air-conditioning advertisements emphasising themes of leisure and luxury for women

nurture her always-cheerful children, and guard her youthful beauty.

Air-conditioning advertisements also attempted to reveal and shape fundamental attitudes about nature in an age of technology where people had unshakable faith in the power of engineering. Names such as 'Weathermaker' were given to the climate controls, accompanying claims that you could have total mastery of the environment, creating the perfect indoor climate that was more ideal than any place on earth. Nature became an abstracted, almost sentimentalised, ideal that could be manipulated. The advertisements promoted this notion in two ways: first, by implying that the home was independent of its natural site through the homeowner's ability to create an ideal climate no matter where it was; second, by emphasising that the air-conditioner gave homeowners the ability to maintain an indoor environment of constancy, independent of the natural diurnal or seasonal fluctuations outdoors.

The paradox here is that the advertisements would promote the environmental control technology's ability to match people's desire for constancy, while simultaneously using images and words associated with the more sensory and variable experiential qualities of nature (Fig. 11.2). Far from

Fig. 11.2 Air-conditioning advertisements emphasising themes of nature

the current thermal comfort standards that advocate 'neutrality' as the ideal, these advertisements would speak of recreating 'springtime in the Rockies', or the 'lazy warmth and comfort of June'. Ironically, the marketing of air-conditioning was able to successfully appeal to people's simultaneous yet inconsistent desires for both a more intimate relationship with, and mastery over, nature.

Addiction to air-conditioning

The co-dependent relationship between comfort expectations and air-conditioning eventually became so strong that, at least in the US, it is often referred to as an addiction, or treated as an entitlement. By 1960, air-conditioning was viewed as 'part of the American standard of living, something we're all entitled to, just as we're entitled to heat in the winter and food on the table' (Reese, 1960). And while some may scoff at the use of the seemingly excessive term 'addiction', Kempton found that attitudes and use patterns of air-conditioning appear to satisfy the same definition of addiction as used by clinicians with respect to drugs (Kempton, 1992).

In a provocative essay, Prins (1992) examined the anthropological dimensions of air-conditioning in the US and presented a scathing argument that 'the physical addiction to air-conditioned air is the most pervasive and least noticed epidemic in modern America'. He suggested that the cultural origins of this addiction arise from two basic needs. First, separation is related to maintaining socio-economic status and to victory over nature. Second, association is related to the expression of the American dream of technological abundance. Prins argues that this cultural conditioning is, in part, driven by advertising (as described earlier) and also by a consumer culture in America that values dryness and the complete absence of natural body odour. In an earlier essay, Fitch also referred to attitudes about body odour and the social acceptability of perspiration when examining historical and cultural differences in what he calls the 'habitat of the senses'. As an example, he identified Elizabethan England as one set of cultural circumstances in which body odours were valued, compared to the contemporary US, where they are considered a social liability (Fitch, 1970).

Prins's article received widespread criticism from scholars in a variety of fields, who offered alternative views to explain cross-cultural and cross-national variations in air-conditioning use. Schnaiberg (1992), a sociologist, argued that structural differences should be explored before proposing cultural explanations. In particular, he proposed that the US addiction to air-conditioning cannot be explained by ethnocentric models of cultural comparisons, but rather that it may be more directly linked to a historical period where utilities were heavily marketing electric appliance use. At the same time, both refrigeration and air-conditioning technologies were rapidly improving and gaining widespread acceptance. This is certainly readily apparent at the commercial building scale. The post-Second World War expansion of large-scale air-conditioning came simultaneously with improvements in curtain-wall technology and the availability of fluorescent lighting. These technical changes rapidly led to commercial building designs with sealed facades, as well as large floorplates and interior zones in which mechanical air-conditioning was mandatory. This technological adoption proceeded at a pace far faster than that of cultural change.

Stern (1992) also found it hard to accept Prins's cultural theories, but noted their value for emphasising the social origins of preference and for raising interesting questions for further investigation. First, Stern queried the malleability of thermal comfort. He presented evidence from various studies to show that comfort bands do vary across cultural groups. Furthermore, these can be stretched in the short term by deliberate efforts (specifically citing studies which used feedback and schedules of slowly changing thermostat settings to induce residents to cut energy use while maintaining comfort). Second, Stern questioned the experience of comfort, noting that individuals' preference for the ideal of 'breezy, dry and cool' might not be as prevalent as Prins's cultural theory claims. Finally, Stern examined the barriers to reversing the 'addiction', and suggested all these barriers have social origins. Stern and others pointed to the uncertainty of whether people's attitudes about comfort, as well as their use patterns of air-conditioning and other comfort conditioning systems, are truly a fundamental part of one's culture. Alternatively, this phenomenon may be a response to social conditioning and the natural tendency to respond to social norms and expectations.

Economic competition has also played a role in reinforcing the addiction to air-conditioning. When commercial establishments began installing air-conditioning, competitors quickly saw, or at least feared, their businesses suffer would if they didn't do the same. This was particularly true in the humid southeast of the USA. 'In some Southerners the preoccupation with indoor cooling reached the level of addiction. According to one business analyst, many Southern shoppers simply refused to patronize non-air-conditioned stores' (Arsenault, 1984). In the Southwest, the rapidly growing migration of people to America's 'Sunbelt' was due in large part to the availability of air-conditioning. This had political and policy consequences, as these large populations use their voices and votes to elect representatives who will vote against energy taxes, restrictions on electricity consumption, or other policy options that would inhibit their access to air-conditioning. Stern (1992) viewed these social institutions and the built environment as part of our 'material culture', and argued that this is where the barriers lie, and where there is both the need and opportunity for change.

While the addiction to air-conditioning may have initially been driven by cultural and social issues, it can eventually evolve into a physiological addiction where 'air-conditioning rapidly teaches the body to hate the heat' (Prins, 1992), and changes our perception and expectations of unconditioned spaces and the outdoors. We create artificial islands of cold within surroundings that are then characterised as 'hot' in contrast to those air-conditioned spaces. 'The common summer-time observation "it's hot out" is most often overheard when persons enter or leave cooled spaces. . . . In [the] words of one resident: "We don't use the air-conditioner because it makes it too hot outside"' (Lutzenhiser, 1992).

Frank Lloyd Wright, in his 1954 book *The Natural House*, also spoke articulately of the relationship between artificial environments and the changes in how we then respond to the outdoor climate.

> 'The human body is able to continually adjust itself – to and fro. But if you carry these contrasts too far too often, when you are cooled the heat becomes more unendurable; it becomes hotter and hotter outside as you get cooler and cooler inside. . . . Finally, nature will give up. She will just say for you, "Well what's the use?". . . . I think it far better to go with the natural climate than try to fix a special artificial climate of your own. Climate means something to man. It means something in relation to one's life in it. . . . I doubt that you can ignore climate completely, by reversal make a climate of your own and get away with it without harm to yourself.'
>
> Wright, 1954, pp. 175–178

Air-conditioning and the standardisation of comfort

One aspect of this deep-rooted co-dependent relationship between comfort attitudes, air-conditioning technology and building design is that it is sometimes difficult to know which came first. It is the development of air-conditioning and its widespread application to commercial buildings that led to the very need for standards to quantify 'what is comfort?' The standards then served as a benchmark, telling engineers (rightly or wrongly) what made people comfortable, and leading to the (often exaggerated) need for air-conditioning as the only means to meet the standards.

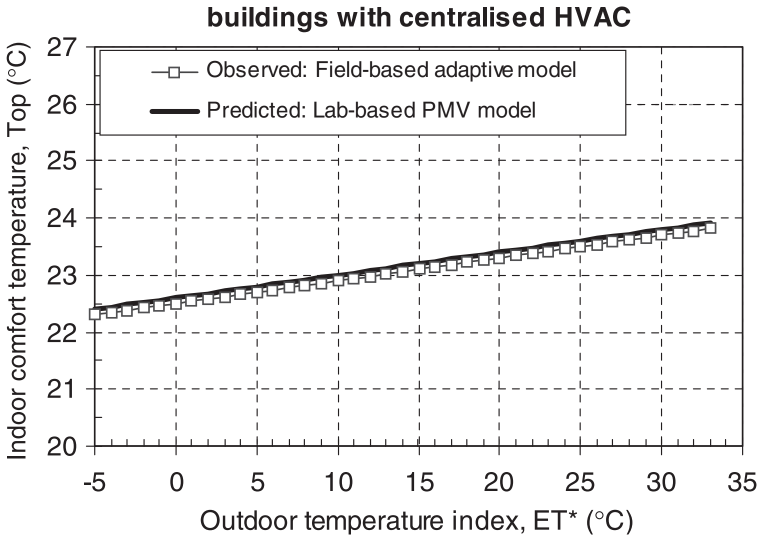
Similarly, people may talk about how buildings shape the indoor environments and the indoor comfort we experience, but it is also a society's attitudes to comfort that, in turn, shape buildings and influence technological development. As such, one cannot separate investigations of cultural attitudes about comfort from discussions about cultural differences in building design or HVAC (mechanical services for heating, ventilation and air conditioning). We are faced with a mutually dependent relationship between them all, where designers and researchers, knowingly or not, make as well as meet expectations of comfort (Shove, 2000).

Building standards are perhaps the most influential mechanism for transferring information from research to practice, yet these often ignore the critical social constructs comprising an inherent part of people's daily lives in real buildings. Current international standards for thermal comfort, developed by both ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) and ISO (the International Standards Organisation), lack any recognition of cultural or regional differences in attitudes about comfort or preferences for specific thermal conditions. Also absent is a lack of recognition of cultural differences in the very need to establish standards. Standards quickly become institutionalised in a society as rules or norms. In an ideal sense, standards should reflect the attitudes that a particular culture puts on those attributes that they relate to (Rapoport and Watson, 1972). In practice, standards become a bureaucratic mechanism of homogenising idiosyncratic quirks like culture, climate, and building purpose out of existence. Standards ignore social, cultural and psychological influences, most likely because these factors are more complex to deal with compared to the physical determinants.

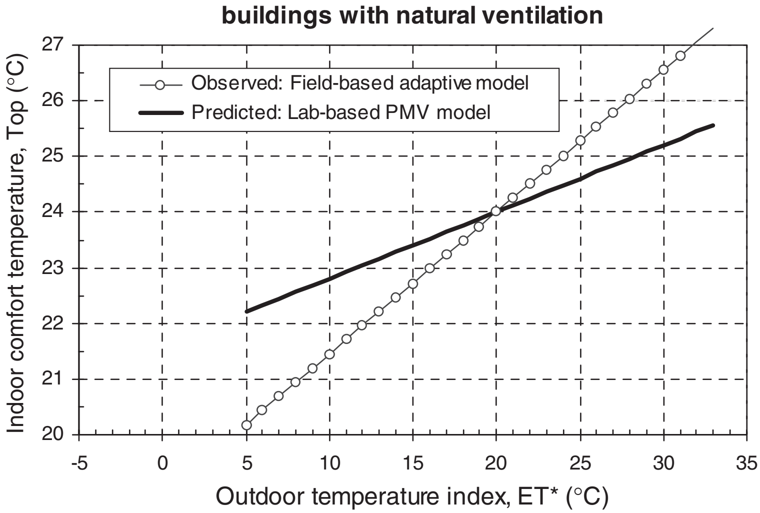
The responsibility for developing these standards has historically been driven by engineers (through their professional societies), in collaboration with other physical scientists and building professionals. These groups are often the last to recognise the role of culture. The omission of social, psychological and anthropological sciences from the engineer's undergraduate curriculum might explain the profession's devaluation of these influences. Furthermore, engineers have a universal penchant for solutions that can be calculated, and subsequently defended on unequivocal technical grounds should their professional judgement be called into doubt. The standardisation of comfort, while convenient, is a dangerous thing in the face of increasing globalisation, and threatens to diminish our planet's essential cultural and socio-technical diversity (Shove, 2000).

Fortunately, there are changes on the horizon. There is recent, strong scientific evidence supporting the notion of an addiction to air-conditioning. This led to a proposal to begin to reverse the trend of air-conditioning addiction by changing the thermal comfort standards to acknowledge the role of user expectations and hopes to reverse our trend towards air-conditioning addiction. The research, funded by ASHRAE, was based on the analysis of 21 000 sets of raw data compiled from field studies in 160 office buildings, both air-conditioned and naturally ventilated, located on four continents in varied climate zones (de Dear and Brager, 2001). Each building had a detailed set of indoor climate and thermal comfort data that enabled the temperature preference of its building occupants to be statistically derived. Figures 11.3a and 11.3b show, respectively, some of the most compelling findings from the separate analysis of centrally controlled HVAC buildings, and naturally ventilated (NV) buildings respectively. The graphs present a regression of indoor comfort temperature for each building against mean effective temperature (ET*), which is an outdoor temperature index that also accounts for the effects of humidity. Each graph shows the regression based on both field-observed responses from the research database, and predictions using the Predicted Mean Vote (PMV) index (Fanger, 1970). The PMV is a laboratory-based index that predicts the mean value of thermal sensation votes of a large group of persons exposed to the same conditions. Both the field and laboratory research collected subjects' votes using the same 7-point thermal sensation scale that ranges from cold through neutral to hot.

In Fig. 11.3a, a careful comparison of these preferences across all 111 centrally air-conditioned buildings in the database revealed a very close agreement with predictions of Fanger's PMV model of thermal comfort (1970), regardless of the buildings' external climatic context. Occupants in these buildings had become finely adapted to the narrow, constant conditions typically provided by the mechanical system, and became uncomfortable quickly if conditions deviated from those narrow setpoints (range of temperature settings). The very slight variation of preferred indoor temperatures as a function of outdoor climate could be fully explained by behavioural adjustments in clothing levels and room air speed. This contrasted with the findings in the 45 naturally ventilated buildings in the database, shown in Fig. 11.3b. In these free-running buildings without



a



b

Fig. 11.3a Observed and predicted indoor comfort temperatures for HVAC buildings
Fig. 11.3b Observed and predicted indoor comfort temperatures for naturally ventilated buildings

air-conditioning, the occupants of buildings located in warmer climate zones actually preferred indoor temperatures that were significantly warmer than those preferred by the occupants of buildings in cooler climate zones. The differences were statistically significant and were too large to be accounted for by variations in clothing customs, metabolic rates, indoor air speeds, or any other 'physical' variable in the PMV comfort equation. Based on the analysis, de Dear and Brager (2001) interpreted these findings as evidence that the occupants of the free-running buildings were adapting behaviourally and psychologically to the varied indoor climates driven by external weather and seasonal cycles. The wide range of preferred indoor comfort temperatures was strongly influenced by shifting thermal expectations, most likely resulting from a combination of higher levels of perceived control, and a greater diversity of thermal experiences in the building. In contrast, the occupants of the air-conditioned buildings were becoming adapted to, or indeed, addicted to homogenous and static indoor climatic regimes. This work has recently been incorporated into the proposed revisions to ASHRAE Standard 55-1992, in the form of a new adaptive comfort standard (ACS) that allows warmer indoor temperatures for naturally ventilated buildings expressed as a function of mean monthly outdoor temperature. This new standard is intended to give designers more flexibility to design naturally ventilated buildings in climates where it is feasible.

Attitudes and air-conditioning use patterns

Expectations also play a role at the residential scale. This was revealed by several research projects that investigated which factors influence the way people actually use air-conditioning when they have access to the controls. A closer examination of actual use patterns of air-conditioning in residences reveals that individuals and cultures vary widely in their perceived need for air-conditioning, and that a complex variety of psychological, behavioural and cognitive factors determine air-conditioner use and associated energy consumption. Examples of these factors include not only the need for cooling, but users' understanding of how the air-conditioner works, complex notions of health and thermal comfort, household schedules, available choices among alternative cooling methods, and user control behaviour (Kempton *et al.*, 1992).

While residential heating use is primarily driven by outdoor temperature and is fairly predictable, air-conditioning loads are comparatively more erratic and have been shown to be a more behaviour-driven system (Lutzenhiser, 1992). Physical comfort and thermal sensation are only some of the many determinants for choosing indoor temperatures in warm seasons. It was found that household schedules and multiple overlapping systems of belief and preferences concerning health and comfort had far greater influences on patterns of air-conditioning use, and that preferred indoor temperatures were considerably wider than one would expect from climate chamber studies (Kempton *et al.*, 1992). Expectations formed outside of the home may also influence residential use patterns. In a study in Thailand, it was found that people working in air-conditioned buildings used air-conditioning in their homes twice as much as people working in naturally ventilated office buildings, even though their economic status was equivalent (Busch 1992).

An important outcome of these studies is that one important way in which we can reduce dependence on air-conditioning, and its associated energy use, is to understand better and influence the attitudes and behaviours that drive people's use patterns. Behaviours can be influenced through a variety of motivational reinforcements, or simply through a form of information exchange such as providing feedback about the comfort and energy-related consequences of their activities (Kempton *et al.*, 1992). One example is a study at Princeton University, where residential energy reductions of 10–16% were achieved by giving residents feedback about their consumption, or by using a signal to tell people when it was possible to turn off their air-conditioner and cool their homes by opening a window (Seligman *et al.*, 1978). Another study achieved 34% savings in air-conditioning energy use, with no changes in perceived comfort or clothing worn, by educating people about space conditioning, giving them feedback on their energy use, and suggesting schedules of gradual thermostat resets (Lovins, 1992)

Person- versus space-based comfort conditioning

Perhaps one area where we see the greatest historical and cultural differences in attitudes about comfort and methods of comfort conditioning is the difference between cooling and heating people as opposed to interior spaces.

In the USA, early commercial buildings consisted primarily of perimeter areas with offices having direct exposure to the outdoors for daylighting, solar gain and natural ventilation. The architectural configuration and design helped keep people cool in warm weather. Open windows permitted breezes to reach the occupants, high ceilings allowed heat to rise away from occupied zones, fans provided cooling in localised areas, and natural lighting for desks near the perimeter minimised the amount of electrical lighting required and the heat gain to be removed. But during the 1950s, large-scale air-conditioning, fluorescent lighting, and curtain-wall technology – combined with cheap and plentiful energy – fundamentally changed the way commercial buildings were designed. While these changes offered new opportunities for designing large buildings, people's enthusiasm for the power of these new technologies led to their misuse, generating the current trend of internal-load-dominated buildings. These buildings typically have flush-skin facades with no shading, low transmittance glass, inoperable windows and large interior zones. Consequently, they are completely dependent on centrally controlled air-conditioning and the focus has shifted from the human system to the building system. The objective of these systems is typically to provide conditions that are uniform over space and constant over time, throughout the entire building. Occupants generally have little opportunity for controlling their own thermal environments. Alternative means of providing comfort, such as air motion, are overlooked, and areas that require little or no conditioning, such as storage areas and entry vestibules, are sometimes wastefully heated and cooled to the same conditions as the occupied portions of the building.

Japan offers a contrasting example of how cultural factors can influence attitudes about comfort and the design of comfort conditioning systems. One fundamental difference is that the Japanese prefer to condition people rather than living spaces. They believe it is wasteful to heat and cool spaces that are not occupied. The traditional heating system in Japan is the *kotatsu*, a person heater placed under the dining table. This provides a social as well as a utilitarian arrangement, and is linked to the preservation of the important social bonds of the family. Even today the *kotatsu* is still a focal point for many Japanese families (Fujii and Lutzenhiser, 1992; Wilhite, 2002). In terms of cooling, the Japanese design of residential air-conditioners also follows the traditional focus on person-based conditioning. In particular, the controls on many of these systems are designed to perceive and respond to user preferences for comfort (Fujii and Lutzenhiser, 1992). The Japanese were also early adopters of 'task-ambient' air-conditioning systems where workers have individually controlled ventilation systems, even in interior zones of large office buildings.

Heschong's *Thermal Delight in Architecture* (1979) describes places with strong thermal qualities from a broad spectrum of cultures and historical periods. All of her examples emphasise the significance of person-centred thermal conditioning, where experiences of necessity, delight, affection, and sacredness all become a purposeful part of design. The sense of renewal in the oasis of the Islamic garden, the Japanese art of associating thermal experiences with other senses, or the ritual of migration in the Baghdad courtyard house – all illustrate the profound cultural role that thermal archetypes and experiential qualities can have.

Comfort and connection to nature

One can also find strong cultural differences in the regard for nature and how such attitudes influence approaches to comfort conditioning. Although American air-conditioning advertising often uses images from nature, the systems themselves are promoted for their ability to provide constant indoor conditions divorced from any features of the outdoor climate. And while the Japanese also use natural images such as glades and waterfalls to advertise air-conditioning, many features of Japanese systems directly reflect their regard for nature.

With the exception of the relatively simple desktop oscillating fan, most American cooling systems are almost exclusively temperature-based and attempt to minimise air movement. Japanese systems purposely use the term 'wind' to suggest a relationship between the person and natural environment, and their controls are designed from the perspective of the user's experience of the conditions rather than referring simply to the machine's 'fan speed'. These relatively sophisticated systems are designed to produce varying air movement patterns that produce seemingly natural breezes inside the dwelling, where intense gusts are less frequent and or shorter duration than are the gentle gusts. Some systems can even sense the location of people in the room to direct the air towards them (Fujii and Lutzenhiser, 1992).

However, even in Japan there are conflicting attitudes about desiring a connection with nature while valuing the benefits of technological development. People cling to strong cultural attitudes about the importance of nature, and the notion of 'natural' is generally preferred to 'artificial'. One study examined Japanese attitudes about natural cooling compared to air-conditioning, and found that 90% considered natural cooling healthier, 75% considered it more economical, and 70% preferred it (Sawachi *et al.*, 1987). On the other hand, there is sometimes an interesting conflict between what 'should' be a better thing compared to preferences for comfort conditions that are more predictable and controllable. It is perhaps this conflict that has led to the unique innovations in Japanese system designs (Fujii and Lutzenhiser, 1992).

Baker (2001) argues that our affinity for the natural world is deeply hereditary, and that the modern built environment increasingly isolates us from it. Baker argues that as urbanisation continues, it becomes increasingly important to bring more nature directly into our built environment, and also to design the indoor ambient environment to include characteristics of the natural climate such as variability in both time and space.

Comfort, building design and social customs

One can ask 'to what extent do culture and social norms affect attitudes and expectations about comfort?' But it is equally interesting to turn the question around and ask 'how might attitudes about comfort, and practices of comfort conditioning, such as air-conditioning, affect culture?' People's behaviour and social customs are an important part of a culture. Traditionally, people have responded to uncomfortable climate by first changing behaviours such as clothing patterns, daily schedules, alternative uses of architectural space, etc.

In one particularly intriguing article, focusing on the southern part of the US, Arsenault (1984) speaks at length about the cultural changes brought about by air-conditioning. Addressing globalisation at the regional scale, Arsenault compares the effects of the air-conditioner to that of the aeroplane and television. The air-conditioner smooths out differences in climate – just as the aeroplane has radically changed our notions of distance, or the television has homogenised popular tastes – all resulting in a reduction of regional diversity and distinctiveness.

As air-conditioning permeates a culture, it has an enormous impact on people's relationship with the outdoor climate, which in turn affects social rituals and customs. The basic pace of life changes – gone is the siesta, where people pause during the hottest part of the day, resting in the shade, taking time to reflect or socialise. Air-conditioning modulates the daily and seasonal rhythms of the sun, allowing us to live and work at a constant yet accelerated pace. One price to pay for this climate control and disassociation from natural rhythms is a dulling of our sense of time and sense of other natural occurrences.

Even more profound is the effect of air-conditioning on our sense of place. While its direct effect on building design is quite obvious and extensive, a thorough review is beyond the scope of this chapter. The effects on commercial building design were noted earlier, but the loss of vernacular building styles is equally significant. Traditional lifestyles in tropical regions inspired a unique climate-response architecture, where buildings were naturally ventilated and not only consumed less energy, but gave occupants a sense of and connection to their climate and culture. Such buildings, however, are rapidly giving way to sealed glass towers that have no relationship with their surroundings or cultural antecedents, resulting in both an increased reliance on mechanical cooling and the loss of this tropical aesthetic (Fisher, 1984). Arsenault also considered air-conditioning's assault on the South's strong sense of place, noting that the South has been

> 'overwhelmed by an almost endless string of look-alike chain stores, tract houses, glassed-in high-rises, and perhaps most important, enclosed shopping malls. The modern shopping mall is the cathedral of air-conditioned culture, and it symbolizes the placelessness of the New South.'
>
> Arsenault, 1984

In Kerala, one of the poorer states of India, a recent study is examining how strongly rooted notions of comfort are rapidly changing, and how the heavy marketing of air-conditioning is resulting in the evolution of traditional climate-adapting buildings towards newer climate-indifferent housing designs (Wilhite, 2002).

Our relationship with our streets and neighbours has changed as well – gone is the social dimension of the porch. Air-conditioning has

> 'seduced families into retreating into houses with closed doors and shut windows, reducing the commonality of neighborhood life and all but obsolescing the front-porch society whose open casual folkways were an appealing hallmark of a sweatier America.'
>
> Trippett, 1979

Researchers reported that

> 'families in air-conditioned houses . . . attended fewer movies, organized fewer picnics, stayed at home more, entertained at home more, and kept the children inside more.'
>
> Cooper, 1998

Industry put a positive spin on these changes, by praising the increased closeness of this inward family life, and promoting these new family patterns as one of the advantages of the new air-conditioning technology. Arsenault (1984) summarises several articles in the popular press from the 1950s and 1960s that portrayed air-conditioning as the saviour of the American family, with benefits ranging from better dispositions to increased family privacy. He also contrasts those to other studies that examined why such claims were misleading and suggests that the overall effects of air-conditioning on family life and wider kinship networks were, at best, contradictory. In contemporary society, this inward pattern of living is increasingly supported by young people's widespread use of the Internet for communicating, moving us further away from face-to-face interactions.

Air-conditioning and the resulting attitudes about comfort have also affected cultural patterns of dress, as we learn to expect constant indoor temperatures that are independent of natural seasonal swings. Particularly in urban areas, where people are both living and working in air-conditioned environments,

> 'many people expect to wear the same sorts of clothing all year round and to spend over 90% of their time in a more or less uniform indoor environment. Such arrangements . . . have implications for the social organization of everyday life, at work as well as at home.'
>
> Shove, 2000

A recent 6-month study of clothing behaviour of office workers in a major multinational call centre in Sydney showed that clothing insulation was constant year-round, having no correlation with outdoor temperatures (Morgan and de Dear, 2000). The exception was on casual-dress Fridays, when workers were able to choose whatever they wanted to wear. On those days, clothing insulation values tracked outdoor temperatures quite closely (with over 50% of the variance being explained), even though the indoor temperatures were held constant. The increasing trends towards globalisation of formal business attire, independent of outdoor climatic context or traditional regional clothing patterns, further mandates the use of HVAC systems to meet international standards for indoor climate, regardless of global impacts of energy consumption.

Thermal monotony and the fallacy of neutrality

The technological means exist to provide an indoor climate that is uniform over all space, and constant across all time. This is exactly what thermal comfort standards and mechanical engineers designing environmental control systems strive to provide. Is this goal appropriate for all circumstances? Is our technology really meeting our fundamental needs, or is it possible that there is a downside to this thermal monotony or thermal boredom?

Indeed, varied references in the literature discuss the importance of providing stimulation to ward off fatigue. In the thermal comfort literature, McIntyre (1980) made an early plea for counteracting thermal boredom with fluctuating interior temperatures to meet our inherent needs for sensory stimulation. Although not going into specifics about thermal experiences, Wohlwill (1972) briefly summarises some of the critical issues related to the psychology of stimulation, acknowledging its potential importance for both perceptual and cognitive functions and motivational processes. In addition to the dimensions of simple intensity, novelty, and complexity, Wohlwill notes that temporal change or variation are important for reducing boredom or monotony. Looking specifically at thermal response, and examining first the physiological basis of the human thermal sense, it is known that the cutaneous thermoreceptors are orders of magnitude more sensitive to thermal transients than to steady temperatures (Hensel, 1982).

Considering psychological and cognitive functions, Gerlach (1974) found that the change of stimulation around a neutral point is more important than the absolute value of the neutral point itself. He presents evidence to support the premise that lack of stimulation and variety lead to greater tedium, stating that 'exposure to unchanging stimuli has been shown to induce satiation and boredom'. While a critical function of buildings is to create shelter and protection from the extremes of the outdoor climate, it is essential that they do not go so far as to deprive occupants of subtle variations that are essential to our mental well-being. Gerlach explains that we perceive what varies because our mental processes conceive relationships more than absolute objects. As with all of our senses, our thermal receptors require stimulation in order to help us maintain a state of alertness. And although it is unlikely that even the most monotonous environments in our buildings could be characterised as complete sensory deprivation, we should still heed the implications of such studies that have found that:

> 'prolonged exposure to a monotonous environment, then, has definitely deleterious effects . . . a changing sensory environment seems essential for human beings. Without it, the brain ceases to function in an adequate way . . . variety is not the spice of life: it is the very stuff of it.'
>
> Heron, 1957

It is time to move beyond our relatively bland goals of creating constant thermal neutrality in buildings in order to simply avoid the negative (discomfort), and minimise dissatisfaction. In a review of research and anecdotes regarding the concept of thermal monotony in indoor environments, Kwok (2000) found that, in contrast to engineering characterisations of comfort, a large number of architectural educators encourage students to explore and utilise the natural dynamic qualities of the thermal environment as inspiration for generating architectural form. This thinking is an important way to move towards using thermal qualities in a more purposeful way to add to the richness of our indoor environments. We should be aiming for a higher level of experiential quality in our environments, where 'pleasantness' rather than 'neutrality' are the goals (Kuno, 1995). Designers should strive to create spaces that are better than 'neutral', where people can find 'thermal delight', where they can interact with their environments and be refreshed and stimulated by them, where saturation of the senses is replaced with variation and a sense of renewal (Heschong, 1979). This may be too much to ask of a thermal comfort standard, but it is certainly an appropriate idea to place in the minds of designers.

One can find clear cultural differences in this thinking about experiential qualities. For example, the Japanese culture has a word *suzusisa*, which means 'a pleasant thermal sensation to be sensed under rather unsteady-state conditions; for example, a hot and humid environment with some breeze' (Saito, 2000). This is in sharp contrast to the semantics used in American culture, and particularly in thermal comfort standards, where references to air movement are almost exclusively in terms of minimising the negative sensations of draught. When the benefits of air movement are mentioned, it is only in reference to counteracting elevated temperatures to maintain the body's overall heat balance. The more sensory 'pleasant' sensations associated with air movement are never acknowledged.

In some Scandinavian cultures the avoidance of draught is almost obsessive, and a light silk or cheesecloth scarf has become almost *de rigueur* in modern casual office attire to fend off the draft at the back of the neck. It comes as no surprise that the 'draught risk equation' that appears in various comfort standards (ISO 7730 and ASHRAE 55) was developed in a Danish climate chamber using a sample of Danish college students (Fanger and Christensen, 1986) but to the best of our knowledge it has yet to be validated anywhere else in the world.

In another example, Tanizaki's essays in his 1977 book *In Praise of Shadows* expound his personal (albeit clearly biased) views about the incongruities of Western and Eastern aesthetics. Speaking primarily of qualities of light and shadow, he paints a picture of the Japanese sense of beauty and relationship with their environment that stems from an appreciation of soft, subtle contrasts and association with other senses, compared to the relative uniformity and flatness of Western environments.

Conclusions

The increasing globalisation of international building styles has critical implications not only for energy consumption (and its associated environmental impacts), but also for the loss of cultural and socio-technical diversity, as well as a loss of sense of place. Buildings that respond to cultural and climatic influences tend to create indoor environments that are varied both spatially and temporally, providing a sensory palette that contributes to the building's experiential aesthetic. Technological advances in mechanical heating and cooling systems have led to buildings becoming more rigidly isolated from the outdoor environment, as well from their social and cultural contexts. These developments have also necessitated information and standards to define how to provide thermal comfort for occupants of these buildings, as they have been denied opportunities to control their own environments to respond to their individual preferences. Ironically, while these standards were intended to improve the availability of technical information, they have essentially ignored the complex and multiple meanings of comfort. In particular, they disregard the contextual influences of behaviour, attitude, and expectations in forming our comfort preferences, and how the building itself influences these preferences. As a result, these standards are being universally applied often unnecessarily and inappropriately, thereby further promoting the globalisation of building styles and the homogeneity of indoor environments.

Thermal comfort is, indeed, malleable and is ultimately a subjective state of mind that depends on social and cultural expectations. People have been shown to adapt to flat thermal homogeneity if that is what they are exposed to repeatedly. Alternatively, people can also adapt to variable indoor climates if their buildings are better connected to external weather and seasonal variability, particularly if they have some degree of personal control over those conditions. Lifestyle shapes our comfort expectations. The way we occupy and interact with buildings that we live and work in is an important part of one's lifestyle. As Western models of sealed glass towers permeate the tropics, and expectations of ever-increasing sophistication in HVAC controls continue to be fostered by the industry, global energy demands of the built environment will also continue to escalate and the end-users will become increasingly marginalised. An 'adaptive' approach by occupants to thermal comfort holds promise. This may assist in the creation of a local approach to defining and fulfilling comfort.

Standards and the use of international information have become enshrined and are a major barrier which the construction supply-side will have to address. One way to initiate change is for professionals in the construction industry to recognise the social and cultural dimensions of thermal comfort. Researchers need to transcend the traditional questions investigated in both laboratory and field studies to develop multi-disciplinary research agendas that explore the complexities of physiological, psychological, behavioural, and social dimensions of how users occupy, interact with, and respond to the indoor environments in buildings. The term 'users' needs to be disaggregated to understand and inform strategies for specific demographics, contexts, localities and needs. A broader, more critical approach to technical standards is required and can be achieved by including academics and practitioners from a wider range of disciplines in the process of making standards. In this way, modifications can be made to the universal 'one size fits all' approach to standards that will allow for social, cultural and climatic differences. Finally, designers of buildings and mechanical systems should develop enhanced capabilities and a more critical approach to information and standards. This will allow them to embrace the possibilities of using experiential qualities to enrich the indoor environments that they help to create, and endeavour to replace thermal monotony with thermal delight and create indoor environments connected to the specificity of social, regional and cultural contexts.

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12

BEQUEST – an International Cross-cultural Cooperation and Information Exchange

Steve Curwell

Introduction

BEQUEST (Building Environmental Quality Evaluation for Sustainability through Time) is an international electronic network. It exists to provide a forum for research, training and practical action in the quality assessment of the urban environment in order to identify the basis for common understanding and implementation of more sustainable urban development (SUD) (BEQUEST, 1998; website: http://www.surveying.salford.ac.uk/bqextra/). This chapter describes a number of the activities and findings of the network as a means of exploring the nature and quality of the interaction and information exchange as an example of international cooperation over SUD. The lessons learned from establishing cross-cultural, inter-disciplinary collaboration and building consensus form the subject of this chapter.

Importance of SUD

The essential paradox of a sustainable society is the conflicting requirements of providing the flows of production and consumption needed to maintain a good quality of life for all humankind, while simultaneously sustaining the local and global environment and biodiversity. These problems are compounded by other factors:

- the increasing urbanisation of humankind (e.g. two-thirds of Europeans now live in urban areas);

- the longevity of buildings and city infrastructure – 60 to 100 years is not unusual for individual buildings;
- the very large quantity of resources which existing cities contain and which are consumed annually to continuously develop, maintain and use them (in the UK it has been estimated that the construction industry uses about 6 tonnes of building materials annually for every member of the population); and
- urban sprawl – the ever increasing land take of cities.

If all these factors are considered together then the built environment sector presents one of the biggest challenges for society. The challenge can be seen in terms of the development of a collective aspiration for better quality of life combined with more sustainable patterns of living and the time it will take put these ideas into effect. Since the 1992 Earth Summit in Rio, most local municipalities in Europe have been developing local plans for implementing Agenda 21. As a result, developers and building designers are increasingly faced with a local context containing sustainability features and criteria, and designers and constructors are rapidly finding themselves at the forefront of moves towards sustainable communities.

The PICABUE definition (described in greater detail on p. 210) of sustainable development (Mitchell *et al.*, 1995) forms a 'shorthand summary' of the Agenda 21 recommendations: see Fig. 12.1. This misses a number of aspects which have subsequently been recognised, such as the six sustainable urban development principles developed at the UN Habitat II conference in Istanbul (1996):

1. The *institutional dimension* of urban development (enabling strategies, subsidiarity, human rights)
2. The *cultural dimension* of the city's development (the need of post-economist culture, overcoming of the pragmatic, computing culture, etc.)
3. The *ethical dimension* of urban development (the struggle against poverty, unemployment)
4. The *environmental dimension* (the use of natural resources, recycling etc.)
5. The *economic dimension* of urban development (eco-industry, small enterprises/industries)

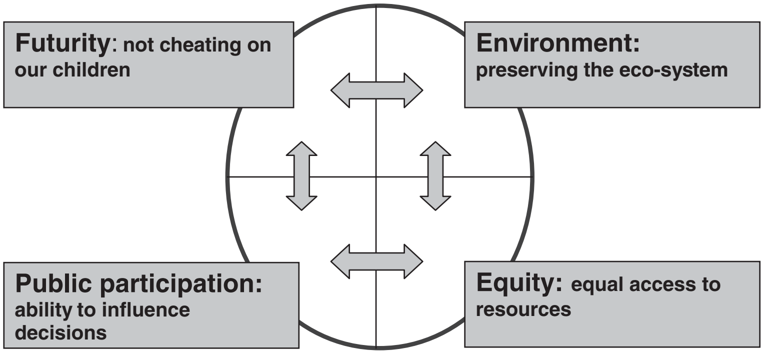

Fig. 12.1 PICABUE model of sustainble development

6. The *spiritual dimension* (the promotion of a different relationship between spiritual development and material development, linked to questions of meaning).

This provides a multi-dimensional and multi-aspectual view of SUD that is rarely appreciated by professional actors in the construction sector, let alone their clients and building users, who still tend to refer to sustainability simply within a narrow environmental protection paradigm.

Background

BEQUEST arose out of a conference evaluating the sustainability of the built environment held in Florence in 1995 (Brandon *et al.*, 1997). This conference began to identify the specific professional cultural differences in the way urban sustainability was described, understood and evaluated between those operating at the building scale (architects and engineers) and at the city scale (planners) (Cooper, 1997).

BEQUEST was successful in securing funding to address this and other related questions for a three-year (1998–2001) networking project, from the Research and Technical Development Directorate of the European Commission (EC) through the Fourth Framework Programme. The EC describes networking projects as 'concerted actions'. This title is particularly appropriate in terms of BEQUEST, as the project sought to address the lack of common understanding of sustainability in the context of urban (re)development between all the parties engaged in the planning, design, construction and use of the built environment. One of the key deliverables was a prototype decision support aid, known as the BEQUEST Toolkit (Fig. 12.2) (Hamilton *et al.*, 2002) presented at an International Symposium on the theme held in Lisbon in 2001 (BEQUEST, 2001a) as well as other workshops where feedback on its functionality have been sought. The BEQUEST Toolkit is discussed further on p. 214.

The main outputs of the project have been disseminated in a special edition of *Building Research and Information* (see Cooper, 2002) as well as in the Italian planning journal *Urbanistica* (Lombardi, 2002). Some of the findings, particularly the framework (Fig. 12.3) that underpins the Toolkit and aspects of the networking methodology, have been directly or indirectly used in other EU research projects, e.g., CRISP (CRISP, 2001) and the European Green Building Forum (EGBF, 2001). Subsequently BEQUEST has:

- hosted a second conference on *Building Sustainable Cities: towards the measurement and understanding of SUD*, held in Venice in April 2002 (proceedings in preparation); and with others

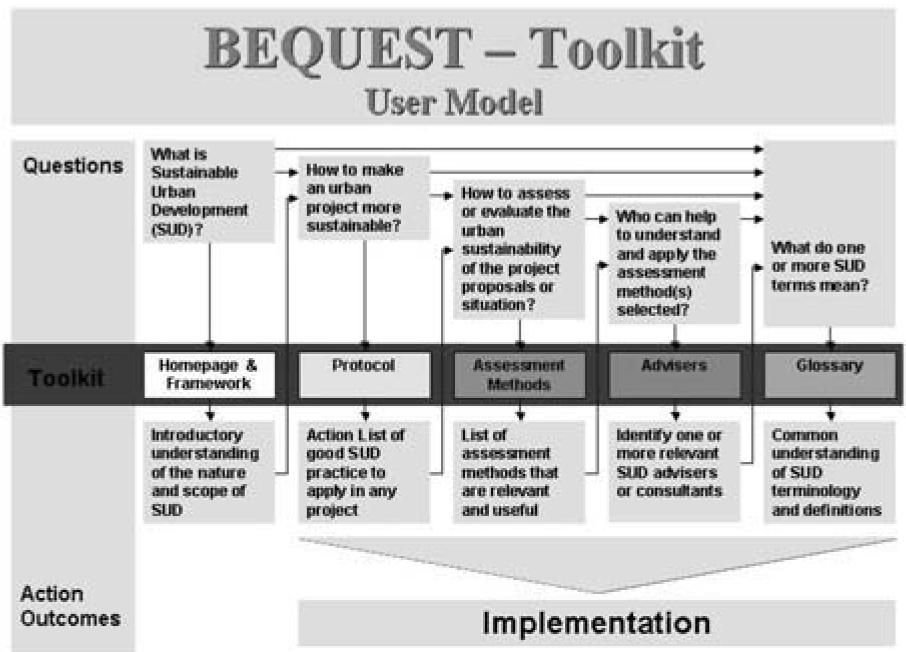

Fig. 12.2 BEQUEST Toolkit

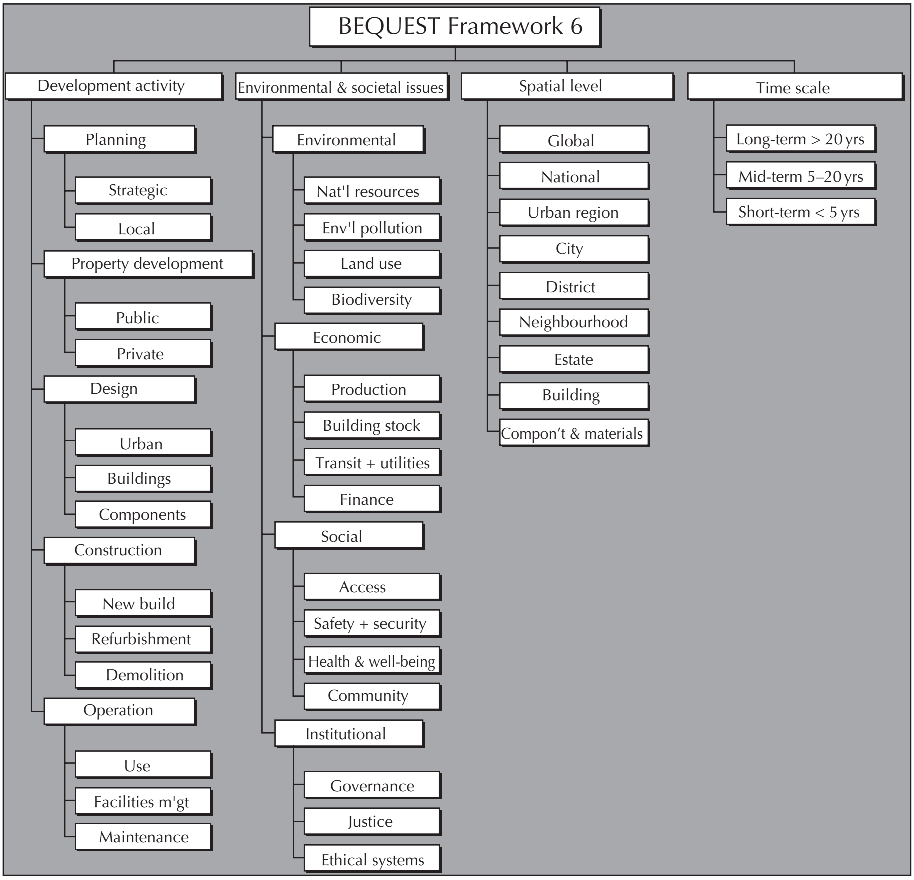

Fig. 12.3 The BEQUEST Framework (version 6)

- received funding from the EC Fifth Framework Information Society Technologies (IST) programme for a one-year project (2002–2003), INTELCITY, aimed at developing a research roadmap for the intelligent use of information and communication technologies (ICTs) to support more sustainable cities.

Working methods

The international cooperation in BEQUEST over the complex and intractable problem of what constitutes SUD, how to move towards it in existing cities and how the sustainability of (re)development proposals can be assessed and evaluated, constitutes seven years of networking activity. This has involved discussion between a core team (24 researchers from 14 partner organisations in 6 EU countries – see Table 12.1) and around 120 representatives of all actors and a wide number of disciplines representing both the demand and supply sides of the property and infrastructure industries. The network members are drawn mainly from European countries, but also include a significant proportion from a wide range of other nations across all continents – see Table 12.2. This indicates the broad cross-cultural nature of the extranet. During the EU project the extranet was created to enabled the project to engage with a wider range of stakeholder interest in the urban environment including all those engaged in strategic planning through to local planning, design, construction, facilities management and use.

A key objective of BEQUEST has been to seek a consensus view of SUD across all stakeholders though an iterative, interactive discussion process, where knowledge and experience are pooled together, and this has

Table 12.1 BEQUEST Partners

University of Venice, Italy
University College London, UK
Polytechnic of Turin, Italy
LT Consultants, Helsinki, Finland
VTT Espoo, Finland
BRE Watford, UK
University of Florence. Italy
IVV Technical University of Vienna, Austria
University of Leeds, UK
University of Salford, UK

Table 12.2 Extranet membership

ATEQUE classification	The pole of collective interest	The pole of operational decision making	The pole of design	The pole of project carry through	The pole of use
Extranet members	98/12 5	14/12 5	88/12 5	27/1 25	51/12 5
Countries of origin	Can, F, Fr, G, Hgy, It, Leb, Nl, Pol, Rom, Sw, Sing, SA, Sp, Swis, UK, USA.	F, Hgy, It, UK, USA	Au, Can, F China, Fr, G, Hgy, It, Jap, Leb, Nl, Pol, Pgl, Rom, Sw, Sing, SA, Sp, Swis, UK, USA	Au, F, Fr, G, It, Nl, Sw, Sp, UK, USA.	Au, F, Fr, G, Hgy, It, Nl, UK, USA

provided the basis of the concepts and consensus that will be elaborated below. Electronic networking using ICTs between the project team at the core and the extranet members continues to be an essential tool for BEQUEST. The iterative process interlinks face-to-face meetings, essential for team building, developing trust and goodwill (three international conferences and ten interactive workshops to date) with structured electronic networking through the BEQUEST extranet (Fig. 12.4). Web pages have been established and are maintained as a means of supporting the networking activities, and the main outcomes and emerging policy issues addressed have been reported in information papers available on the Web (BEQUEST 1998 (1,2); 1999 (1,2); 2000, and 2001). In this way, additional interactive dialogue over the various proposals and the BEQUEST decision support guidance incorporated in the Toolkit represents a broader

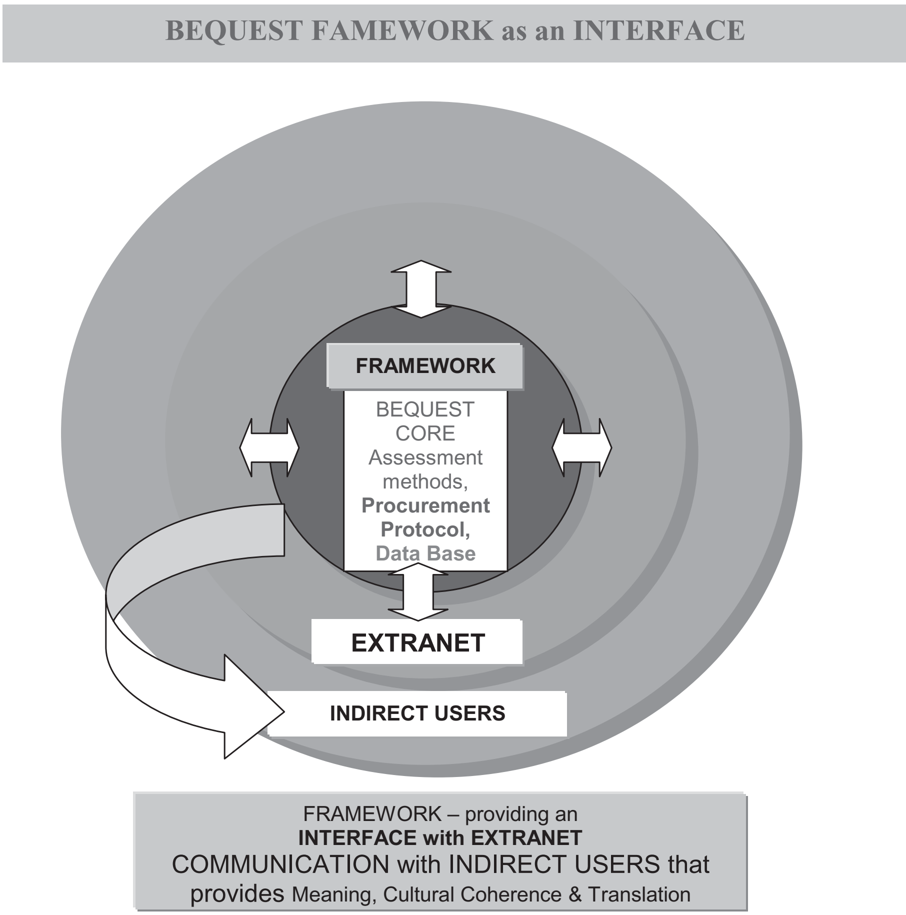

Fig. 12.4 The BEQUEST extranet – method of working

cross-cultural consensus than could have been achieved through the research partners alone.

Thus, BEQUEST has engaged in a more structured discussion of sustainability issues and assessment methodologies with a broader range of actors across a wider range of interests involved in the urban environment than has been seen to date. The methodological aspects of the network have been described as 'exemplary in many respects' (Kohler, 2002) and as an early example of the 'new production of knowledge' through 'e-working' (Cooper, 2002).

Establishing consensus – BEQUEST's challenge

BEQUEST had a clear objective of developing common understanding of SUD across the differing cultural contexts and across the wide range of stakeholder interests involved in urban (re)development. Human understanding of sustainable development continues to evolve, remains fiercely contested and

> ' . . . has become the catchword of our decade, used and misused in many contexts. Yet it has been notoriously difficult to define the term, let alone translate it into other languages.'
>
> (Dahl, 1997, p. 69, quoted in Cooper, 2002)

Given this lack of agreement, BEQUEST's objective of a common or consensus view was extremely ambitious when it was formulated in 1996. It was a conscious objective to attempt to transcend the difficulties presented by the vast scope of the subject and to move forward on a wide multidisciplinary, multi-aspectual front accepting the risk of little or no progress. This was necessary in order to begin fully to understand the differences in approach, language, objectives, and means of sustainability evaluation of the various professional actors that had become apparent in the mid-1990s and the potentially disabling problem this presents for genuine collaborative inter-professional and international cross-cultural action.

Key characteristics of cross-cultural groups

A number of BEQUEST's key characteristics are also common to most cross-cultural groups working in this area, whether transnational, transcontinental or trans-disciplinary:

- focused on application-based problem solving
- engaged with emerging understandings and/or conceptual framework(s)
- composed of a transient, problem-defined team (or loose association)
- consensual or normative, involving negotiated knowledge production
- innovative through the reconfiguring of existing knowledge held in disparate or geographically separated groups
- electronic communication over the internet
- disseminated through partners and networks.

BEQUEST's vision of sustainable urban development

Scope

BEQUEST began by attempting to define the scope of the SUD problem in terms of space, time and the range of actors involved, as well as the range of conceptual sustainable development (SD) that have emerged in the post Brundtland era. These dimensions, plotted in terms of a conceptual matrix indicating the differing scales of response to SD in the urban environment, are shown in Fig. 12.5. This indicates the increasing level of engagement and commitment with SD with increasing spatial scale, timeframes and need for cross-sectorial cooperation as one moves from addressing sustainable construction to global SD. It graphically illustrates the principle of interconnectedness between sustainable construction, sustainable community issues and the cross-cultural nature of the global sustainable development agenda.

Conceptual ideas for SD

A 'four sided' model of SD, known as PICABUE (Fig. 12.1) (ERC, 1996), was a key building block of the BEQUEST vision. PICABUE is based on the 27 principles of SD agreed at the first Earth Summit in Rio together with a review of the literature on SD (Mitchell *et al*., 1995). Although the Agenda 21 principles agreed in Rio were well-meaning, the hindsight of 10 years since their formulation reveals an indiscriminate mix of environmental, social, economic and institutional factors in almost every clause. This undermines common understanding (Bentivegna, *et al*., 2002) and provides potential for only partial understanding or even misinter-

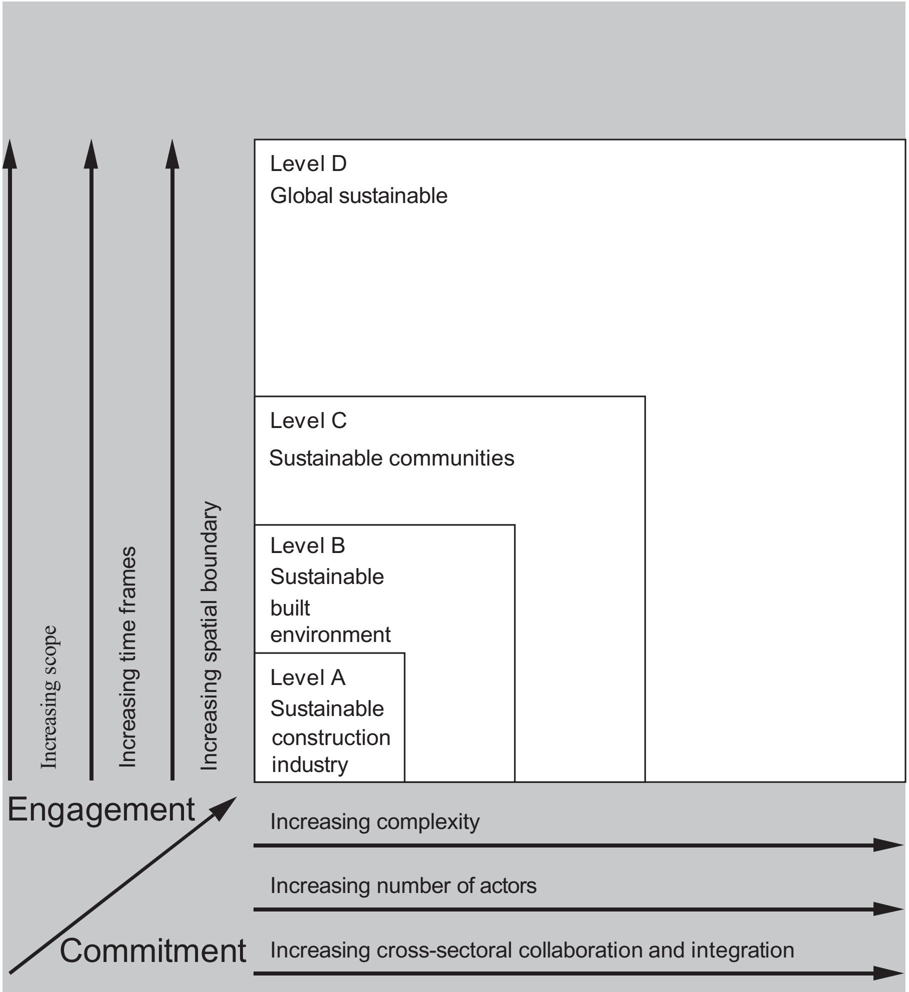

Fig. 12.5 Levels of response to sustainable development open to the construction and property sectors

pretation. Therefore, the simplification of the concepts underlying SD in PICABUE was important to the development of BEQUEST. It formed an acceptable working 'shorthand' benchmark definition, used in the early stages of the project to help explore common understanding and terminology for SD across the network (Cooper, 2002) and to test other models and concepts with a view to developing consensus over a conceptual model of SUD. The review embraced a wide range of SD concepts from government, non-governmental organisations (NGOs), industry and research, including the OECD Pressure State Response Indicator Model (OECD, 1994), the Pentagon Model (Nijkamp 1998), and the Quantifiable City Model (May *et al.*, 1997). Other building blocks included the Natural Step and the Service Economy concept (Giarini and Stahel, 1996), the Charter of European Cities and Towns towards Sustainability, known as the Aalborg Charter 1994 (ICLEI, 2002), and the United Nations' HABITAT 2 conference held in Istanbul in 1996 (UN, 1996). The latter two conferences emphasised the human dimensions in terms of cultural continuity and participation in decision making.

From this work and from a number of the case studies explored in BEQUEST workshops, it is clear that none of these models provided an adequate representation of sustainable urban development. Nevertheless, a number of common, underlying factors emerged from the analysis:

- SD is a relative rather than an absolute concept, i.e., humankind will only be able to recognise progress towards the goal of SD in relation to where we are now.
- SD is a process, not a product or fixed destination. It is difficult to identify SD precisely in terms of some (Utopian?) ideal society and/or physical form, and therefore easier to see it in process terms.
- SD is concerned with very long timeframes. The built environment can be very long-lived so decisions taken today create very long-term implications. The lifestyle enjoyed in European cities today was largely formed by development decisions taken 30 to 100 years ago. In some cases this can be traced back centuries.
- SD is an ethical construct. Underpinning SD thinking is the concern for the wellbeing of present and future generations, which is ethically laden.
- SD must be culturally grounded. Villages, towns and cities are the physical container of urban life and one of the main manifestations of culture. Much ill-considered modern urban (re)development has and is undermining cultural continuity.

The overall conclusion is that in order to address progress towards sustainability questions adequately development *must integrate* economic, environmental, social and institutional factors (Bentivegna *et al.*, 2002). These points represent additional principles, which have been used to develop the PICABUE concept to form a consensus view of SD upon which the BEQUEST vision of SUD is based, which in turn has been used to configure the BEQUEST Framework for SUD.

The BEQUEST Framework for SUD

The Framework is important because it represents the cross-disciplinary, cross-cultural consensus over the nature and scope of SUD developed by the network and provides the underlying structure behind the Toolkit. The Framework relates four main dimensions of urban development: Development Activity, Environmental and Social Issues, Spatial Level and Timescale (see Fig. 12.3), which are explored further below.

Development activity

As identified earlier, SUD is a process. Therefore, good practice guidance on SUD and on the use and procurement of assessment methods needs to be integrated with the urban (re)development processes from strategic planning on the one hand to utilisation of the resulting built environment on the other. The main activities, their sub-activities with their associated actors, i.e., planning (strategic and local), property development (public and private interests), design (urban, building and components), construction (new build, refurbishment and demolition) and operation (use, facilities management and maintenance), represent separate processes. Within each of these processes, more SUD thinking, good practice and assessment have to be applied.

Environmental and social issues

Various human activities are created by, or are consequences of, sources of environmental, economic and social stress. Environmental stresses include depletion of natural resources, pollution, and excessive land take with consequent loss of biodiversity. Economic stress is often a cause and effect of loss of production, decaying building stock, and/or inadequate finance or incentives. Transport and utilities are important industrial sectors that affect and are affected by other economic sectors. Social stress may include lack of access to facilities, inadequate safety and security, poor health or general loss of wellbeing, which is often associated with poor sense of community. Good governance is necessary to create equality of access to resources along with social participation, and judicial means of redress are all part of the institutional framework necessary to support SD. All these aspects, and the spiritual dimensions of life, are ethical constructs.

Spatial levels

Urban development occurs at various spatial levels, from the scale of the whole city, to neighbourhoods, to the individual building and its material components. Equally, the environmental effects, or other socio-economic implications, can be felt from local to global levels. A planning proposal can lead on to various new industrial and commercial consequences for the environment, economy and society from the level of the whole city down to the neighbourhood scale. The provision of new buildings can affect the extraction of raw materials and the manufacture of components, which in turn can create emissions that can have effects on the environment from the local to global scale and so on.

Timescale

The importance of long-term thinking to SUD has been mentioned above. The timescale used by BEQUEST represents the normal scale used in economic and strategic planning, i.e., short-term (0–5 years), medium-term (5–20 years) and long-term (more than 20 years).

BEQUEST Toolkit

The main features and use of the Toolkit are shown in Fig. 12.2, but the full extent of the features are best appreciated via the World Wide Web, accessible through the BEQUEST homepage at http://www.surveying.salford.ac.uk/bqextra. The Toolkit evolved over the three-year period of the EU funding. Proposals were subject to numerous revisions as the partners developed their common understanding of SUD, and the requirements of an integrated decision support system for urban sustainability. Work was carried out in task groups, and this led naturally into a modular structure.

Modular structure

The Toolkit is subdivided into four main modules (see Fig. 12.2):

- The *Protocol* includes checklists of actions that urban actors should consider as well as case studies of good practice in order to make their development more sustainable, collectively addressing economic, social, environmental and institutional objectives.

- The *assessment methods directory*: this is a compilation of 25 assessment methods, ranging from well established to experimental, that have been, or could be applied in the sustainability assessment of urban development, with hypertext links to other lists and descriptions, such as that created by the International Energy Agency Annex 31 group. Each method is described in common format: name, description, data requirements, status, relationship to framework elements, and sources of further information, including references and cases studies. An overview and evaluation of these methods with respect to assessing SUD is provided by Deakin *et al.* (2002).
- The *advisers directory*: this module contains details of advisers and consultants with experience in assessment methods and expert knowledge on individual steps identified in the protocol.
- The *glossary* explains various SUD and environmental protection terms used in the Toolkit, as collectively understood by the BEQUEST network members.

In operation, the Toolkit allows direct access to each module, via a menu system and search engines. In this way suggested actions for more SUD, potential assessment methods and evaluation techniques, terminology and advisors together with respect to the activity-issues-scales domains are inter-linked by the BEQUEST framework.

End users

A key task that the team addressed at an early stage was question of the potential users of the Toolkit. As described above, the Framework recognises a wide range of users from planning, development, design, construction and use. However, the final prototype available on the web is designed with three broad end user groups in mind:

- *Professional users* (architects, planners, engineers, etc.), whose primary need is to access the best available information on appropriate assessment methods and 'how to make development more sustainable' good practice protocols
- *Mediators*, who are able to interpret the information on behalf of non-experts such as politicians and the general public. Mediators will be particularly interested in the checklists of good practice and the case studies of previous urban interventions. They may be drawn from NGOs, pressure and community groups, or from the professional and research communities

- *Researchers*, whose principal interest is in exploiting the richness of the information (methods, case studies, good practice protocols, relationships between system elements) to gain new insights into sustainability problems.

The needs of these groups are not mutually exclusive, as an individual may belong to all three groups, so the Toolkit is designed so that information needs can be satisfied generally. The reasons for this are twofold: lack of a common language, and lack of common understanding of what constitutes SUD that could bridge both professional and cultural divides.

Common understanding

The contested nature of SD and the additional difficulties created by the complex multi-disciplinary problems presented by SUD have been explored earlier. These problems are a consequence of humankind's lack of understanding of what these terms really represent. At the current stage of the development of knowledge, research provides some directions. To complement this, BEQUEST sought to explore case studies of good practice in the EU. However, most of these showed only partial approaches, concentrating mainly on economic and environmental protection and usually neglecting social and heritage issues. The timeframe of analysis in all of the cases was very short, i.e. exploring or projecting around five years into the future, effectively ignoring the intergenerational equity question (BEQUEST 1999-1; Bentivegna *et al.*, 2002). This indicates not only a serious lack of rigorous multi-aspectual SD analysis, but more fundamentally an almost complete absence of important dimensions of SD thinking in urban (re)development practice. In turn, this is reflected in the content of the BEQUEST protocol in that the advice offered in the economic and environmental protection areas is much more extensive than in the social and institutional.

Common language

In this context the difficulties of creating the BEQUEST information framework have already been explained. However, at the beginning of the project it proved relatively easy to agree on common definitions of terms for the glossary, as a basis for a common 'English' language for SUD. This is probably due to the fact that the research partners accepted the terms used by the British members of the team. There were exceptions. One important example of this was the term ‘procurement’. In the Anglo-Saxon speaking zone, in addition to the general meaning ‘securing goods and services’, it is also accepted as a term for the process for securing the design and construction of buildings and city infrastructure. This second meaning is not understood in most of the other regions of the EU.

In the Protocol, BEQUEST sought to bring together and rationalise the current research and good practice information on SUD in a structured manner (hence the framework previously described). For the reasons suggested above, agreement on the various good practice advice clauses was difficult but possible to achieve when issues were addressed at a generic level. For example, in urban design it was possible to agree on the recommendation ‘provide high occupational density with mixed use of dwelling, industry and retail’ as there is a clear balance of professional opinion that this will lead to lower urban transport demand. However, as there is no clear research evidence to support this proposal, and as the application of this advice is so location-specific, it was not possible to agree a clear density and/or mixed use target figure. Thus, detail was much more difficult, partially due to lack of knowledge but mainly due to the need to respond to local needs in any specific urban area or city.

Lessons to be learned from BEQUEST

Lessons from the Framework and Toolkit development

The full potential of the BEQUEST Framework (and Toolkit) is still being investigated. Large parts of 5265 separate domains in the framework (13 development activities, 15 environmental and social issues, 9 spatial and 3 temporal axes) remain unfilled. This is due partly to resource limitations, but primarily it represents two main areas of deficiency:

- lack of current knowledge on what constitutes SUD or on how to evaluate it
- lack of consensus across cultural divides (national and/or professional) over what action should be taken.

This is particularly acute in terms of the social and institutional dimensions, where ‘gaps’ in understanding, consensus and assessment of SUD include:

- what constitutes good quality of life
- common agreement over resource reduction or efficiency targets (factor, 4, 10 or 20?)
- lack of transparency in the decision-making process for all stakeholders
- means of conflict resolution, particularly between the public and private interests
- lack of faith in local participative democracy in general (BEQUEST, 1999-2).

These problems have always existed in the planning process, but the pursuit of SUD emphasises them, particularly in the sense of powerlessness not just in ordinary citizens, but also in the professional actors. This feeling in professionals can be summarised as 'whatever I do, it won't improve matters'. The inability to address these problems effectively in modern society is one of the real disabling factors in moving to much more SUD in the short to medium term, and forms a key policy imperative.

The extent to which pan national, pan cultural solutions can be found for such problems is an interesting question. There are good examples in Europe. The 'Polder system' of local democracy in the Netherlands seems, from an outsider's perspective, to offer many advantages in terms of providing greater inclusivity in decision making together with a strengthened sense of individual responsibility necessary for community action. The role of the 'evaluator' in the Tuscan planning process offers a more effective means of reconciling or mediating between public and private interests in urban (re)development. The process is less adversarial than that in many jurisdictions so that development control is potentially much less wasteful in terms of time and human resources. However, these examples sit within quite local cultural confines, and so their transfer elsewhere is problematic. Yet the use of the new techniques emerging in the so called 'information society' is seen as offering great potential for new, more efficient solutions to these structural disabilities in urban decision-making processes. The intelligent use of ICTs could empower stakeholders, and generally improve the planning process from an SUD perspective. This is the subject of a new EU research roadmap project: INTELCITY (2002), which is to build on the work of BEQUEST.

Therefore the provided advice had to be very generic to be generally applicable. As a consequence, users must interpret this generic content for their particular cultural, geographical and climatic context, sphere of activity and stakeholder groups. The generic nature of the content was and continues to be a point of criticism. Although the framework provides a logical structure for the necessary discussions involved in developing consensus, the evidence of a number of interactive Toolkit testing sessions held towards the end of the project (in Helsinki, Edinburgh and Lisbon) suggests that most professional users were uncomfortable or dissatisfied with the generic level information provided. These users felt the need for more detailed advice targeted to specific groups and localities, e.g. in relation to local planning or building regulations. Thus although the advice was useful in identifying the main actions that could or should be considered it was not enough to enable the complete and detailed translation of good practice advice or knowledge from one cultural context to another.

SUD guidance

The wide range of guidance in the Protocol can be summarised into five main actions.

- Use fewer resources – do not build unless it is necessary; rehabilitate, reuse, recycle.
- Place the (re)development in the continuum of history in terms of the cultural context and where it is appropriate, ensuring longevity through durability and flexibility.
- Minimise damage to the environment: air, water, land, energy, plants and animals.
- Persuading your clients that they care – buying goods and services locally to strengthen the local economy and community.
- Ensure public participation in the process.

Although this is a gross simplification of the richness available, in this context the BEQUEST Toolkit (and its underlying information Framework) is intended to help make 'better' decisions along the way. In order to achieve the objective of development proposals that are more sustainable, it is necessary to benchmark the current situation, to identify a range of possible best practice policy and physical development options, and to select the optimum for the situation under consideration.

In all cases there is a clear need for assessment and evaluation techniques that enable objective sustainability assessment and provide sound information both for decision makers and for the wide range of other stakeholders. Through the logic of the Framework, BEQUEST provides a unique integrated representation of the scope and extent of SUD. This links socio-economic and technical dimensions as well as planning, property, design and construction interests, in time and space which:

- provides a 'model' of SUD that adequately represents, but simplifies, the breadth and complexities of the problem as already explored
- forms the basis for common understanding between a wide range of stakeholders
- enables the classification of assessment and evaluation methods (Deakin *et al.*, 2001, 2002) that assists in understanding their relevance to various decision makers and urban (re)development problems as well as a means of identifying current gaps in sustainability assessment
- forms a means of structuring current good practice guidance so that it is relevant to various decision makers and urban (re)development problem situations.

However, following BEQUEST guidance cannot, on its own, overcome a number of wider social and political impediments. These impediments tend to slow or constrain implementation of more integrated approaches to SUD. They include:

- the overall lack of demand in some countries/cultures for more sustainable solutions
- inadequate participation and empowerment in urban (re)development decision making and loss of citizens' faith in governance in general
- lack of clarity and agreement about what sustainability targets should be set and upon the indicators of progress towards a more sustainable built environment.

Final success (or failure) in any particular (re)development situation will be dependent on two essentials.

(1) A closer dialogue is required between all stakeholders from the point of view that sustainability is an essential requirement for human settlements in future. Open, accessible and accountable negotiation is necessary over what each stakeholder is trying to achieve. BEQUEST offers a more defined and constructive language for SUD enabling insight into wider problems, and the framing of more constructive negotiations.

(2) Greater integration is needed across various urban decision-making and professional disciplines. The BEQUEST vision for SUD supplies a framework for this integration.

The really positive news from BEQUEST is that complete agreement on all aspects is not necessary in order to make progress. Identifying the common ground and building on this has long been understood in diplomatic circles, and so conflict resolution becomes a vital skill. In this context, urban policy makers, planners, property developers, designers (architects and engineers) and constructors need to see themselves as change managers seeking innovative solutions to adapt and re-generate the built environment so that it can support more sustainable regenerated city life. The strategies that should be employed should be based not on a fixed target or blueprint, but on an integrated and flexible approach that adjusts to local conditions and the local community requirements.

Implications for other cross-disciplinary, cross-cultural 'virtual' groups

Managing 'virtually' is very difficult and requires more time, effort and resources than face-to-face encounters, especially as electronic communication is much less effective and less 'rich'. It is very important for research policy makers to be aware that the latter is still necessary until we have developed ways of establishing rapport and trust necessary to building consensus and resolving conflicts remotely.

Experience in the EU with various networking projects such as BEQUEST, and with international collaboration over standards (e.g. the Environmental Impact Assessment, and other initiatives such as the Green Building Challenge), shows that as yet there is no common model or agreement about how to conduct inter-disciplinary, cross-cultural working most effectively. BEQUEST has illustrated some techniques for developing a shared perspective, e.g. through a common conceptual framework and using self assessment techniques to draw out and identify areas of commonality and areas of difference between members both of the research team and of the wider network.

Working methods used in BEQUEST were central to the success of the networking. It is not possible to assume that all are familiar with all aspects of the ICT revolution. In agreeing baseline inclusive standards for e-mail, and other IT-related communications, it may be necessary to use less technically advanced formats or software to ensure that all can take part.

Working virtually can extend lead time in the decision-making process. An effective technique used by others and applied successfully in BEQUEST is the discussion paper. This starts with an outline in which parts are gradually added over several days or weeks by team members based on their own area of expertise. By the end, reasonable consensus can be reached. A project leader and task group leaders with diplomatic skills are important in these circumstances. The author, as director, was able to 'manage' most disputes; however, it is not always possible to have the time to 'talk out' issues and so means of conflict resolution are necessary. In BEQUEST one individual attended most of the workshops, but was not allocated to any specific task group. He was accepted as an 'honest broker' acting as mediator when agreement was lacking but decisions had to be made. However, there had to be sufficient face-to-face contact, in BEQUEST's case three three-day workshops per annum, for sufficient trust to be established for such mediation to be effective. Taken together these techniques have created the BEQUEST method, which enabled the team to transcend discipline boundaries, and build a 'common space' necessary for effective collaboration.

Conclusions

Cultural diversity is a major policy objective in the EU. This has led the Council of Europe (in December 2000) to revise the Brundtland definition of SD from the perspective of cultural diversity:

> 'Sustainable development as defined in relation to cultural diversity, assumes that technological and other developments, which occur to meet the needs of the present, will not compromise the ability of future generations to meet their needs with respect to the production, provision and exchange of culturally diverse services, products and practices.'
>
> Information Society Technologies, 2002

Thus the importance of maintaining cultural diversity as a dimension of sustainable development, as a counterbalance to globalisation and homogenisation, should not be overlooked. This chapter indicates the potential for group work and consensus building across many disparate cultures and disciplines. It illustrates how it is possible to work together to create and define common ground despite cultural and language differences. In this case, commonality and agreement have been established on the definition of sustainable urban development and on advice and guidance over SUD that is relevant to a range of European cultural contexts.

It is important to note that complete agreement over what constitutes all aspects of SUD was not necessary in order to make progress. BEQUEST was a three-year project. This length of time was important as it enabled the gradual building of knowledge, transfer of capabilities and cross-fertilisation of ideas between different disciplines and cultures.

The example of BEQUEST provides a successful model for addressing the challenges of cross-cultural networking where these dangers and limitations of cultural exchange have been recognised and addressed. In cross-cultural exchange, it is important to recognise the elements that are common and which can be usefully standardised, but equally to recognise those items that are important in each individual cultural context. The major lesson is that successful cross-cultural exchange is based *not* on the transfer of products, technologies or designs, but in providing a common understanding of the sustainable urban development process, a language to explore the question and a framework for analysis which assists in understanding those things that are generic and can be commonly addressed and those that are local and specific to the climatic and cultural context. Successful cross-cultural exchange needs to recognise these important points and should avoid simple transfer of case study findings in an uncritical, uncomprehending manner. Loss of the specifics of context is dangerous because it leads to undesirable and unnecessary homogenisation.

BEQUEST has demonstrated the need to make explicit what often is implicit, through an agreed terminology, agreed objectives, criteria and a transparent decision process to evaluate different approaches and to facilitate a clear dialogue between participants. These factors are important to any project, but working across cultures, be they national or professional, emphasises the need for inclusivity and transparency in decision making. In the context of this book the interest in BEQUEST lies in two areas:

1. The development of an agenda, framework and evaluation tools for SUD that has been explored in this paper.
2. The development of a method and language for, as well as demonstrating the possibilities of, working across cultures at the *generic* scale. Although BEQUEST is not unique, the methods adopted provide an example by a particular research community that may, given time and development, provide some useful lessons for practitioners and others who continue to make the mistake of unsympathetic 'instant' stylistic and/or technology transfer.

Therefore the wider lesson for the academic and practitioner communities is that the cross-cultural exchange of 'information' (technical data, practices, case studies or technologies) is best done at a generic (abstract) level and that this involves a range of skills/capabilities that have traditionally not formed part of the 'armoury' of construction professionals. This will enable them to engage in a fuller inter-disciplinary and cross-cultural process of evaluation. It is necessary to recognise the limitations of case study examples due to the difficulties of fully understanding the context behind them. The author's experience with a pan European higher education programme (in the area of the evaluation of SUD) provides additional reinforcement of these points and raises significant, parallel implications for addressing these problems in higher education and the media.

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13

Reconciling Expectations

Nick V. Baker

Introduction

It is essential to understand how social and cultural expectations inform the creation and use of the built environment. If a building is not socially and culturally embedded, there is a high risk of failure. This is due to both (social) non-acceptance of the building itself, and technical failure due to lack of management know-how. However, social expectations are malleable and subject to change. This malleability is open to abuse by advertising and consumerism. The concept of expectation is dangerous as it is often interpreted to imply justification and provision. A more critical view is necessary to unravel individual expectation and whether it is always wise to plan for meeting expectations.

The increasing availability of a plethora of information and technologies presents a series of problems for designers of the built environment:

- how to understand local users' expectations
- assessing whether these expectations are realistic and accord with their needs
- assessing if the expectations are 'sustainable'
- assessing adapting information to this context
- considering their role for changing the expectations of clients and users.

The context of energy consumption is used in this chapter to illustrate the wide variation in expectation both within a society and between different societies. Within the context of energy use in buildings, even the notion of indoor comfort is defined by a host of expectations which vary considerably between different societies.

The growth of global energy use

Nearly one half of the world's commercial energy is used by buildings. The majority of this energy is derived from fossil sources, thereby making the built environment the single largest contributor to CO_2 emission and hence global warming. Transport is a close second, with industrial and manufacturing process energy taking third place. How do buildings account for so much energy consumption? Most of the energy is used for conditioning the environment – to further the climate-moderating effect of the building, and to reduce the constraints on the use of the building imposed by the prevailing environmental conditions. In domestic buildings in cool climates, huge amounts of energy are used to provide heating, mostly by local combustion of gas, oil and solid fuel. In non-domestic buildings a greater proportion of the energy is used to provide lighting, mechanical ventilation and mechanical cooling. In this case the power is delivered as electricity, which if generated from fossil fuel generates about three times as much CO_2 per delivered kWh as the direct burning of fuel on site.

When primitive man occupied caves, the coupling of his living space with the ground meant that the temperature he experienced within the cave followed the annual average temperature quite closely. Thus the cave was relatively warm in winter and cool in summer. The discovery of fire was probably first exploited for cooking and as a form of defence, but its ability to provide light, and radiant warmth, would have quickly been apparent. As soon as this fact entered the primitive culture it opened up the possibilities of inhabiting more inhospitable climates, lopping the life-threatening peaks off the winter extremes. No other species uses combustion to release thermal energy. Indeed, virtually no other species uses energy in any form other than food, and few species have colonised such a wide range of climates, ranging from the scorching Kalahari Desert to the windswept plains of Siberia, where the average January temperature is minus 50°C. So is energy consumption the key to this success as a species?

The remarkable fact is that this global colonisation has largely been achieved by the passive performance of the shelter itself. As in the case of the 'found shelter' of the cave, vernacular architecture has long been held as a model for appropriate climatic response. For example, by heat gains from the occupants alone, the Inuit snow house moderates the outside temperature of minus 40°C, with a wind chill of about minus 70°C, to a relatively comfortable minus 10°C in still air, quite survivable in the traditional highly insulating clothing and with a fatty diet. In other climatic extremes – the hot arid desert regions of the world – maximum daytime temperatures as high as 45°C are moderated to a survivable 30°C by the massive mud-brick and masonry traditional dwellings.

It is difficult to assess the contribution that energy use has made to survival, through the conditioning of the living space. Nonetheless, the energy demand was small. It is also certain that no vernacular architecture relies on non-ambient sources of energy to provide cooling. Ironically, this is where the greatest growth of energy demand is found today.

Thus, massive energy consumption was not a prerequisite of survival in all but the most extreme climates. Furthermore, it could hardly be claimed that energy consumption was an essential part of our cultural development either; much of the art, literature, classical science, law and politics which are still part of our contemporary culture are the product of pre-fossil-energy mankind.

Variance of energy use

A quite different kind of evidence casts doubt on the necessity of the massive use of energy by buildings. This is the observation that the energy consumption of individual buildings within a given use type and in the same climate and culture is extremely uneven. Figure 13.1 shows the energy consumption of 92 office buildings in the UK. The worst consumes 20 times more energy than the best, and yet the buildings are basically used for the same purpose. Why should some buildings consume so much more than others for the same function? One clue is that almost all of the buildings in the higher consumers are air-conditioned. Consider this scenario: two office buildings on a warm spring day, one daylit with open windows – no lights, no mechanical ventilation, no air-conditioning. The other has a sealed tinted glass façade, artificial lighting throughout and full air conditioning to remove the resulting solar and lighting gains. The difference in energy consumption is huge. The underlying expectations within both the design team and the occupants of the two buildings are different, but there is no evidence to show that the high-energy consumer delivers more comfort or more satisfaction.

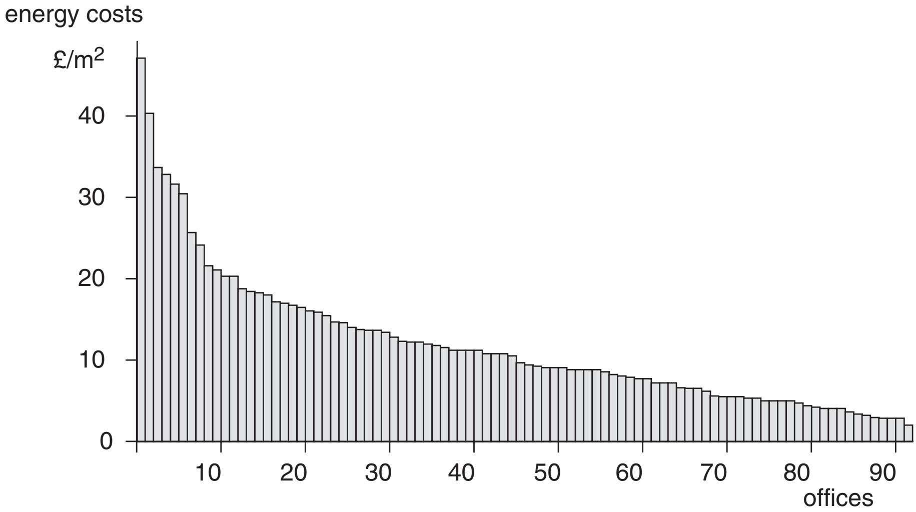

Fig. 13.1 Annual energy cost (which closely relates to CO_2 emissions) for 92 UK office buildings shows a very wide variation

We are even more inconsistent in our energy use in our cultural lives. A holiday for a European family hill-walking, fishing or just enjoying the beach, with the main mode of long distance travel from home by train, would consume about 2000 times less energy than the same family's package holiday to Disneyworld, Florida. The latter would consume as much energy in aviation fuel as that required to heat their home for a year.

How can this cavalier attitude to such profligate consumption be explained? In these examples there are several contributory factors.

First, energy is cheap. In the UK, since the early 1950s, the real cost of energy across all fuels has more than halved. One kWh of electricity today is about 80 times cheaper than it was at the beginning of the twentieth century, when publicly generated electricity was first marketed. Typically the energy costs for an office building are less than the cleaning costs, and the average annual space heating cost of a three bedroom house is £280, equivalent to the cost of a modest restaurant meal for two people six times a year. The financial incentive for a filling station manager to turn off the forecourt lights in the daytime, for a building manager to insist that cleaners only switch on the lights in rooms that they are cleaning, for a householder to choose hardy plants for his conservatory rather than heat it with off-peak electricity, is very weak.

A second reason is that buildings, as energy-using systems, often have inherently poor energy performance. This is because, other than the weak cost incentive above, there are really no other penalties for high energy use. In contrast, an airliner has to carry fuel that has technical penalties in performance, and intense interest is directed towards fuel efficiency. If buildings were tested for energy efficiency, we would find many where simultaneous heating and cooling, wasteful fan and pump operation and inefficient control would all lead to far higher consumption than necessary.

Low-energy building design is not difficult, as clearly illustrated by Fig. 13.1. Research in energy use in buildings has been active since the oil crisis of the 1970s, and has concentrated on technical issues. Standards of insulation, boiler efficiencies, luminous efficacies of light sources, and more innovative technical design such as night ventilation and use of thermal storage in the ground have all advanced sufficiently for us to design buildings which, when simulated, consume very little energy. But in practice, they rarely live up to these predictions. From field studies, Leaman (see Chapter 10) suggests this predicament is due to poor understanding of users' needs, failure to understand the technology and poor management. These all seem likely individual factors, but it is the compounding of these factors which accounts for major shortfalls.

The third, and probably least understood, factor is the expectation of the occupant. As outlined above, conditions could be achieved more economically by the application of technical principles. But why are these conditions demanded in the first place? Are they essential to survival? Clearly not. The answer lies in our perception that these are essential to our expected lifestyle.

What do we expect, and how are our expectations nurtured by the opposing forces of society – altruism and self-interest? And how is the diffusion of these expectations influenced by the global access to information? Will it be for the good, or will it confound our efforts to curb global warming? And ultimately, can some of these mechanisms that are, at the moment, driving this supertanker of energy consumption ever faster, be harnessed somehow to slow and turn the monster round?

The answers to these questions may be sought in the main contributions to this section. Some of the main issues are discussed below.

The global village

Seaden (Chapter 9) asserts that although the proportion of the world population having Anglo-American cultural origins is relatively small, its values and expectations are disseminated almost universally through global communication systems. In spite of the inappropriateness of many 'international' products, even in underdeveloped countries there are enough well-off consumers to respond with a real demand. This is particularly true in the fields of transportation, communications and consumer products. Here the multi-national companies invest huge effort in fine tuning the product to the demand, or more realistically (and efficiently) in creating a demand to match the product.

On the other hand, small firms undertaking small local projects form the majority of the construction industry. Could this mean then that the influence of the international industry giants is relatively slight? A glimpse of new building projects in almost any developing country will show that this is demonstrably not the case. According to the World Trade Organisation figures for 2000, almost 75% of the global market for architectural services derives from the developing world, with 80% of those fees accruing to firms in the world's seven richest countries (Booth, 2002).

Just as global communications can create a demand for Coca-Cola and Levi's, so too it seems they can create a demand for a Western-style built environment. All too often the result is over-glazed high-rise office blocks, surrounded by dense housing towers, standing in a traffic-choked polluted road system. Unfortunately, the criterion of appropriateness is pushed down the priority scale, well below those such as prestige (based on acquiring status and following international fashion) and short-term political gains.

Regulation, both local and international, is only weakly influential in countering this. In many cases, regulations that in principle impose quite strict environmental and ecological constraints are not enforced, due either to corruption or at best to incompetence. Thus, they are little more than a form of self-delusion, allowing politicians false membership to genuine international concern. In other cases, national regulation is either weak or non-existent. Or, as in the case of the United States and the Kyoto Accord, in spite of the existence of many internal regulations, the underlying objective of reducing global impact is not ratified.

It is interesting to speculate whether world regulations such as the Kyoto CO_2 targets, or the internationalisation of 'local' regulations such as insulation standards and plant efficiency, will have the most impact on reducing global warming. Whilst the former focus on the 'ends', the latter imply some kind of 'means', i.e. have an implicit educational content. This would suggest that these are more appropriate for international dissemination to developing countries. We can already see some successful cases of this in emission standards from motor vehicles in India and the Far East.

On the other hand, it is ironic to note that one of the best agents for promulgating air-conditioning has been the formulation and diffusion of environmental comfort standards, by bodies such as ASHRAE, CIBSE and ISO.

Seaden situates the construction industry within a larger context of free-market economic and production processes. Competition can lead to innovation and improved products and services. Other industry sectors provide examples to compare and contrast to construction for the creation of high standards of quality, service and performance. Consumer satisfaction (and the requisite understanding of client desires) is the key to success in many industries.

Seaden argues this also applies to construction, and discusses what clients' needs actually are new approaches to fulfilling these. One approach, BOOT (Build–Own–Operate–Transfer), reduces risks for clients and emphasises long-term operation and functionality. The growing awareness of performance (both the building operation and, in turn, its abilities to support its occupants' functions) presents new opportunities for the construction industry to influence client expectations to create environmentally sound buildings.

Is the comparison valid? The built environment is not a disposable entity. By the time a municipality discovers that its city centre development is an environmental disaster it is too late, and there is not a 'next time' to shop around. It may have to be lived with for the next half century.

The creation of markets

Two aspects already touched on – the creation of demand by advertising, and by regulations and codes of practice – are central to Brager and de Dear's contribution. The meteoric rise of domestic air-conditioning in the US from the 1950s was largely a result of advertising – selling a product which had no existing market base. As always, advertisers employed the subtlest psychological methods, invoking concepts ranging from modernity to family values and gender roles. So successful was the advertising campaign that Brager and de Dear (Chapter 11) quote Reese (1960), who already noted that air-conditioning was perceived as 'part of the American standard of living, something we are all entitled to, just as we are entitled to heat in the winter and food on the table'. It could equally well be described as an expectation.

Regulation has played a complementary role – supporting the market by providing 'needs' rather than 'wants'. Regulation in the built environment has always been concerned with health and safety – structural stability and durability, fire safety and hygiene, some of these dating back to the nineteenth century. More recently, comfort has been added to the list. The objective of regulation was to protect those in and around the building; in that sense they were 'local'. This is quite distinct from much more recent environmental and ecological regulations where the objective is global – e.g. reduction of energy consumption and hence of CO_2 emissions.

In many cases, the two types of objective are in conflict or at best unrelated. The most obvious conflict arises in comfort standards and legal definitions of acceptable indoor temperature ranges, as well as other environmental parameters such as mechanically delivered fresh air and artificial illumination levels. The meeting of these standards has not only increased energy use directly – the maintenance of higher temperatures in winter or lower temperatures in summer – but has demanded certain technical provisions in order to control conditions within narrow bands. It is this, probably misguided, objective which creates the demand for energy-profligate systems such as air-conditioning. Another circle of self-perpetuation is that parameters that can be measured easily, e.g. temperature, become the subject of standards. Once the standard is established, the perceived need is only to meet the standard, not to meet the original objective by any other means. The move towards performance guarantees and litigation only reinforces this trend. Thus the engineering objective of controlling temperature and humidity within narrow limits has become the primary objective rather than the actual comfort of the occupants.

The science behind the regulation

Clearly, the original intention for regulations and standards was to support the provision of a comfortable environment. However, as Brager and de Dear ask in Chapter 11, was the mechanism of comfort behind the standards properly understood? Most thermal comfort standards are firmly based on laboratory experiments on human subjects, which identified an environment which was thermally neutral, as optimum. Field studies, on the other hand, consistently show that occupants are satisfied with a far wider range of conditions, including those that partially track prevailing outdoor conditions. The explanation for this apparent discrepancy is that first, people make adaptive actions which improve their heat balance, e.g. adjustments to clothing, posture, degree of animation etc. Second, the context of the perceived thermal sensation is taken into account in establishing the degree of satisfaction – a person sitting next to an open window may find an occasional cool draught quite acceptable, where a similar draught from a air-conditioning grille would be unacceptable.

Another key factor is the degree to which the occupants can control their environment. It has been suggested that this relates to man's innate and very successful ability to adapt to the natural environment, but it is demonstrable that occupants have a far wider tolerance to environmental parameters (such as temperature) if they are in control.

In summary then, definition of comfort hinges on two conflicting notions. On the one hand, comfort is defined by the notion of optimum environmental conditions, requiring no adjustment, and delivering thermal neutrality. On the other hand, comfort is context-dependent, and the opportunity exists for the occupant to carry out relatively minor actions within a much more loosely controlled environment. This is often referred to as *adaptive opportunity*. Both notions are underpinned by social and cultural expectations, although the former was (wrongly) assumed to be based on purely physiological mechanisms.

The latter approach, often referred to as the *adaptive model*, is gaining consensus in the building science community as the way forward. However, it is far more difficult to define. Temperatures can be standardised and equipment designed to deliver these conditions. But how can adaptive opportunity be defined and quantified?

Building performance – the holistic approach

Leaman in Chapter 10 begins to answer some of these questions by taking a holistic look at the users' response to the building, based on many user surveys, rather than examining individual environmental parameters and theory. He claims that there are *emergent properties* of buildings that distinguish between buildings in which the occupants are satisfied for a relatively small technological investment, and buildings where high levels of dissatisfaction prevail in spite of energy-rich environmental control.

The emergent property is a way of describing mutually supportive characteristics – i.e. where the whole is greater than the sum of the parts. This may well go some way to explain the wide variance of energy consumption shown earlier in Fig. 13.1. Leaman suggests that buildings (and that includes their architecture, their mechanical systems, and their management) tend to promote either virtuous circles or vicious circles.

User controls are again identified here as positive attributes, as are features such as openable windows and good views, supporting the earlier point that people's response to a stimulus is positively moderated by its context, in particular links with outdoor conditions and nature.

The concept of control is also extended to include management issues. Leaman rates highly the value of a management responsive to occupants' (reasonable) wishes, relating to a wider range of aspects than the thermal environment alone. On the one hand this is good commonsense, utterly consistent with our intuitive understanding of the world around us. On the other hand it is a nebulous and ill-defined target, which may be difficult to convey by standards and regulation, and even more difficult to transmit across and between cultures. As a consequence it is of little surprise that it is technology, technical standards, and the creation of global markets which dominate cross-cultural exchange, and that tacit knowledge involving the understanding of occupant needs in building management and operation has failed to be transmitted.

Sustainability and urban development

Curwell (Chapter 12) describes the BEQUEST programme, working in a cross-cultural framework with particular reference to sustainable urban development. A key objective is to develop a consensus view of what sustainable urban development means, across a wide range of both cultural contexts and stakeholder interests. Could this be a model for a more active approach than the uncontrolled diffusion of information over global networks?

The main means for achieving a cross-cultural diffusion of knowledge and expertise is the BEQUEST Toolkit. This addresses the problem of applying inappropriate solutions geographically transplanted to widely differing climatic, social and economic contexts. Instead it offers a framework for local application to urban environmental problems.

'Sustainable urban development' is used to describe a wide range of sustainability issues – social, economic as well as environmental. However, it begs the question of whether these objectives are compatible. It is easy to imagine conflicts between economic and environmental sustainability, and not difficult to imagine conflicts between social and environmental sustainability. The key factor is time-scale – is the expectation really to create a solution 'for ever' or, as in the politicians' case, until the next election? Definitions of sustainability do not explicitly confront this issue. The perception of the time-scale of sustainability would be very different for different societies and cultures, in particular those of widely differing stages of development. This may be a major impediment to the diffusion of environmentally friendly solutions.

Conclusions

Expectation is an ill-defined word that is open to misinterpretation. Does it mean something that we should have? Or probably will have? Is the fulfilment of desire (in the built environment) always appropriate? There is the danger of predicting expectations and then providing to meet them. It does not have to follow that if 'workers in a modern office expect air-conditioning' it should be provided for them. These questions can also address global environmental issues and questions of equity. Although Americans expect to have cheap and abundant petrol (and as a direct result consume about 300 times more energy per capita than the average African), it does not mean that the expectation is justified.

In the field of thermal comfort, 'expectation' has been used to describe an almost physiological phenomenon where a person is apparently more tolerant of thermal stress because it is what they expect it to be. We expect it to be hot on a sunlit beach so therefore we tolerate it. But is the expectation really the *cause* of the tolerance? Tolerance is due to two factors. First, (in most cases) the person is going to the beach voluntarily. Second, the person knows how to take adaptive action to overcome his thermal discomfort – jump into the sea or have a cool drink in the shade.

The diffusion of social expectations across different societies which have a negative impact on the environment proceed far faster than those which are environmentally positive. Certainly, from a historical perspective, the diffusion of information and knowledge from developed nations to less developed nations has invariably led to the adoption of high energy use. Whilst technical solutions toward environmental protection can be shared on global networks, technical solutions are not the answer. It is life-style that has the major impact on consumption. The diffusion of life-style by the media is promoting consumer expectations at a global scale. This is a negative view of the role of global communication, but it is better to confront it than to ignore it.

What can be done to mitigate its effect?

Regulation offers some hope. Regulations stand between the political and technical sphere. Given the will, politicians can impose regulations on the individual for the good of the wider environment. Emission control on motor cars, non-greenhouse gas propellants in aerosols, insulation standards in buildings are good examples. The adoption of common regulations by more than one country, e.g. the European Union, suggests that, in principle, specific standards and regulations could be adopted worldwide. However, care must be taken to avoid the adverse effects of inappropriate performance targets, at either local or global levels. Clearly the establishment of world regulations, to support a sustainable future, will require a massive exchange of information – scientific, social and economic, and at all levels – personal, local and global.

In addition, designers and clients can offer leadership in helping to create more realistic expectations. As Brager and de Dear have argued, expectations are malleable, and viable alternatives need advocacy and championing. In addition, designers of the built environment will need to develop an improved anthropological/sociological understanding of occupant groups in order to assess what designs and technologies are most appropriate for the specific context (social, cultural, climatic, etc). Designers and policy-makers require enhanced abilities and will need to adapt the vocabularies, tools and methods from other disciplines to ensure a balance between meeting and moulding expectations.

Finally, do we really believe in sustainability? Does anyone really believe that we can turn round and stabilise the processes taking place on our planet? Should we not concentrate on first aid – righting the obvious injustices and inequalities? Fortunately many actions serve both objectives – but there is a danger that with our sights set on saving the planet we may miss things which affect people's lives in the present and in the immediate future. All too frequently expectations promote inequality, injustice, and lifestyles that are physically and biologically unsustainable.

Postscript

It may be significant that at the World Summit in Johannesburg in the summer of 2002, most objectives to protect the global environment were, if anything, weakened, whilst the provision of water and sanitation received high priority, although this makes no contribution to the stability of the ecosphere Earth.

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Section III

Understanding Process

14

Understanding Process

Jeffrey Cook

Human processes – even when following a common blueprint – are each to some degree unique. The series of discussions on 'processes' in this section are very different, yet provide a rich tapestry of issues confronting delivery mechanisms for the built environment. The differences in content are emphasised by the orientation and distinction of each author who represents a distinct discipline or position of purview, with oversight responsibility for the built environment.

Paul Oliver's research studies and many publications in traditional and popular architecture began with on-site field experiences in Africa in 1964 and have continued on five continents. As a scholar of the human condition, especially in the material culture of shelter, his studies are founded on first-hand experiences and are further informed by cultural anthropology, material sciences and sociology. Oliver's understanding of popular vernacular cultures, especially how shelter and the built environment relate to social values, is well grounded. His observations on the interactions of technology with daily life situate our present cultures within the lineage of centuries of human habitation. Most memorable is the persistence of particular technologies, the extraordinary continuity of certain ways of doing things. Placing that time-honoured 'information base' within the context of the exploding global industrial base is a fundamental dilemma, yet one that must be reconciled as we move forward.

In contrast to the intimate, immediate, and often intuitive responses found in vernacular traditons, Pascale Michaud discusses the larger context of governmental and corporate processes for procuring complex engineering projects (US$500 m–$2 bn) between 1994 and 1999. Using a databank of 60 international case studies, the question for Michaud is how the lengthy 'front-end' development stages are crucial to the definition and successful delivery of a project. By investing in early and detailed negotiations to reduce risk and ensure success, a number of important processes are needed to incorporate social understanding, cultural values, innovative solutions and create institutional change. The front-end process entails timely negotiation between sponsors, promoters, governments, financiers, contractors, lobby groups and local stakeholders as well as many feedback loops. Understanding the current institutional and governance barriers/drivers on complex projects provides significant lessons to inform how the context for delivery processes need adaptation. Michaud's work suggests the possibility of providing a better fit with local cultural and environmental values by explicitly acknowledging the larger contextual constraints and, in some cases, making major modifications. The front-end process is a key to managing cross-cultural knowledge and holds the promise of adaptation to smaller building projects.

Joe Carter, a Canadian architect living and practising for many years in Beijing, has participated in China's new hybrid ways of architectural and planning practice. He identifies the most visible building dilemma in China as external style, which is a manifestation of a lack of architectural continuity with traditional form, materials and ways of life. The problem is how to reconcile China's desire to be part of an advanced technological global society while retaining the unique identity and values embedded in its traditional architecture. How can existing cultural and environmental values inform what should be designed and built? In terms of knowledge and technology exchange, the question for Chinese architects is how to select and adapt what is appropriate for their rapidly changing culture. This challenge is beginning to be taken up by a new generation of Chinese architects. Some design traditions continue in the orientation of high-rise flats preserving the ancient practice of southern exposure, the marking of entrances, and the tradition of courtyards, although the scale and height of projects have changed. The real dilemma for the built environment in China may be that the society's advancing consumerism may supplant traditional practices and expectations.

In contrast, David Cohen, John Spengler, and Ahira Yamaguchi describe the transformations of a traditional house type in Hokkaido, Japan. The strong bioregional philosophy developed by Yamaguchi for his vertically integrated housing company combines local knowledge and regional timber resources with carefully selected construction techniques. The challenge is to create a house in harmony with its surroundings, informed by local cultural traditions, using environmentally sound methods and making a positive contribution to the economy.

Kazuo Iwamura describes an environmentally symbiotic housing project in Japan and how daily life is affected by this new emphasis on residential design rooted in the ecological features and cultural history of the site. Iwamura provides evidence to suggest that occupant consultation and participation in the design process can contribute to the environmental and social success of the project. The design process of a public housing project in Tokyo, the Fukasawa Complex completed in 1997, is presented as a case study. Although these processes are epitomised by new complexities with higher standards of expected performance, the means of delivery are surprisingly familiar internationally.

15

Technology Transfer – a Vernacular View

Paul Oliver

Introduction

Before any discussion of the means involved, the necessity for technological transfer and whether it is related to building construction or to materials, services, installations and methods could, and in my opinion should, be debated. Implicit in the phrase is the assumption that the technology of the West (especially Europe and North America) should be passed to cultures and countries of the one-time 'Third World', now the 'Developing World'. In this term is built a further assumption: that 'development' is technological rather than, for instance, educational or social. It is important that we question our own terms, our sense of priorities and our perception of the 'need' for technological transfer. Is the transfer now to be one-way only, even though concepts and devices, from the zero to the astrolabe, the wheel and the windmill to the pointed arch and the bungalow, were the inventions of the East transmitted to the West (Fig. 15.1)? We may rightly be critical of the arrogance of former attempts at technological transfer made without consideration of the cultures affected. But we should also be prepared to criticise the assumption that we in the West have the 'answers', which we wish to transfer to the 'primitive' or 'retarded', the 'backward' or 'developing'. What lessons may be learned and what good may come from such trans-cultural undertakings of technology and information transfer are unknowable until the principles have become action and the results of the actions have been experienced. However, we can profit from the evidence of former attempts and we may draw conclusions as to the causes of their success or failure.

In this discussion I can only cite a few examples from the distant and recent past, bearing in mind that they have often been poorly documented,

Fig. 15.1 Technology transmission from the East: the Arab *noria*, a mule-powered water-lifting apparatus with buckets on an endless chain, was introduced to Spain by the Arabs probably in the fourteenth century. This one was still in use six centuries later (Photo: © Paul Oliver)

come to some conclusions, and make some suggestions. Just where we might begin is in itself suspect, for the nature of technology may be said to begin with the flaking of flint and the carving of antlers, the transmission of which raises problems enough (Gamble, 1986). It is becoming increasingly evident that Palaeolithic hominids developed both the technologies and the cross-continental routes and contacts for mammoth ivory from the Balkans to have been used by cave-dwellers in Iberia during the first Ice Age. Evident we may say, though irrelevant. But is it?

Of stone and steel

On a remote part of the west coast of the Cape York peninsula in Australia lived an aboriginal people with a Palaeolithic economy, which had few contacts with Europeans until the twentieth century: the Yir Yoront. The skills, resources and techniques in making stone axes, which were the universal tools, were a male preserve, and the axes could only be borrowed by women or children in accordance with the rules of kinship. Apart from this, Yir Yoront social structure was not hierarchical; there were no chiefs, but patrilineal totemic clans defined status, roles, behaviours and values. The stone for the axes was obtained through a chain of trading partnerships from 400 miles to the south, the Yir Yoront providing in turn hunting spears and spear throwers, which gained value as they were passed along the trading chain.

In 1915 an Anglican mission was established in the territory but the Yir Yoront had little to do with it until the 1930s when the missionaries sought to raise aboriginal living standards, supplying them with useful and 'improving' articles, including a short-handled steel axe. Missionaries believed that the steel axe would be more efficient and save time, though in fact it made little difference in use, and the time saved was spent in sleep. But it had a major impact on the social structure, for the working parties introduced by the mission and on the cattle stations (with steel axes as rewards) were organised on a leader-and-group basis, contrary to the Yir Yoront's non-hierarchical system. Welcomed by individuals in the tribe, the steel axes were given to women and young men, who no longer depended on the older men for them, upsetting the traditional roles and attitudes to possession. Trading relationships with other tribes to the south were permanently damaged. The social upheaval that resulted from the introduction of the axes brought the totemic myths into question, an effect that was probably appreciated by the missionaries but which rapidly resulted in the collapse of Yir Yoront culture.

An American anthropologist witnessed and subsequently reported on the destructive impact of this simple example, which, nevertheless, is informative of a number of aspects of technology transfer (Sharp, 1952, pp. 69–90). There is little doubt that the replacing of stone axes with steel ones was well intentioned but their introduction without respect for the values and social system of the recipients was insensitive. We may note that many aborigines welcomed the new tools and were themselves unaware of the damage that could be done to the culture by their adoption of the steel axes, their according with an alien structure of labour management and their submission to subordination. There was also a significant knock-on effect, with many communities suffering as a result of the breaking of the trading chain. It is not simply a matter of the transfer of a technology which is important, but also the consequences of the means by which it is implemented. In this case it was partly one of altruism, but in spite of the restricted circumstances of a mission in a remote area, it was also one of the exercise of power.

Power and domination, whether political, military, religious, ideological, educational or simply of technological superiority, play a major part in the spread of knowledge between cultures. The more powerful imparts what it deems effective and withholds what may be ultimately to its disadvantage, while gaining what it may from the lesser or subjugated. We need go no further back than to the expansion of Augustinian Rome, at which time the craftsman's toolkit comprised hammer and chisels, saws and planes, and organising templates, which were dispersed throughout the Roman world. Two millennia later, the kit of the craftsman of the early twentieth century in all parts of Europe remained virtually unchanged (Fig. 15.2). Under the dominion of Rome, cultures of western Asia, North Africa and Europe shared many of its inventions, from the use of tiles for roofing buildings to the devising of the hypocaust system where the climate warranted it (Singer *et al.*, 1954, pp. 77–94 *et seq.*).

Or was the influence in the reverse direction, with the tiled roofs and the *kang* hypocaust of the Chinese Han empire the source of these technological innovations? Debatable though the sources may be there is no doubt as to the power of empire in dispersing technology, whether Ottoman or Arab, Iberian or French, British or American, or Soviet

Fig. 15.2 Timeless tools: both his forge and the tools that this Iranian blacksmith has wrought from scrap iron are virtually identical to those made and used in Roman times (Photo: © Paul Oliver)

Russian. Certain technologies were restricted to colonists, and access to them was only available within limits for many of the subjugated and frequently enslaved cultures. While imperialism and conquest are not intended to be a part of any proposed programme of intervention, it should be emphasised that Western, especially American, technological hegemony is resented in many parts of the world and attempts at technical 'improvement' may be regarded with suspicion, even hostility.

Though in no way comparable in scale, the instance of the steel axe was, nevertheless, still one of power relations. It was a case of a deliberate technological introduction, but many, perhaps most, instances of technological transmission may not have been so motivated. To what extent such inventions as the bow and arrow, the harpoon, the spear thrower, the potter's wheel and the weaving loom were devised and carried by nomadic groups or were the products of autogenuous, independent creation, we do not know. Based on the uneven archaeological evidence it is possible to hypothesise the passing on and sharing of traditions and technologies over the centuries. So, for instance, the potter's wheel as a pivoted disc was discovered at Ur, dating from 3000 BC. Wheel bearings for foot-wheels found in Jericho are more than 4000 years old; Palestinian Arab potters are still using the same system (Singer *et al.*, 1954, pp. 197–201).

Such passing on of a technology we ascribe to 'tradition'. Though the means of oral transmission have been little researched, they include maxims and formulaic learning by rote, while non-verbal transmission involves demonstration, mimicry and practice in stages. 'Handing down' of tradition is most frequently from grandparents or parents to offspring, or from masters to apprentices in guilds or crafts. Technology transfer will usually involve instruction, which may in due course be passed on by oral or non-verbal means between generations. But this form of transmission over time is only achievable where there is a responsibility, or a willingness to learn from the elders; rarely will tradition be the vehicle by which most technological innovations will be introduced (Oliver, 1989, pp. 53–75). This is no reason for ignoring the importance of the temporal dimension: however rapidly an innovation may be introduced it takes time for it to be assimilated by a culture and to be no longer an alien element. Novel, impressive, efficient perhaps, the deliberate introduction of a new technology or product may be initially welcomed until the novelty wears off. It can also be met with dismay, or disgust, if it calls into question established practices and traditional values, even though its exponents or purveyors may be tolerated. 'In time', as we say, change may be effected or innovation modified to conform with cultural norms, but it takes a minimum of three 'generations' or cycles of behaviour for a tradition to be acknowledged and observed, and those seeking to initiate change should be aware of the temporal implications of so doing.

Spreading abroad

As appropriate to our discussion is the subject of diffusion, or the dissemination, assimilation and 'spreading around' of cultural phenomena. Already, mention has been made of 'cultures' or matters that are 'cultural', so a few words of explanation of their use here may be desirable. Probably the earliest definition was offered by the English anthropologist Sir Edward Tylor, who in 1874 proposed that culture was 'that complex whole which includes, knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society' (Tylor, 1874, p1). Many other definitions have been offered since – two anthropologists reviewed 160 of them half a century ago (Kroeber and Kluckhohn, 1952, pp. 1–223), and still they come. While according with Tylor's definition, some have emphasised that culture is 'learned behaviour' and that communication is therefore fundamental to it. A 'culture', as distinct from cultural phenomena, comprises those people who share such 'aspects' or attributes that make up the 'complex whole'. They may be numerous or few in number: the Yir Yoront were a culture, as were the Ottoman Turks. Clearly, there are differences in scale just as there are many correspondences in detail, and the vast literature on the subject grapples with problems of cultural relativism, cultural dynamics and the processes of culture change. Cultures are not necessarily discrete; in fact many contend that all cultures are hybrids to some degree, and it could be argued that, like plants, they are the stronger for it. Unfortunately, the term 'culture' was appropriated in the last century by advocates of aesthetics, who applied it to poetry, literature, music, art and architecture, with concepts of 'high', 'low' and 'popular' culture being propounded. This has led to the 'deconstruction' of the concept of culture by some authors.

In the present chapter, culture as an abstraction is considered as 'the totality of values, activities and products of a society which give meaning and direction to the lives of its individual members' (Oliver, 1997). It must be evident that tradition is an important, even fundamental aspect of culture. Nevertheless, cultures often have certain traits in common with each other, sometimes to the extent that a 'culture area' may be defined where common elements are pronounced. Such sharing of traits may arise from contiguity rather than from inheritance, the transmission of tradition

Fig. 15.3 Logging on: Lige Oliver (no relation) built his cabin at Cades Cove, Tennessee, in the nineteenth century. The main building is 'square-notched', but for the kitchen 'half-dovetail' notching was used. Both have been learned from other settlers, for no notching system was ever used in Britain (Photo: © Paul Oliver)

being essentially diachronic while diffusion is broadly synchronic (Oliver, 1991, pp, 56–7) (Fig. 15.3).

Diffusion as a process may be regarded as spatial and geographic, though the passage of time also has to be taken into consideration in many instances, including the diffusion of technologies: the invention, dispersal and acceptance of the plough, for example. First recorded in Egyptian tomb-painting, four millennia ago, it played a major part in the later stages of the agricultural revolution of the 'fertile crescent' which embraced Mesopotamia and Persia; but in the twentieth century AD there were still African tribes who would not accept the plough because iron was believed to corrupt the soil. There may also be practical reasons for the rejection of recently introduced technologies. In Anhui, China, ploughs drawn by water buffalo are extensively used in paddy fields but, as I have witnessed, mechanical tractors which have been introduced to draw the ploughs become bogged down and rendered useless (Oliver, 2000).

Although many anthropologists prefer to research discrete cultures rather than study the effects of diffusion, consideration of the means whereby technological innovations are accepted or rejected by vernacular cultures remains important. We have already touched on some of the principal channels of influence, including conquest and the expansion of empire. Yet there are others that relate to the phases of establishment, from exploration and pioneering to homesteading and immigration, whether in the United States and Canada, India, Australasia or southern Africa. Distinctions can be made between the colonists who retain their traditions, representing power and exerting authority, and the settlers who retain some loyal values but seek a new life and new opportunities. Settlers are often more willing to converge, compromise and adapt, as exemplified in the adoption by English settlers in the United States of Scandinavian and Central European log construction, or by the sharing of some building traditions by British and Boer settlers in South Africa (Lewcock, 1963). Later emigrants tend to bring much of their past culture with them and attach themselves to those who share similar culture traits. Yet influences are not simply one-way; the dominant colonists may still learn from the autochthonous cultures, not least from the use of available materials and the building of climatically appropriate structures.

Clearly, the movement of peoples is significant, but so is the circulation of specialists, such as the mediaeval journeymen craftsmen who were employed in the building of cathedrals and fortresses across Europe. Joints and mouldings, stylistic features and forms, decorative elements and motifs were subtly diffused, even though the craftsmen prided themselves on meeting the requirements of their employers. Theirs was diffusion by contact, by the evidence of their practical skills and by the lasting influences of their completed craftwork. In the course of their travelling and sequential employment they also assimilated unfamiliar refinements of technique and method (Leeson, 1979). Borrowing from adjacent cultures is the most pervasive form of reflex diffusion, admiration, envy and the desire to emulate or excel resulting in the adoption or adaptation of processes and products, where they satisfy needs or values. The outcome of these forms of diffusion by contact between contiguous or related peoples contributes to the definition of the culture area, wherein substantial elements of cultural exchange are established while local identity is retained. This is evident in the vernacular architecture of the Balkans with its identifiable regional traditions, but with correspondences in scale, structure and functions among the buildings of Slavic peoples (Husa *et al.*, 1967).

How diffusion takes place has been one of the many bones of contention gnawed by anthropologists over the past century (Herskovits, 1963, pp. 461–483). I can only summarise here some aspects that appear to be germane to the study of technological transfer. What I term 'intra-cultural diffusion' and what has been otherwise identified as 'primary' diffusion, is that which takes place 'in the country of origin'. This emphasis on the country is questionable, for diffusion within a cultural complex may spread far beyond national boundaries, as the Akan peoples of West Africa illustrate, the culture area extending across the rain forest regions of Ivory Coast, Ghana and Togo (Oliver, 1964, field notes). 'Inter-cultural diffusion' may penetrate much further then the apparent definition of a single culture or culture-complex, to reach others still more remote, who may display a greater degree of 'element transformation' or change.

A 'rock in the pool' metaphor is often used to illustrate the centrifugal theory of such diffusion. When a rock is cast in the centre of a pool, the immediate area is most dramatically affected but ripples spread outwards bringing with them strong waves of change. This is regarded as corresponding with a major, often urban, innovation at the cultural centre, with marginal folk survivals at the periphery of the widening circle with its faintly perceptible outer 'ripples'. The 'centrifugal' image is an oversimplification, of course, with diffusion sometimes following a narrow channel of communication: quite literally, along trade routes or river valleys, as in many cases of the passing on of material artefacts. Thoroughly researched examples of architectural diffusion are few, a detailed study of the dispersal of the crossed-pole frame and saddle-roof ridge in South-East Asia being a notable exception. This diffusion route followed the arc of the Indonesian archipelago, challenging the centrifugal theory by culminating at its eastern limit with the most extreme form, the great roofs of the Toraja of Sulawesi (Domenig, 1981). Other characteristics of diffusion are observable: a 'leap-frog effect', for instance, as the nearest culture to a source may resist its influence, but a culture beyond may adopt it.

At this point it is important to emphasise that 'diffusion' generally refers to cultural or technological transmission that has been *achieved*, rather than referring to the possibility of doing so. Since the early 1950s or so, however, aural and visual media have dominated in the direct spreading of some cultural phenomena, such as various forms of popular music. They have also created an ever-widening circle of indirect influence as in the promotion of images of advanced technologies. But there is a negative aspect to this, such means provoking frustration as much as admiration, contempt as well as envy, depending on the cultural priorities of the peoples to whom the media are directed. Such responses also apply to the presence of tourists, or to fast food outlets and other invasive expressions of Western commercial interests, however much they may, or may not, contribute to the economies of the so-called developing countries.

Resistance to change may be ascribed to 'tradition', 'custom' or 'conservatism', clichés of explanation which, nevertheless, by implication acknowledge the persistence over generations of cultural values that are not readily compromised. Resistance is expressed when the innovation is uncongenial and fails to fit the accustomed patterns of utility or behaviour. Yet the problem remains that, if most cultures are to some extent hybrids, what may be the circumstances that account for the acceptance of technological introductions? First, we have to recognise that any such introduction brings about a degree of social change (White, 1962). Sometimes this is merely a change in habits, but when instruction or education of the young is involved there can be a marked social disruption within a matter of a few years. Clearly, circumstances differ and there are no rules, though tendencies can sometimes be traced. Often the change is not one of sudden impact, but rather one of a succession of minor modifications in resources, processes and consumption – quite literally, in the case of food. This may be anticipated by reputation or by rumour: what has been termed the 'bow-wave' effect, indicating by its disturbance the craft that follows it.

Broadly speaking, we can identify some of the conditions under which the introduction of new ideas and of technologies may be admissible (Hetzler, 1969, pp. 161–184). Most important of these is necessity: the need for a resource or a means of delivering it, or of making it available in order that life may continue and a culture survive. From the twelfth century desertion of the Chaco Canyon pueblos to the famine in Afghanistan a millennium later, the loss of water and the incapacity to irrigate land and crops brought cultures to the point of collapse. 'Necessity', we say, 'is the mother of invention', and the most effective inventions are those made within the culture, rather than externally, when the resources and the means are available. When they are not, external assistance is welcome. Indigenous inventions are generally made to improve efficiency, and efficient solutions to persistent problems can be admissible. The popularity of boxes of matches across the world in the years following World I War was contrary to expectations, for firelighting was frequently accompanied by ritual; that the matches were splinters of wood, and corresponded to a degree with fire-sticks, appears to have made them acceptable.

At another level of technology, the wrist-watch has been remarkably successful: some 10 million owners of wrist-watches are estimated in India. As a figure this is impressive – but it represents just 1% of the population, which has now exceeded a billion people, for a large proportion of whom the passing of the minutes has little significance. This, and the fact that they cost money, even at their present prices, keeps the relative figure low. Efficiency is valued when it assists, when it saves time when time is at a premium, and when it protects against subsequent expenditure. As we have seen, however, there are other planes on which receptivity lies, the assumption of status through possession among them. Pride of possession is related, but diminishes in time, as the distinction becomes less apparent or the rare becomes commonplace. Association with a donor, or prestige attached to the receipt of a superior tool, can also have its temporary appeal, but is as likely to create dissatisfaction among others in the group. Awareness of necessity, evident and improved utility, economic feasibility and cultural compatibility are among the principal factors which most influence the acceptability of an innovation.

There is probably no introduction to vernacular architecture from Western technology that is more universally applied than corrugated, galvanised sheet metal, which meets most of these criteria. Not all – often it is uncomfortable thermally, but it keeps the rain out even if it is noisy. Corrugated iron is cheap, easy to fix, more durable than thatch, and comes in sheets of sufficient pliability to fit most roof forms. It can easily be replaced and, like the kerosene can roof tiles and the *bidons*, or flattened oil drum modular wall units, is used with ingenuity by the world's poor (Fig 15.4). Recycling and further use of a redundant technology may be preferable to the costly purchase of new resources or devices. Consider the volume of worn-out vehicle tyres used in many countries as fuel in kilns, as weights on grass silos, as boundary markers, as playground features and as fend-offs on harbour walls. Others, as in the Philippines, are turned inside-out and used as waste bins. Rubber strips cut from the inner tubes of tyres are used in Kenya to reseat tubular steel chairs of designs traceable to the early masters of the Modern Movement, probably the most widely diffused (Oliver, 1960–2002, field notes).

Intrusion and intervention

So who transmits, who exchanges, how is diffusion or the introduction of technologies achieved? As we have seen, intra-cultural diffusion generally emanates from within a culture, perhaps from its seat of power or more sophisticated centre, and spreading, sometimes with decreasing intensity and over a period of time, to its outer limits. Or it may occur between contiguous cultures, where language may not be a barrier and where environmental and social circumstances are sufficiently compatible to make the recognition, desire for, and acceptance or mimicry of an innovation

Fig. 15.4 Tin plate: *bidons* or flattened oil drums and other waste metal sheeting have been used to wall in this compound in Mozambique. Traditional panels of layered palm leaf are used for the walls, but the roof is of galvanised iron sheeting (Photo: © d'Alpoim Guedes)

likely. It is broadly acknowledged that changes in technology are more rapidly assimilated by cultural élites even if, in some respects, they are more conservative. This is the case historically, in the use of fired brick in England by the Church and the aristocracy, from late in the twelfth century. Under Flemish influence, brick became broadly popular in East Anglia, the peat-fired kilns of Hull making the Hanseatic city the first to be brick-built in Britain. Here the 'trickle-down' effect of technology from the higher status to the common people occurred in time, while the regal use of brick for the palaces of Henry VIII assured its continued use among the rich (Lloyd, 1983, pp. 1–25).

The example of brick demonstrates the 'horizontal' flow between members of groups within a class, and the 'vertical' movement between social strata. Typically, prestige and fashion were important, as was formerly the case with stone, and later with stucco rendering. But brick was cheaper to work than stone. Much later, kilns of the oval Bull's Trench type in which bricks are continuously fired by manually moving the chimneys were introduced by the British to India (Fig. 15.5). They partially replaced the clay-covered clamp kiln, which remains the preferred type among many brick producers in India and Nepal (Spence and Cook, 1983, pp. 71–75). Yet there were unanticipated problems. The British brought the clamp kiln to the Sudan, and built cone-and-cylinder 'African' houses for railway employees (Fig. 15.6), expecting by their example to

Fig. 15.5 Bull's Trench kilns: The British brought the Bill's Trench kiln system to India. An oval trench, which spans the illustration, permits a continuous building and firing of a kiln. The black iron chimneys are manhandled so as to be above the kiln at all times (Photo: © Paul Oliver)

Fig. 15.6 Railroad housing: Housing built in Khartoum for African railroad workers was substantial and permanent. But their design reflected the Christian south of Sudan rather than the Muslim north, and was culturally inappropriate. Nevertheless, some are still occupied because of the housing shortage in the city (Photo: © Paul Oliver)

change the habit of building in unfired brick. Neither the house type, which was associated with Southern Sudan and inimical to the Muslim north, nor the decline in use of unfired brick was adopted in the vernacular (Oliver, 1977, field notes). Fired brick was used for prestigious buildings, but with a consequent destruction of palm trees to fire the kilns that created a major problem by the 1980s. In India and Nepal the consumption of wood for the firing of the Bull's Trench kilns exacerbated the destruction of the forests that contributed to the flooding of the Ganges plain.

We are now considering 'intrusion' rather than 'diffusion.' Intrusion, the 'action of thrusting oneself in without right or welcome' or the 'encroachment on something possessed or enjoyed by another', is what many technological innovations and their introduction in alien circumstances are really about. Specialists in the field prefer the term 'intervention', which they regard as 'stepping in' to assist. The dictionary does not entirely disagree but the word is defined as 'the action of intervening, "stepping in", or interfering in any affair so as to affect its course or issue'. To intervene is to 'interpose, to intercept, to come between, to prevent or to hinder' (*Oxford English Dictionary*). For most of us such a definition does not include our motivations: our desire to make improvements to standards of living, to see the benefits of modernisation as we perceive them, shared among all the peoples of the world. But we should not disassociate ourselves from the implications of such a position, which places Western technological innovations on a pinnacle of achievement to which others are believed to aspire.

No doubt many interventionists believe that such advantages, from modern construction methods to information technology, are indispensable aids to development, and are perplexed when even a minor intrusion in an existing practice is not regarded with the same sense of value. Even relatively simple innovations are differently perceived by diverse cultures. Most of us would agree that improved sanitation is desirable in much of the world, though we are also aware that water-borne systems, even of 'grey water', are wasteful of an urgently needed resource. Improved sanitation is welcomed, but if it involves a regular period of treatment such as a composting apparatus may require, it may prove difficult to sustain. Reactions and responses to improved systems can differ markedly. When ceramic standing toilets were introduced to a Greek village the people were proud to leave the doors of their newly constructed and plumbed outhouses open so that others could be aware and envious of their sanitary installations. But they preferred in practice to use their traditional 'privies' (Friedl, 1967).

In Gediz, in the Western Anatolia area of Turkey, the use of a sanitary facility is a very private matter. Traditionally this took the form of a medieval garderobe, or 'dropfall' toilet, suspended on an external but concealed, wall of a house. When the Gediz region was struck by an earthquake and tens of thousands of people had to be rehoused, a three-roomed dwelling was provided for each family, with a toilet–shower unit attached (Fig. 15.7). The entrance to the lavatory was external, and hence its use was not private – a source of great embarrassment to the disaster-stricken people. Though they were not hazard-resistant, most families built an enclosure around the entrance so that the use of the toilet could be hidden from view. Both may seem extreme responses, the Greek open doors being a sad display of pride and assumed status, the Turkish enclosure an expression of modesty apparently out of all proportion to the scale of the tragedy (Oliver, 1986, pp. 117–127).

This latter case was an aspect of post-disaster housing provision, in the long-term appraisal of which the author was personally involved. The state-provided house was essentially designed by absentee architects for a nuclear family, but the traditional house accommodated a large, extended family, as well as its cattle and stores. To avoid being inequitable the sites were drawn by lottery, but often the result of this was the separation of the generations of an extended family. Interiors of the state houses were

Fig. 15.7 Disaster housing: following the Gediz, Turkey, earthquake, post-disaster housing on a European model was provided. Extensions were built by the occupiers to provide space for their familes and to conceal the access to the toilets. These were not earthquake-proof but they were culturally more appropriate (Photo: © ODA Gediz Project)

viewable from outside, but the people of the Gediz region valued their privacy and were driven to board up the windows to retain it. In these and many other respects the post-disaster houses, based on the World War Two English 'pre-fab', or pre-fabricated house, did not meet the social needs of the Gediz people; many were abandoned or heavily, if unsafely, adapted (Aysan and Oliver, 1983).

These may be minor examples but they are illustrative of the cultural values which can help or hinder the acceptance, use and maintenance of a technological improvement introduced as an interventionist measure. Lest the impression be given that the introduction of appropriate technologies is impossible, a well-known but significant example of technology transfer may be cited. In Southern Algeria, Niger and Chad, vernacular building is in adobe block, or in moulded clay. Roofs, however, have had to be spanned, and as timber became scarce this was mainly done using palm trunks. Eventually, in this dry desert region, this resource too was becoming scarce. A multi-national team, the Development Workshop, had formerly worked with the Egyptian architect Hassan Fathy. His rediscovery of the Nubian vault system of building earth vaults without using wooden formwork (Fig. 15.8) was incorporated in his significant, if ill-fated, New Gourna project. The members of

Fig. 15.8 Nubian vault: African builders from Southern Algeria, Chad and other drought-stricken areas where there are few trees are taught how to construct the Nubian vault from mud bricks, without the use of wooden formwork, reinforcement or beams (Photo: © Development Workshop)

Development Workshop devised a 'woodless construction' programme which included a training scheme for builders in this recovered technology, and, by working with the communities, introduced the Nubian vault system to these regions. The method was adopted, did not impede or influence the plans of houses and settlements, and solved the problem of using local materials to span the structures. It was a model of successful technology transfer, rather than of intrusion (Cain *et al.*, 1976). So too has been the work of the architects and labourers of the Barefoot College of Tilonia, Rajasthan, who have used scrap materials and discarded items of agricultural hardware to make houses with geodesic domed roofs for the homeless of the region (Merrick, 2001, p. 9). This has been achieved by shared objectives and mutual agreement in practice, but such ventures run the risk of impinging upon the most subtle and least conspicuous of qualities in the relationship between building and occupier. We may be inclined to think in terms of 'housing units' – of their design and supply, of quantified components and construction costs. But to the householder and family who may themselves have been responsible for much of these, their association with the vernacular dwelling is intimate. Building the dwelling, from the orientation of the site to the ceremony of completion, is for many a spiritual process, and the symbolic connotations of the building, whether they are of the structure, form, spaces, decoration or details, are profound.

Socio-spatial issues on the larger scale are also important, many cultures organising their settlement patterns according to belief and rule systems, such as the Japanese *hogaku* or the Indian *vastu-sastras,* of which only the popularised versions of *feng shui* are widely known, if largely misunderstood. Innumerable cultures reflect their ancestry, clans, lineages, age-sets and phratry divisions in their settlements in ways that are not immediately perceptible but are nonetheless meaningful. Laying out service lines in militaristic grid patterns on the grounds of efficiency is frequently advocated in the West. But such grid plans can be in direct conflict with traditional socio-spatial customs to the extent that they can be culturally destructive or are rejected by the recipient communities.

Belief systems, language, gender differentiation, child labour exploitation and a great many other cultural factors may compound the problems of intrusive alien technologies, which may also have many adverse biophysical aspects. Climate constraints and variables such as monsoon periods, hurricanes and natural hazards, and difficulties of access to fresh or clean water when this is still denied the populace, are just a few among the many environmental and resource difficulties that confront the interventionist. But even so, it is still the cultures that reside with them and have resolved ways of living that go far to meet their spiritual, spatial, social, domestic, economic, technical and architectural needs, that have to be understood, nurtured and sustained throughout the process and into the future. It is not possible to discuss here the implications of the cultural factors that can be in conflict with technological intervention, though the mismatch between the provision of post-disaster houses in Turkey and the domestic structure of the Anatolian family mentioned above is indicative. Failure to recognise the close identification with their architecture and settlements that is characteristic, even if expressed in different ways, among cultures throughout the world, may lead to the inevitable collapse of any attempt at technological or informational transmission which intrudes upon it.

Meeting the problems

What, then, can be done to meet these cultural differences, and is there any future for the scale of technological change to vernacular traditions in architecture that some would believe is necessary in the developing world? Fundamental to any answer to this question is the understanding of the nature of the cultures concerned: their values, their social systems, their economies, their resources, their responses to their environments, and the embodiment of much of this in their settlements and dwellings. The performance of their buildings relative to the prevailing climates is the most readily analysed scientifically, and the most extensively documented (Givoni, 1969). Anthropologists can tell us much more about the intangible abstractions of cultures, though their respective structuralist, functionalist, socio-economic and other professional emphases must be recognised. For the purposes of the present discussion the work of theorists and researchers in the field of social change can be valuable, though often the built environment is the aspect that has received the least attention (Steward, 1955). So, one may ask, where can we turn for the information that we need and guidance on how we may proceed? This problem, in the author's view, could be met in part by the compilation of a multi-disciplinary world encyclopedia of vernacular architecture (Oliver, 1997).

The inculcation of an awareness of technological introductions that may make life more fulfilling, less stressful and less dependent on meagre resources is important, in the writer's opinion. Preferably, this may be done by way of demonstrations or marginal examples that do not seriously impinge upon the culture, until the benefits, the economic implications and the possible disadvantages are recognised and understood.

These need not intrude on the vernacular architecture of a culture to any great extent but rather, they should support it. Vernacular technologies are rarely damaging of the environment or of natural resources, and only in those situations where such resources are threatened or exhausted need alternatives be introduced. Primary attention should be given to services, such as fresh water – through desalination plants, if necessary – and to sanitation, waste disposal and electricity supply. Replacement of threatened materials by others that are renewable should be combined with transmission on their use in construction, and on their sustainability in the future.

Technology transfer that facilitates the solution of a problem confronting a culture could be undertaken, but not with the intention of achieving an objective that satisfies, favours or benefits the transmitting technologists rather than the recipients. A fundamental question which must be addressed concerns the need to ascertain what the basis may be for a recipient community's reluctance to admit introduced technologies. We seek to understand indigenous cultural values, in order that any obstructions to the acceptance of innovations can be overcome. Is the desire to defeat such resistance, which will doubtless be interpreted as ignorance or prejudice, justified? Of course, we will argue that it is, that the advantages of certain Western advanced technologies should be for the 'benefit' of everyone. Knowing indeed how beneficial they are, we should find the means to communicate them. In other words, where a culture has the peculiarities of belief or custom that make the introduction of new technologies unacceptable, we may convince ourselves that it is our responsibility to combat such resistance in their interests.

Responsibility? their interests? – or our self-interest? What drives our desire to make our innovations so intrusive? Is it altruism, defined in the *Oxford English Dictionary* as the 'regard for others, as a principle of action'? Is it driven by a desire to dominate and to colonise, however masked or subconscious the desire might be? Or is it fundamentally commercial, with the marketing of products a major motivation, even if they are thought to be to the advantage of the recipients? Even if we deny that we have neither of the latter intentions in mind, our claims for 'altruism' still raise the question of the identity of the 'others' for whom we have 'regard'. It is not an idle query, for it highlights the problems of how those we believe to be in need of unfamiliar technologies are identified and how their requirements are ascertained, appraised and evaluated. These uncertainties and doubts come to mind as the processes and outcomes of introduced technologies or changes in practice in the past and in 'vernacular' communities are reviewed. They should be given serious consideration by any and all who embark upon the intrusive and frequently uncalled-for transfer of technologies. Regrettably, the ethics of intervention, which by definition (*inter venere*: to come between) means intrusion into the lives and futures of other cultures, are rarely, if ever discussed (Oliver, 2000, pp. 115–126). Nevertheless, they involve serious problems that are concomitant with the introduction or imposition of different values which may conflict with the recipient communities' priorities, beliefs, roles or traditions, and which may also infringe their cultural rights. Examination of such ethical issues, and they are many, would form an important constituent of any education programme designed to meet these challenges.

All these matters have considerable implications for academic research, for architectural, technical and environmental education, for those aspects of the building and supply industries involved in the transfer of technologies and the transmission of information, and for the interrelationship of these largely distinct sectors. At present, there are scarcely any schools of architecture and related subjects that run courses on, or otherwise give any serious attention to, the issues raised here. Yet little advance can be made until the dimensions of the problems related to information and technology transfer are recognised, understood and accommodated by intending practitioners. Such courses would have to be inter-disciplinary, in order to inform on such factors as resources, climates, population, economics and globalisation. In addition, the syllabuses would need to be augmented with social, anthropological, behavioural and environmental studies, drawing examples from both the past and recent history. It may be demanding but it must be attempted (ISVA, 1998; 2002).

Management and mid-career practitioners could miss out on this, but short courses could be mounted for those already engaged in the field, for whom the results of research activities would be of particular value. Consequently, advanced research is essential, particularly in the monitoring, analysis, and comparative studies of specific cases where information and technology transmission has been implemented, whether successfully or otherwise. Such research also requires follow-up studies over extended periods in order that the long-term effects of the actions taken are understood and communicated. Future projects, whether initiated by governments, educational establishments or commercial enterprises, should be planned and budgeted so as to have impartial research done in parallel with the transfer operation. Moreover, the research should continue at intervals in order that the assimilation, progress and development of projects and their effects may be evaluated over time.

It takes two to transmit and receive, and there are problems that are more complex and sensitive than these. They relate to the assistance that may be necessary for those recipient communities living in vernacular ethnic or cultural contexts, whose desire to retain their sense of identity and association with their traditional environment may be increasingly evident in the face of the homogenising tendencies of globalisation. In the author's opinion the need for technological innovation or modification must be recognised, and preferably expressed, by the receiving culture with whom, and with whose indigenous knowledge, any changes may be introduced. A facilitating role rather than an interventionist one is essential. It may have less commercial appeal to the suppliers of new technologies, but assistance in achieving the objectives and aspirations of the recipient cultures in the long term will be more effective and more enduring. Sustainability through independence, rather than dependence, is vital. A dependent society which cannot function without the injections of concepts, technology or finance is ultimately doomed. One that is aided towards freedom to make choices, to accept what may be considered appropriate to the realisation of its future and to reject what is not, is a society that can sustain its values and ways of life into maturity. Such freedom must be ensured for intracultural and intercultural diffusion to take place, for traditions to be passed on, and for social change to occur in the forms and at the rate that meet cultural norms. With these safeguards and by such means the vernacular architectural traditions that have developed and adapted over time, and with which their builders and users identify, can continue to evolve or re-direct. By giving appropriate support, we may help the present and future generations to meet the massive demands for housing that the 50% growth of the world's population in the next half-century will create.

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16

Social and Organisational Understanding of Stakeholder Interests

Pascale Michaud

Introduction

This chapter describes how large engineering projects can be powerful enough to cause significant change to occur in the existing institutional frameworks of countries, regions and industrial sectors in which they are developed, and how some projects clearly break the rules of the game to create new paths. Large-scale infrastructure projects ($500 million – $2 billion) raise interesting questions about the economic foundation of the forces of change in the built environment. An economist's perspective of building activity helps to provide an understanding of how institutional innovation (new rules and frameworks enabling the delivery of projects, games and sets of engagements framing them) takes place and the significance of initial coordinating mechanisms on the final attributes and impacts of a project. Research by the International Programme for the Management of Engineering and Construction (IMEC) informs the argument presented in this chapter. IMEC was an empirically grounded research initiative on large-scale infrastructure projects conducted over the period 1994–1999. Key insights and lessons learned on the process of delivering complex projects are discussed in this chapter by referring to case studies developed as part of the research programme. The concept of 'institutional breaker projects' (Michaud, 2001) is used to describe projects where key stakeholders entice major changes to social institutions and regulations in order for their project to be approved, financed, built, and operated. How these projects release various sources of 'latent' innovation (institutional, organisational, and/or technical innovation) has implications for understanding (and improving) cross-cultural exchange of technology and knowledge. Trade-offs between these types of innovation are highlighted, with lessons and implications for improving the 'front-end' development of smaller building projects, especially for the delivery of environmentally progressive buildings appropriate to their social, cultural and economic context.

The chapter addresses macro-processes of project delivery, as opposed to detailed analysis and explanation of specific interventions by stakeholders. Therefore, the implications of projects on the local economy, culture, and environment are approached in a more general fashion.

Research on large-scale infrastructure projects

The IMEC research programme was a four-year international industry–government–university partnership launched by a team of industrialists and researchers in 1994 to analyse best practices in complex large-scale engineering projects.[1] Sixty detailed case studies of recent projects were developed as part of the programme. The author was the programme manager and field research coordinator of IMEC. Projects analysed are shown in Table 16.1.

The programme's initial goal was to explore the premise and limitations of the project management literature in explaining project performance. The key idea was that the front-end development phase (i.e., the early shaping stages of a project) was fundamental to its performance and success. Moreover, the front-end development stage was equal to or even more important than the project management skills deployed during detailed design and execution. The front-end stage was shaping the project's governance framework in a way that later defined its ability to resist risks and pressures and to embrace opportunities for enhancement.

These premises were largely confirmed by the research, comprising representative projects from various sectors, countries, and practices for the development, financing, and construction of infrastructure projects.

The underlying empirical research process consisted of three exercises. First, for each project, searches were made in secondary sources (e.g., Reuter, ABI Info, *Engineering News Record*, and others) to track

[1] A book synthesising key findings of the IMEC research programme was published in 2000. See reference to Miller and Lessard (2000) in references.

Table 16.1 Projects analysed in the IMEC Research Programme

Hydroelectric projects	**Thermal and nuclear power projects**	**Roads, tunnels and bridges**	**Oil projects**
• Bakun (Malaysia)		• BNPL (France)	• Andrew (U.K.)
• Birecik (Turkey)	• Bergen (U.S.A.)	• Cofiroute (France)	• Copan (Canada)
• Caruachi (Venezuela)	• Civaux (France)	• Highway 407 (Canada)	• Njord (Norway)
• Freudenau (Austria)	• Clover Power (U.S.A.)	• M1–M15 (Austria)	• Vigdis (Norway)
• Igarapava (Brazil)	• Gazmont (Canada)	• Mexico Road Program (Mexico)	
• ITA (Brazil)	• Hub (Pakistan)	• MUSE (France)	**Technology and other projects**
• Kazunogawa (Japan)	• Indiantown (U.S.A.)	• Confederation bridge (Canada)	• Boston Harbour Cleanup (U.S.A.)
• La Grande 1 (Canada)	• Lambdon (Canada)	• Prado Carenage (France)	• CAMSIN (Canada)
• Lambach (Austria)	• McWilliams (U.S.A.)	• Second Severn Crossing (U.K.)	• Euralille (France)
• Machadihno (Brazil)	• Nanko (Japan)	• Third Dartford Crossing (U.K.)	• Gardemoen (Norway)
• Old ITA (Brazil)	• Navotas 1 (Philippines)		• Lambdon flue-gas desulphurisation (Canada)
• Pangue (Chile)	• North Branch (U.S.A.)		
• Pehuenche (Chile)	• Ocean State Power (U.S.A.)		• Service Ready Plane (Canada)
• Ralco (Chile)	• Paiton (Indonesia)		• Telerobotics (Canada and France)
• Tucurui (Brazil)	• Port Dickson (Malaysia)		• Thames Water Ring Main (U.K.)
	• Subic Bay (Philippines)		
	• Sumatra (Malaysia)		
	• Wabash River (U.S.A.)		

information in the public domain. Public documents, memoranda, and prospectuses on the projects were also gathered. Second, structured individual discussions (typically two-hour interviews) took place with senior managers of the most important parties linked to each project (e.g., sponsors and entrepreneurs, government officials and civil servants, financial advisers, regulators, engineering and construction firms, equipment suppliers, and social groups). Structured narratives were written to capture the content of interviews. Third, a set of questions rating the context, the project risks, and a number of process and performance variables was addressed by respondents and researchers. Project performance was designed as a multi-dimensional variable, in order to capture assessment of environmental performance, cost and schedule performance, economic impact, and other measures.

Multiple stages of project development

The case studies clearly unveiled the long and often tedious process a project undergoes prior to its detailed planning and execution. A project that typically requires three to four years to design and build can take, up front, more than twelve years for its conceptualisation, formal structuring, and approval. Front-end analysis and negotiation for the division of rights and obligations between key stakeholders is a fundamental reason why their development is long and complex. For many aspects of the project, sponsors must act as active agents of change and create new space to modify laws, regulations, established practices, and standards. For example, the case studies (full details of which are found in Michaud, 2001) reveal the following:

- The Confederation Bridge project in Canada required the passage of two pieces of enabling legislation: an amendment to the Canadian Constitution Act of 1982 to authorise the private undertaking of a fixed-link project through a federal subsidy agreement and imposition of user toll fees; and the Northumberland Strait Crossing Act to authorise the complex financial engineering model adopted and the division of rights, risks, and obligations proposed.
- The Third Dartford Crossing project in the UK brought significant changes to the prevailing institutional framework. The proposed financial structure created the possibility of extracting a revenue stream from the existing two Dartford tunnels to partly finance the cost of construction of the third river crossing at Dartford. The project required Parliament's amendment of bills to transfer ownership of

the existing two tunnels and their approach roads (from Essex and Kent County Councils to the Transport Secretary). In addition, the design of a new hybrid bill by Parliament was needed to authorise the Transport Secretary to lease the new bridge and existing two tunnels to a private operator. The project served as a benchmark to develop the UK government's Private Finance Initiative, which encouraged the participation of the private sector in a number of infrastructure projects traditionally managed and financed by the public sector.

- The Hub Power project in Pakistan was innovative in many respects. It was the first time private equity was being raised on an international basis for a power project that was still at the stage of conceptual design. Negotiation of the major contracts with the Pakistani government (namely the electricity tariff, the purchase of power, and oil availability) required many institutional adaptations within the country and frequent interventions from the World Bank. The financing of Hub comprised a complex web of local and international debt, equity, and guarantees, considering the country's high-risk profile. The novelty of the various agreements and guarantees set between the government and the private developer company served to design the new power policy of Benhazir Bhutto's administration in 1995.

Other case studies testify to the complex processes characterising projects at their early stage of development and the impact they subsequently have on their surrounding environment. Exploring the dynamics of project governance highlights some of these processes below.

Governing the front-end development stage of a project

Some processes that take place at the front-end development stage of a project are:

- the early exploration process, in which visionary individuals and organisations mould the project concept and test possible receptivity to it by a number of stakeholders
- the inner governance process, where core sponsors and developers define rules of the game to coordinate themselves (in terms of specialisation of roles, risk sharing and accountability)
- the fact-based gathering and analytical processes, in which financial, social, technical, and environmental viability are tested and the project concept refined

- the outer governance process, where efforts are deployed to rally potential opponents, obtain rights from government, and influence regulations for the project to be economically viable once in operation.

All projects analysed, independent of their industrial sector and country, had complex sets of interdependent processes. This is because projects are dynamic undertakings, characterised by a non-linear evolution. They are shaped through analyses and searches for optimum solutions by the parties involved and entice much bargaining in order to capture economic rent and share risks. Investment decisions and cost estimates of projects rely on analyses made early on, at a time when little detailed engineering work has been initiated. Hence, decisions and agreements are materialised on the ground of a future engineering artefact delivering value, at a certain period of time, for an estimated number of years (e.g., a power plant delivering *x* megawatts of energy by date *y* for *z* years). Negotiation between sponsors, promoters, governments, financiers, contractors, and lobby groups to come to a viable project concept is based on the anticipation of the value and potential impact (including externalities) the project will generate. There are many feedback loops involved between the players since information is incomplete and built up gradually; opportunistic behaviour by parties takes place; and laws, methods, and standards to protect the project and give it legitimacy are inadequately defined and sometimes non-existent.

The example of the Birecik power project in Turkey reveals the complex front-end development process of large-scale projects. It took eleven years between the moment the energy ministry invited private entrepreneurs to submit a proposal (to build, finance, and own the project through a concession model) and the time construction started. The Build–Own–Operate–Transfer (BOOT) model was a new, radical ideology of the government to enable the construction of modern infrastructures by private developers without financial recourse to the state treasury. There were high risks involved in developing, financing, building, and operating the project under such market schemes, considering the country's relative instability, poor economic development, inadequate institutional framework, and discontent from neighbouring Syria and Iraq about changing the flow of the Euphrates River in order to produce power in Turkey.

More specifically, two main factors increased the complexity of negotiation, illustrating the level of uncertainty a project can have on local economy and environment. First, the reluctance of state officials to agree to privatisation of investment in infrastructure projects, especially to opening the power sector to private foreign investment. Second, the international banks' low interest in supporting and financing the project on a non-recourse basis (meaning no recourse to the state in case of the private company's failure to reimburse its financial obligations). When Turkey's BOOT programme was launched in the mid-1980s, with the Birecik project being one of its pioneers, the constitution and legal framework had not been modified to incorporate such private initiatives. This issue hit the Birecik project later, in 1993 (eight years after its initial conceptualisation), when sponsors tried to obtain approval for their guarantee and financing scheme. The project aimed to be a stand-alone, by securing guaranteed purchase of energy volume and guaranteed price of electricity from the Turkish Energy Authority (TEAS). For this market scheme to be viable, sponsors required to be able to call for foreign arbitration in the event of default or other problems. The concession status in Turkey would not allow such arbitration. In 1994, after intense efforts, a law was passed to set a code for the development of BOOT projects, and a specific article within that law gave energy projects a non-concessionary status. However, within a year, Turkey's constitutional court ruled that it was unconstitutional for projects to be categorised as non-concessionary (the government did not have the right to change the law relating to areas of public ownership under the constitution). Such a change in law would require a parliamentary vote. The Birecik project was eventually cleared as an individual case from the law through powerful games of influence, and was approved as a commercial contract in 1995. Figure 16.1 shows the financial deal structure for the Birecik project. The intricate web of guarantees put in place increased the cost of the project. Despite successful financial closing, the project caused discontent on the part of the Turkish population, who were excluded from negotiations, particularly because of the high electricity tariff and strong sovereign guarantee offered by the government to the private sponsor. Hence, institutional and organisational innovation was made at the expense of end-users' involvement in final choices.

The Hub Power project in Pakistan, also among the first BOOT schemes in Asia, had similar dynamics. The 1292 megawatt power project initiated in 1985 could supply 13% of Pakistan's electrical power requirements and was viewed as a critical learning case for the country. In 1990, halfway through its front-end development phase, it was reported to be the world's largest BOOT project. It was, in fact, the first private power project structured by the World Bank, which took a significant participation in the project's development and brought innovative financing mechanisms to support the debt portion, considering the country's high-risk profile. The newly developed innovative financing and guarantee solutions enticed

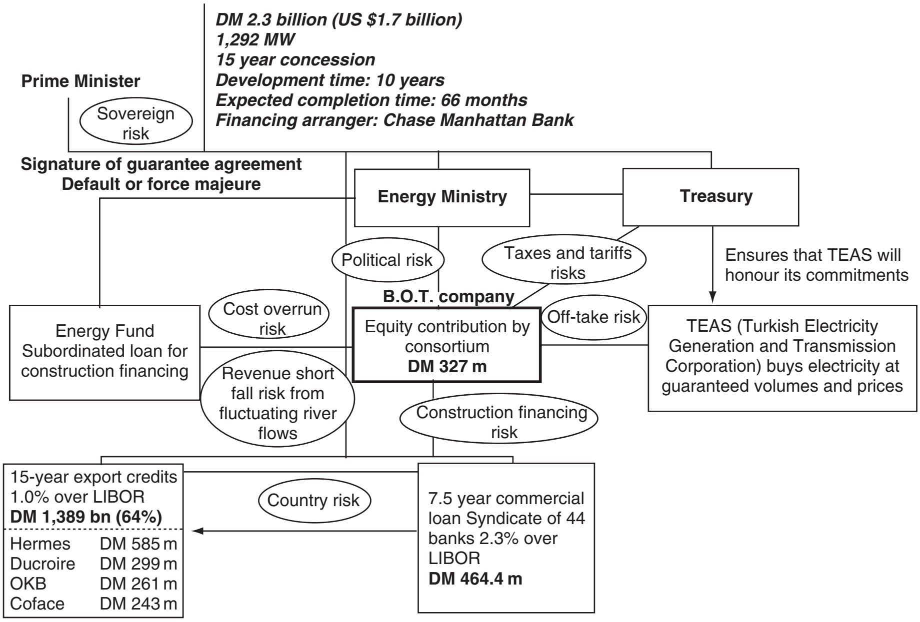


Fig. 16.1 Financial arrangements, Birecik power project

tremendous cooperation and coordination amongst the World Bank, the Japan Exim Bank, bilateral export credit agencies and commercial banks (including local banks). The design of two financial instruments by the World Bank (the Private Sector Energy Development Fund and the Enhanced Co-financing Facility) was crucial in making the financing possible.

The initial BOOT projects promoted in industrialised countries and undertaken in the same period of time faced similar challenges and complexity. Despite being developed in countries with lower risk and more mature institutional and regulatory frameworks, they had to manage various financial and political hurdles and build their legitimacy in order to reach approval for finance, design and construction. Considering some of the urban transportation case studies, the Confederation Bridge in Canada took eight years of development prior to approval for execution and the start of detailed design. The Second Severn Crossing in the UK required 13 years. Both projects hit various unforeseen problems and challenges as they evolved from concept to reality (including technical, geological, social, environmental, political, and financial issues). Both had to deal with a long parliamentary process in order to secure a bill for their private undertaking. Like the Birecik and Hub projects, a broad set of coordinating mechanisms were used in order to enable the project to move forward.

Creating coordination

Amongst the recurrent coordination mechanisms identified in case studies are:

- long-term planning
- the conducting of detailed technical studies
- structured and informal debates and negotiations between sponsors and promoters, and with governments and local groups
- the use of market mechanisms (e.g., competitive bidding for BOOT contracts)
- competition for the offering of debt portions to financial institutions
- common goal setting, formal contracts, etc.

An important finding from the study was that a wide variety of co-ordination means are used in each project because a wide variety of negotiations and transactions occur to shape a project gradually.

Rather than categorising and benchmarking all types of modes of co-ordination, Thompson's (1967) definition of coordination was adapted to consider how the use of coordinating mechanisms impacts on projects (Michaud, 2001). As an illustration, raising debt for the project through the market (e.g., soliciting international banks for them to 'buy' debt in the project) plays an important shaping role. In the projects described above, for example, raising debt according to parameters that are acceptable to core stakeholders took many years, during which time the projects were constantly in danger of being shelved. Numerous adjustments needed to be made to make them financially viable (e.g., reducing their size, shortening their construction schedule) and numerous forms of guarantees provided to lenders, therefore constraining the degrees of freedom (e.g., having specific large-scale international engineering or construction firms as key partners to lower the risk level and attract more financiers). Hence, the raising of debt influences the shaping of the project's technical, institutional, and organisational attributes.

The way in which hearing processes with communities are organised offers another illustration of how coordinating mechanisms impact on the attributes of a project. Environmental issues, for example, can be potential deal-breakers throughout a project's development due to the economic importance of local trades or the strong vocal opposition of environmentalist groups. Often a plethora of environmental studies must be conducted to explore environmental concerns. A project-specific environmental assessment process may need to be organised to reassure pressure groups who have successfully challenged the adequacy (or lack) of prevailing environmental evaluation methods. These reviews can play a critical role in the technical design of the project and change rapports with communities.

In the case of the Confederation Bridge, the project was stalled by an unforeseen two-year hiatus just after private developers presented their proposals, caused by intense scrutiny of the potential environmental impacts of the project. A high level of public concern with the government's generic initial environmental evaluation process sparked the ensuing environmental debates. Various interest groups felt the evaluation matrix was too broad, and the analysis 'too academic'. They wanted specific evaluations of each bridge concept proposed by pre-qualified developers. Consequently, the ministry of public works had to appoint an environmental assessment review panel, and the project was put in the hands of the minister of the environment. The panel eventually recommended that the project should not proceed because of impediment to the movement of ice out of the river strait and harm to local lobster beds. However, if a fixed link could be designed in a way that it did not delay the ice movement process by more than two days, the project would be environmentally acceptable. The government incorporated the panel's recommendations into the project selection criteria and asked developers to review their proposals.

Within the project's inner governance organisation, coordination between sponsors and partners testifies to a broad spectrum of contractual devices and tools, ranging from highly informal to highly formal. For example, the negotiation and enactment of the core construction contract is a key coordinating mechanism in setting relations between engineering firms, construction firms, equipment companies and ultimate clients. In the Second Severn Crossing project, the winning consortia of the BOOT process (John Laing and GTM Entrepose, with their financial advisers Bank of America and BZW) incorporated a concession company (SRC plc) to build, own and operate the crossing. SRC plc became the client of the project, that is, the owner-operator. John Laing and GTM Entrepose also formed an equal joint venture for the engineering and construction work. Under this scheme, SRC plc was taking the commercial risk of the project, including traffic risk and toll fee operation risk. The John Laing/GTM Entrepose joint venture (the contractor) fully assumed the construction cost and schedule risk under a lump-sum contract. To manage their delivery risk, they opted to reduce the expected schedule by six months. This goal was achieved by simultaneously building the central span and approach viaducts as well as using mastered technology. Hence, the organisational and contractual arrangements influenced the construction methods and lowered the degree of technical innovation.

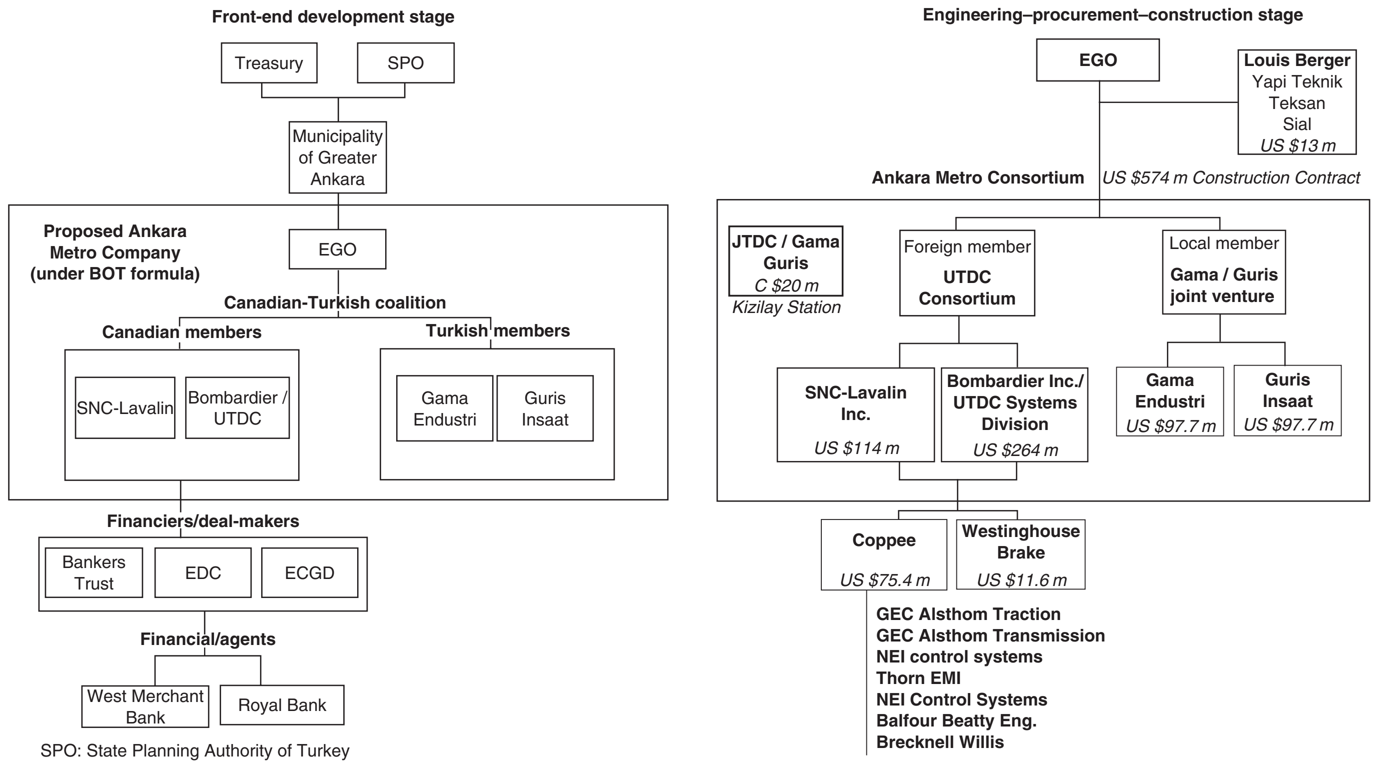
Managing cross-cultural dimensions

Every case study confirmed challenges in integrating players from various countries and sectors, because of the mix of international stakeholders and practices involved. Figure 16.2 shows the organisational structure for the Ankara Metro, for example, at both the front-end development and engineering–procurement–construction stages. There were Turkish stakeholders (the Treasury, the state planning organisation and the municipality of Ankara); the engineering and construction firms (Gama and Guris); Canadian players (the engineering firm SCN-Lavalin, the export development corporation of Canada and the Royal Bank); and British players (the export development corporation of the UK and West Merchant Bank).

Not only were the cognitive models and ways of working of these various players different, the objectives they pursued varied. Although they aimed toward a common goal (i.e., to provide Ankara with a heavy-rail transit system) stakeholders wanted to meet individual objectives. For example, the engineering firm SNC-Lavalin, the early promoter–developer of the project, wanted to access the East European/Asian projects market to develop an international reputation in mass transit projects. The State Planning Organisation wanted to meet the Turkish Prime Minister's objective of implementing BOOT projects in Turkey and therefore to be recognised internationally in succeeding in such an endeavour. The Turkish engineering and construction firms Gama and Guris seemed to mainly want to fill their order books.

The aim for a common goal was certainly the most determinant co-ordination mechanism that rallied the various stakeholders, notwithstanding their culture. Despite growing difficulties to get the project financed and approved (the Gulf war declared in the spring of 1991, the bankruptcy of Lavalin and the subsequent takeover by SNC, changes in Turkish government at the national and local levels), the commitment of core members of the coalition to deliver the project never failed.

Specialisation of roles by areas of competence was also a core means of managing cross-cultural issues: project management, political



SPO: State Planning Authority of Turkey
EGO: Mass Transit Authority of Greater Ankara Metropolitan Area
EDC: Export Development Corporation of Canada
ECGD: Export Development Corporation of the U.K.

Fig. 16.2 Organisational models: Ankara metro project negotiation, local regulation and permits acquisition, construction competencies, etc. Interaction between key stakeholders was mainly by direct means: working meetings, exchange of letters of intent, and by creating early on a joint project team sitting in the same office. Another important aspect was time. From the moment the first proposal was made in 1987 to the time the financial agreement was concluded in 1992, mutual recognition of skills and trust was developed. Hence, the long period of time characterising the front-end shaping of projects can be essential to deal with cross-cultural 'co-habitation'.

In all the projects analysed, cross-cultural issues were particularly sensitive when negotiating the division of rights and obligations between project developers and state or local governments. More than a cross-cultural issue, those negotiations revealed a cognitive challenge: divergence in the belief of the private sector delivering and operating large-scale projects in an optimal fashion, or in the priority of the project for attaining broader socio-economic or political goals. Many features of the institutional framework were directly impacted by negotiations: the constitution and constitutional traditions, the local legal and commercial practices, the local regulatory bodies' commitment ability, etc. Various real-time devices and incentives were designed by project developers and other stakeholders to compensate for ill-defined institutional foundations for their projects, including stand-by financing, guarantees, project-specific regulations, partnerships with opponents, and the setting of new voice mechanisms to manage rights of local communities including new forms of hearing processes.

In summary, large-scale, international projects result from a complex set of interactions between entrepreneurs and other stakeholders who use prevailing institutions to promote and protect their project and who try to change those institutions incrementally or significantly when needed.

Crafting the innovation process

Projects may stimulate broad institutional change to a region or country by setting new project delivery models that establish paths for the delivery of the next projects. Scott (1995) well illustrates the process of institutionalisation, empirically observed in the case studies.

Projects forcing major redesigns to the institutional framework come at the end of an 'institutional cycle' (a concept similar to business cycles – see Freeman and Perez, 1988). They are 'institutional breaker projects' setting new trajectories (Michaud, 2001). They emerge from entrepreneurial actions by public and private agents who seek new models and policies to attain broader socio-economic, industrial or organisational goals. From the interaction of sponsors, government officials, regulators, financiers, and other actors, these projects set new models to govern rights and obligations between public and private players.

New institutional arrangements resulting from institutional breaker projects may establish a dominant design by shaping the next series of projects. The La Grande hydroelectric power project in Northern Quebec, Canada is typical of a project shaped by its predecessors, or a 'commoditised' project (one done as part of a series). Although its technical design was somewhat different from the previous hydroelectric projects done in that region, it inherited the exhaustive institutional and economic framework (the James Bay agreement) negotiated with local populations for previous projects.

Dominant designs from institutional breaker projects may extend over several decades, such as the private power monopoly model in the United States in the twentieth century, which guided the modelling of many projects (Hughes, 1983).

Managing trade-offs in innovation

Large-scale projects provide information on the trade-offs made between institutional, technical, and organisational innovation. In several projects analysed, institutional and organisational innovation was made at the expense of innovation in technical design. New public–private partnership arrangements especially create pressure to shorten project development cycles because of the private financing scheme and resulting higher level of risk for promoters and financiers. This can have perverse effects on technical innovation, pushing for the use of simple and mastered technologies to reduce project time and development cost, and quicken the project's legitimacy process up front with financiers, government élites, and regulators.

The Dartford Crossing in the UK is an illustration of this phenomenon. The project team interviewed at John Laing and GTM Entrepose confirmed that they decided to take no unnecessary risks because of the financial obligations negotiated in the BOOT contract. Managing technical risks led to the construction methods driving the detailed design (instead of the design driving the construction methods), in order to respect strict delays tied to the financing clauses specified in the concession contract. Such projects tend to be less innovative in terms of design. However, the pressures built into contract triggered incremental innovation in construction and project management methods. This allows the sponsors to increase the likelihood of operating the infrastructure at the earliest possible date and/or to make the largest profit on construction (depending on where their financial incentives and the risks they support lie).

Addressing the sustainability of various approaches

The research identified two broad types of cognitive framework for the transition to new forms of public–private ventures. They are tentatively named *stretching the market* and *true public–private partnerships*. It was recognised that any specific project does not necessarily fall perfectly in either one or the other description.

'Stretching the market' is an ideology that uses market theory to modify the institutional framework significantly. It tends to push complex, non-linear projects to their limit. Changes promoted by various agencies such as the International Finance Corporation or the International Monetary Fund are based on a strong ideological belief that private firms, disciplined by competitive market forces, can deliver large-scale projects with superior efficiency than state-owned companies and governmental agencies. The creation of competitive market forces is supported by innovation in technology, financial markets, and economic regulation. For example, competitive market forces are supported by the unbundling of activities in which economies of scale are believed to have less importance (e.g., the power generation sector), and by eliminating regulatory barriers to entry. In such models, there is a strong belief in the minimisation of monopoly forces, reduction of government guarantees, and the reliance on non-recourse project financing (projects financed on their own through revenues from operation rather than relying on government guarantees).

As shown in Table 16.2, analysis suggests that the concept of stretching the market presents higher risks for projects.[2] Projects following that ideology often result in much incoherence in institutional designs, for example:

[2] Typologies of 'stretching the market' and 'true public–private partnership' were assigned *a posteriori* to projects based on the research team's judgement. Evaluation of risk is a measure built from quantitative and qualitative observations.

Table 16.2 Relation between public–private partnerships models and project risks

Transition model to public–private partnership	Degree of project risk: Low risk	Medium risk	High risk	Number of projects	%
No transition to market model	14	11	3	28	46.7
Stretching the market	3	7	15	25	41.7
True public/ private partnership	1	2	4	7	11.7
Number of projects	18	20	22	60	Total
%	30.0	33.3	36.7	100.0	
Chi-Square	**Value 17.22394**	**Degrees of freedom 4**	**Significant .00175**		

- transition from a public to a private model without the exercise of real ownership rights by private sponsors (e.g., some Indonesian projects analysed in IMEC where the public–private contractual clauses were not respected by sovereigns)
- contract-based regulation without appropriate legal foundations (e.g. BOOT contracts in Turkey were illegal according to the constitutional provisions and each of them is still today a case for major debate)
- a private sponsor bearing high risks but being strongly limited in terms of profits, therefore supporting most of the downsides and little of the upsides (e.g. some of the projects undertaken under the Private Finance Initiative in the UK)
- public–private partnerships without a legitimate public partner (e.g., the MUSE highway project in France was not supported and protected at the right level of government).

Such models require significant changes to prevailing institutions. If any of their key assumptions and requirements is not fulfilled or if some strong beliefs in competition fade, projects are at risk. This may occur as a result of new political elections, change of leaders, regulation not becoming adapted as promised, user tariffs not allowed to be increased to make the project economically viable, or changes from monopoly to market dynamics not being managed properly.

By contrast, designing true public–private partnerships follows a different ideology. They are structures that blend private initiative with public accountability, rather than unduly pushing all complex problems onto the market (Brooks *et al.*, 1984). Economic agents from both the public and private domains realise that there is an opportunity for a positive-sum game. Partnerships are based on the design of state-chartered private companies who are given concessions and whose charters stipulate fair pricing structures and price escalation, standards of construction and maintenance, etc., in return for innovation and for some measures of regional socio-economic development and environmental protection. Uncertainty in future revenues is taken into account: government provides various forms of support, such as land grants (e.g., to capture a portion of land exploitation revenues to manage economic risks); the guarantee of serving a large base of paying customers by means of monopoly rights; subsidies to compensate for imposition of low tariff escalation; guaranteed prices or revenues; aid-in-kind; or other mechanisms and means to compensate for risks and costs borne by private developers. These projects look to the long-term viability, anticipating that they will lock in solutions for sometimes up to 100 years, and therefore will have consequences for technologies, society and other dependencies. They emphasise front-end analysis efforts in order to analyse several options for the project and they report lock-ins to the latest stage possible.

The Confederation Bridge in Canada is among the best public–private partnerships investigated in the IMEC Research programme. Despite critiques by various stakeholder groups, it represented a fair alliance between the public and private sectors rather than client–supplier relationship. Front-end analysis embedded social and environmental impact analysis and mastered public hearing processes. Decisions were made according to criteria formally embodied in negotiation and agreement contracts. A form of limited partnership was created, articulating the rights and responsibilities of parties and specifying the management of externalities and spill-over effects.

Implications for the delivery of environmentally progressive buildings

From the perspective of some key findings in studying large-scale engineering projects, what are the key implications for the design of future buildings?

There are at least two lessons. First, the research shows that for any project, institutions are incomplete and need to be transformed to some degree in order to manage projects' risk and uncertainty and foster innovation. In order to be developed in an innovative fashion and set an environment for future capturing of value, projects must force changes onto institutions and regulations: this serves to unfreeze prevailing practices, rules, laws, and perceptions, thereby allowing innovation and adaptation into new environments. Both institutional determinism and adherence to prevailing rules and standards (Parsons, 1960) and evolutionary mechanisms to change the prevailing institutions where needed (Nelson and Winter, 1982) act together to support the means and ends of project development.

The diffusion and application of progressive building approaches therefore require changes in the particular institutional environment (local and/or international) that frames a project, and the ways in which to manage related risks. This serves to directly shape the project's governance model – that is, the coordination devices used by sponsors and stakeholders to manage joint project objectives and overcome hurdles in the process of innovation. Governance models are often emulated from institutional arrangements developed for other projects in various countries and sectors (e.g., copy of BOOT model agreements from other projects and of their legal contractual arrangements). If viable, they can enable the establishment of a new path, or diffusion process for other projects to come.

Transforming institutions to achieve higher project performance is possible. However, a limited number of stakeholders and firms have the competencies and the resources to play the 'institutional shaping game'. Major transformation of the culture of institutions is complex and time-consuming; it requires a deep understanding of the many social, cultural, historical and legislative features of a country, region, and sector, as well as careful, locally adapted strategies. Creating the right coalition of stakeholders is key to success, and the quality of parties and of the coordination mechanisms used to protect and promote the project directly affect its success.

Second, the research indicates that short-cuts to the front-end development process are hard to achieve and likely to be non-viable in the long term. Social groups not involved effectively, government officials and regulators assessing after the event that private developers have obtained too much value through contracts negotiated, and others will react during project execution or early operation to try to change the course of things. Unbundling agreements and renegotiating division of rights and obligations is expensive and risky. Projects are better off accommodating local social, environmental, economic and cultural issues by structuring the right voice mechanisms and integrating these inputs into the project's strategy and governance model.

While the IMEC research focused on large-scale projects, it provides lessons for projects of smaller scale – especially those where the procurement rules appear rigid. The answer may lie in the appropriate management of trade-offs between institutional, organisational, and technical innovation in order to manage degrees of freedom. Engineering firms, construction firms and suppliers must strategically think (and behave) as much as possible as promoters and developers of projects and find the appropriate interstice(s) to innovate. For this, detailed planning and in-depth strategy development at the front-end development of projects are crucial.

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17

Contemporary Chinese Architectural and Planning Practice – Aspirations and Challenges

Joe Carter

> 'China has no precedents in its past for buildings or spaces in higher density urban areas; courtyard cities are one-storey high. The farmer and the Emperor both lived in the same house-type; only the size and decoration were different. Marco Polo said Beijing was the largest village he ever saw. The urban planning may be brilliant, but there is an absence of urban design.'[1]
>
> Qi Xin

> '[I]f we want to preserve our national characteristics, we must first make sure they can preserve us. Distinctive things are not necessarily good, so why must they be preserved? Why keep a carbuncle just because it's Chinese?'[2]
>
> Lu Xun (1881–1936) Chinese author and social critic

Introduction

By embarking on a rapid path of modernisation of its built environment, China is encountering problems at architectural, technical, environ-

[1] Qi Xin, conversation, 21 March 2002.
[2] Lu Xun, quoted by Ruth Weiss, *Lu Xun, A Chinese Writer for All Times*, New World Press, China, 1985, p. 85.

a

b

Fig. 17.1 View of old Beijing from Drum Tower. The Bell Tower (a) and old courtyard housing submerged in trees (b). A new line of high-rise construction begins at the edge of the old city in 17.1a

mental, and social levels. These challenges are particularly poignant for Chinese architects and planners. These professionals are attempting to reconcile and apply ideas imported from the West along with China's vast heritage. As a Canadian architect resident for 17 years in Beijing and Tianjin, it has been a privilege and a challenge to learn from traditional and current Chinese practice, and to participate in China's search.

Fig. 17.2 View of Shanghai, Pudong District, from Jin Mao Tower

The pace of development in China is so intense it presents both enormous potential and threat. Most of urban China has been built since the mid-1970s, at a rate of over 150 million m^2 per year, often in huge single projects. This rate of urban expansion is unprecedented and is contributing to serious physical and cultural environmental degradation. Along with increased water and air pollution, diminishing water resources, and desertification, the physical remnants of China's urban cultural wealth are collapsing from neglect or being brushed aside. A World Bank report in 2001 praised China for handling severe environmental problems since the early 1990s but warned that spending on conservation was being outstripped by economic growth, and urged a more active approach.

Although China's urban population is still relatively poor, a rising standard of living and the accompanying rising expectations of material prosperity are challenging the sustainability of development. Will increasing prosperity lead China to embrace the same consumer-driven and unsustainable growth patterns of wealthier countries or to benefit from their mistakes? An even more disturbing threat to sustainability is the emergence of corruption, economic crime, opportunism and a renewed disparity between rich and poor.

Chinese children now are eagerly learning English, science, mathematics, and engineering to enter a global society. About half of China's urban adults own mobile phones, and the information highway has been adopted wholeheartedly. Among urban families, 10% now own a private car and Chinese cities are beginning to choke on this new traffic where once there were mainly bicycles. China is proving to be outward looking and eager to adopt Western science and technologies. These are often regarded as panaceas for all social and economic development ills and are not necessarily subjected to critical examination for their appropriateness or economic, social or environmental implications. The nature and still relatively low level of education and management experience inhibit the proper application of Western ideas and methods. While many are aware of the opportunities to leap over the older technologies or planning errors and paradigms of 'developed' countries; this happens by legal necessity or economic opportunity more than it does by considered choice.

Currently, the opportunity exists to build in order to improve living standards, accommodate large migrations into the cities, and allow for further industrialisation. As the cities absorb tremendous population pressure and demand for shelter, existing urban fabric and traditional ways of life are under threat. Thus the questions arise: which solutions to apply? as well as what should be retained? and what should be discarded?

With the rapid supply of high volumes of the built environment, little time exists to learn from the lessons of the past, or from other countries, and weave them into present practice. Moving a culture forward, when the shadow of the past on the present is so large, can make it more a burden than a rich source from which to borrow. In 1949, *Towns and Buildings of the World*, by Rasmussen, rated Beijing as pre-eminent. Of 'Peking, the capital of old China!' he asks, 'Has there ever been a more majestic and illuminative example of sustained town-planning?' The past can be a hard act to follow.

In terms of a contemporary national architectural style, China is still struggling to progress beyond the ten monumental structures built to celebrate its 10th anniversary in 1959, including the Great Hall of the People, the History Museum, the Beijing Railway Station, and the National Art Gallery. These structures are dignified and have some Chinese motifs, but they are still just preliminary steps toward reinterpreting China's architectural and urban design heritage in modern terms. The new Beijing West Railway Station, designed in the early 1990s, tries harder than its 1950s predecessor to be a modern prototype, but lacks the dignity of the original station.

Fig. 17.3 Modern office building in Beijing with a Chinese pavilion and roof incorporated into the whole façade

Fig. 17.4 Modern office building in Beijing with a Chinese pavilion in the upper area of the facade and another pavilion as an entrance

Liang Si Cheng, the founder of China's premier school of architecture at Qinghua University said, more than 50 years ago:

> 'Now, with the coming of reinforced concrete and steel framing, Chinese architecture faces a grave situation. Indeed there is a basic similarity between the ancient Chinese and the ultramodern. But can they be combined? Can the traditional Chinese structural system find a new expression in these materials? Possibly, but it must not be the blind imitation of "periods". Something new must come out of it, or Chinese architecture will become extinct.'[3]

The real estate boom that started in the early 1990s saw the construction of many office and apartment towers that had either foreign designers, some of whom have never been to China, or local designers experimenting with and emulating Western design. For foreign-invested, high standard office and residential buildings, the design is usually a wholesale import from the West. Local architects also made attempts to make some new buildings 'Chinese'. The references to historical styles, often quite literal, look uncomfortable on modern building types. Just as uncomfortable is the awkward imitation of Western detail. The resulting built environment at best lacks an architectural and urban design language and at worse is deemed chaotic and even 'barbaric'.[4] This gives renewed urgency to answer the question 'What is modern *and* Chinese?' Every developer's design brief still asks for 'modern with Chinese characteristics', but its realisation is elusive. The result is fragmentation, a clash of old–new, East–West, and thoughtful-immature design.

When the boom started, the mayor of Beijing attempted to protect the city from over-Westernisation. To counter the concerns that too many new tall structures with flat roofs were being built in Beijing, he insisted that all new towers wear a Chinese pavilion roof 'hat' and parapets with glazed Chinese tiles to create a more Chinese-looking skyline. Although this aspiration was admirable, the result was unsatisfactory. Locals recognise

[3] Liang Si Cheng, *A Pictorial History of Chinese Architecture*, MIT Press, 1984, p. 3. Chinese classical architecture has a post-and-beam wood frame structure connected with complex nail-less joinery. This frame structure, while almost obscured by walls of brick and roofs of clay tile, is independent of them, and, in this sense, contains a basic similarity to frame structures with a curtain wall.

[4] Phyllis Lambert, head of the Canadian Centre for Architecture, used the term 'barbaric' to describe China's modern urban landscape in a lecture at Beijing University, 12 November 2001. Qi Xin, a 42 year old Chinese architect, educated in Beijing and France has described the character of China's modern architecture as 'chaotic'.

Fig. 17.5 Beijing streetscape with local adaptations of modern and classical Western architectural forms

the artificiality of such roofs and refer to the strip of tiles applied to the parapet as the 'watermelon rind'.

These issues have been the focus of soul-searching by all of China's leading planners and architects. Their aspirations are entwined with China's desire to modernise and become a contributor to the modern world after so many centuries of isolation. However, challenges exist at many levels:

- reconciliation of economic development with social wellbeing and cultural continuity
- differentiation between technological and cultural needs
- a clash between former revolutionary values of self-sacrifice and austerity and new policies promoting individual acquisition of wealth
- architectural and planning heritage embodied in the old building fabric that is dilapidated
- China's urban development model now has much higher densities than before and consequently the old fabric and buildings are threatened with replacement

- new construction lacks craft; old construction was rich in symbol-carrying craft and detail
- current patterns of development are large-scale, centrally designed and organised in contrast to the traditional city composed of single (extended) family houses built using traditional patterns
- old cities cannot sustain the onslaught of the private car.

The transition to higher density cities

In the West, there is debate about whether sustainable city form is compact high-density, decentralised low-density, or decentralised concentration. While 'it is not possible to state categorically that one particular theoretical urban structure is more sustainable than another' (Moughtin, 1996), the model for urban China today is based upon compact and high-density cities. The average gross plot ratio[5] in new residential areas of Chinese cities is a minimum of 1.0 and often higher. The traditional old city in residential areas had a plot ratio closer to 0.3. The gross average population density of the built-up part of a Chinese city, including near suburbs, is about 10000 people/km^2 (100 people/hectare).

The argument for the compact high-density city is that density of buildings and people will optimise exchange, access to services, and opportunities for mutual support. Higher density should enable a more equitable and accessible distribution of community resources with walking access to shopping, schools, services, and more efficient public transportation. The density should not be so high, however, that the system becomes paralysed and suffocating, nor so low that it needs unsustainable infrastructure to support it. No definitive numbers exist for 'optimum' sustainable urban densities, so further research is needed to inform policy and practical levels. Indeed, the recent and emerging experiences of urban density in China would also inform such research. If the compact high-density city is a valid sustainable urban form, then, in this aspect at least, Chinese cities have the potential to be more sustainable than most North American cities.

[5] Plot ratio or floor area ratio (FAR) is the number of square metres of building on a given site compared to the size of the site. For example, a ten-storey building with 1000 m^2/floor has a building area of 10000 m^2. If this building were placed on a 1 hectare site (10000 m^2), the plot ratio would be 10000 m^2 of building/10000 m^2 of land, or 1.0.

However, the reason for creating compact high-density cities has been limited means rather than a conscious policy of sustainability. Chinese pragmatism, moderation, a frugality learned from poverty, and limited land resources result in new construction with a relatively high urban building density and a Spartan lifestyle. Most urban Chinese people cycle or take a bus to work, wear long underwear in winter, turn off lights when they leave a room, live in small spaces, and are sparing in their use of water and cooking gas. With rising wealth, the advantages of optimum density city construction and energy-saving lifestyles can erode unless there is increased environmental awareness and education. Gains in building envelope performance, for example, may be outpaced by rising standards of comfort. If the socially acceptable and affordable limits of comfort increase, then the gains in building performance will be countered by expectations of higher indoor temperatures in the winter, etc. China cannot afford the West's sprawling very low-density suburbs resulting in expensive infrastructure. While sustainability was not a conscious goal, the results nonetheless achieve sustainable characteristics.

Chinese architects and planners can play a decisive role to help retain the current unconscious eco-habits and sustainable development patterns by making them conscious. One available instrument is China's Agenda 21 Programme. Its 'constitution' is *the Government White Paper on China's Population Environment and Development in the 21st Century*. This clear and informative 1994 document is a blueprint for coordinated action on many fronts. Among other things, the Agenda, especially Chapter 10, 'The Development of Sustainable Human Settlements', could become part of the curriculum for architectural and planning education, and a guide for foreigners interested in any aspect of sustainable urban development in China (see also www.townsnet.com/agenda2.htm).

While favourable arguments can be made for the new higher density Chinese city, from the point of view of architects and planners some major problems exist. First, there is a lack of a satisfactory urban design language for this new level of density. New densities far exceed former densities and therefore threaten the existing traditional city. Second, the urban development process is 'top-down', and delivered at mega-scale, leaving little room for diversity and participation. Third, globalisation, initially at least, seems to be a vehicle for the transmission of a consumer-driven development paradigm that not only threatens sustainability but obscures the possibility that China's vast philosophical and cultural reservoir might provide clues to valuable alternatives. Finally, the ability of the high-density city to sustain social and cultural needs over time needs to be validated.

Urban design for high density

The bulk of the compact Chinese city is composed of housing, and its form is defined by a number of factors:

- limited budget (about US$120/m^2 for construction)
- scarce land
- high dependency on apartments to meet density demands; the house typology is almost non-existent in modern urban China
- a modest apartment unit size
- an ancient tradition of southern exposure for all buildings
- a willingness to climb six floors without a lift (elevator)
- reliance on natural cross-ventilation for summer comfort. (There are no double-loaded corridor apartment layouts in China. Normally there are two units per floor at each stair landing.)
- structural requirements for earthquake-prone areas
- a work force using simple tools and methods.

Within the above criteria and constraints, until recently most housing in China was six-storey walk-up apartments with plot ratios between 1.0 and 2.0. Even at the edge of many cities, six-storey residential buildings are typically built across the road from farmers' fields. More recently the plot ratios, within the property lines of a 10 to 30 hectare housing estate, have risen to 2.5–3.0. The population density on these sites can exceed 1000 people/hectare.[6] When the plot ratio in a residential area goes over 1.0, the house type disappears and the apartment type predominates.

Most mid- and high-rise housing in China is now free-market housing, not social housing. People are willing to buy high-rise housing because it is affordable and provides more interior and outdoor (communal) space. These building densities are not perceived as overcrowded, because people have usually moved out of even more crowded conditions (as low as 4 m^2/person) in older parts of the city to a new apartment with 15–20 m^2/person.

[6] We can compare these two ratios to determine a third ratio, building space per person. In the above example, typical of new urban China, the ratio is an average of 20 m^2 of building per person.

Fig. 17.6 Housing in a northern suburb of Beijing with a density (plot ratio) of about 3.0

If the current densities for the new Chinese compact high-density city are sustainable, then the village-like one-storey, old courtyard city with its plot ratio of around 0.3 will not be preserved unless it is recognised for its high cultural value. An alternative urban multi-family dwelling type with three-storey apartment blocks forming small courtyards and a plot ratio of approximately 1.0 was created by Professor Wu Liang Yong at Qinghua University, Beijing, in the late 1980s. Despite being awarded a UNESCO Habitat prize, much publicity, and thousands of visitors, the model has not been replicated. This is mainly because land values have risen and the project's density is now too low to be affordable. It also appears to matter little to the average family to live in a quintessential Chinese courtyard house. The six-storey, higher density slabs are perceived by Chinese consumers to be better because they provide more light and air to all the units.

There is also a lack of vocabulary for public space, as its use was not encouraged in China's old cities. Old cities were mostly administrative centres, not centres of trade. Consequently, there is a lack of a semi-private, and semi-public space in the spatial hierarchy. In addition, there are no precedents for modern building types such as office towers, airports and railway stations.

Only when other values are strong enough to intervene at policy and implementation levels, such as the value of heritage preservation, will such districts will be preserved. If the policy of higher density is viable, then lower density areas have to be preserved and sustained by internal cross-subsidy from areas of higher density. However, this often comes with the cost of gentrification.

Another design challenge is China's current scale and pace of development. A 10-hectare site, in urban China, with a plot ratio of 2.0 has 200000 m^2 of buildings and is not considered a large-scale development. Christopher Alexander's (1987) idea of healthy, piecemeal, organic growth is in development sizes with an upper limit of about 10000 m^2; only one-twentieth of China's smaller scale developments. A typical New York city block for example is about 80 × 270 m, just over two hectares, one-fifth the size of China's smallest.

For security reasons and to obtain more protected green space for residents, these 10-hectare and upwards housing projects tend to be 'gated communities' with no through streets. This tends to contradict the rationale for higher density, namely, to improve accessibility. The rich grain of small-scale urban street blocks advocated by Jacobs and Alexander is not found in New China. Chinese planners would be challenged by Cliff Moughtin, Emeritus Professor of Planning at the University of Nottingham, who says:

> 'The larger and more homogeneous the street block the greater will be its power to destroy the social, economic, and physical networks of the city. The large-scale single-use, single-ownership street block is the instrument most influential in the decline of the city: its effect together with that of its partner the motorcar are among the real causes of the death of the great city.'
>
> Moughtin, 1996, p. 138

Along with city size, and population and building densities, street block size is another area of useful international comparative research.

If the higher-density compact city is an aspect of sustainable urban development for China, then the recent appearance of single-family home, suburban developments in larger Chinese cities is a threat to sustainability. This niche market has attracted foreign developers, with some promoting the use of wood frame structures for this housing. Flammable wood construction cannot be used in China's higher density cities; its use must be confined to the 'unsustainable' suburbs. Although traditional Chinese structures were all timber frame, this was only possible in a lower-density one-storey traditional city. Timber has also become a scarce resource in China. Its harvesting is a major contributor to flooding and soil erosion. Importing timber violates the sustainability principle of using local materials. Fortunately, a perception that repairs and alterations would be too expensive inhibits Chinese developers from pursuing the use of timber.

The urban development process

The current urban Chinese development model allocates large tracts of land to large development companies, with centralised organisation, using one design company to provide a few identical unit plans using national standardised construction details. The tremendous volume and speed of urban construction in China, achieved in such a short time, has been accomplished through a military approach with rules, regulations, and armies of workers (mostly farmers) organised like soldiers, living in barracks on the site.

While this method achieves the desired speed and volume of building construction, its centralisation discourages diversity. Top-down organised 'mass housing', built according to national standards works, against the use of regional pattern languages. There is also a tendency toward the 'majesty' of monumental symmetrical facades, and impressive wide streets cleared of outdoor markets, sidewalk pedlars, and small private shops. This hurts street life and reduces the stock of valuable, older, low-rent, 'incubator' buildings[7] so useful to China's budding entrepreneurs. The overall result can be a numbing homogeneity, and a rough coarsening of the urban grain. The process is understandably simple given limited management resources, a shortage of design professionals and an authoritarian social condition.

Property management, no longer the responsibility of the government, is undertaken by a subsidiary company of the developer. Early attempts are being made to organise residents' management committees but two difficulties are encountered: the vast size of housing developments containing 2–3000 families, and passive habits acquired during five decades of state care, which inhibit the realisation of self-management.

[7] Jane Jacobs, the author of *Death and Life of Great American Cities*, refers to a city's stock of older, low-rent buildings as essential for economic development, as places where budding entrepreneurs can experiment, with lower financial risk, to establish new businesses.

Implementing a more decentralised process will take time. Although China has gained valuable experience implementing national policies, such as the Housing Reform Policy (allowing local government to interpret guidelines according to local conditions), the size of the cities is still so large and the authoritarian mode so prevalent that urban development is still controlled from toward the centre.

Valuable international precedents for alternative urban development models exist for China to look at. The St Lawrence Market Neighbourhood in Toronto, for example, is a multi-tenure, multi-developer, multi-architect housing estate (with some other uses mixed in) built around a common municipal plan. Only the overall development guidelines were centralised. This project has a scale and density consonant with China's needs, but with greater complexity and diversity of organisation and building design. Another is the Berlin IBA (Internationale Bauaustellung). It involves public funds, public interest, private development, and some of the most prominent architects in the world, all used for urban renewal and rehabilitation in an open process.

Globalisation

The end of China's long, dynastic cycle of civilisation and its search for modern identity both coincide with accelerating globalisation. The Chinese dynastic cycle of civilisation, from its great Tang, Song heights, has just finished its decline; a decline that concluded with 100 years of colonisation and civil war. New China is barely 50 years old. The memory, even the shame, of the decline, and the glamour of new 'Western' wealth, obscure and inhibit recognition of China's potential contribution to the philosophical underpinnings of our collective development. As long as the current Western, consumer-driven development paradigm model stands and China 'buys' into it, in the near future, at least, the possibility that China could contribute to alternative scenarios will not be recognised by others, or even by itself.

The Harvard University sinologist, John Fairbank (1992), calls China a latecomer to modernity, especially since the Open Door Policy of 1978, and asks whether it has emerged from isolation just in time to participate in the demise of the world or, with millennia of survival experience, to help rescue it. James Yen, a Chinese pioneer in rural development in the 1930s, suggests the latter possibility:

> '[T]hrough the last forty centuries China must have matured her thought and learned many lessons in the art of living. . . . Surely, with China's four hundred million people [in 1930], four thousand years of culture and vast resources, she must have something to contribute to the peace and progress of mankind.'

One of the main reasons why the Chinese have a nagging sense of being 'behind' is because the 'modern' is so often defined in narrow terms of technical and scientific progress, comfort and wealth, and the predominant but non-sustainable Western consumer society. If 'modern' were defined as achieving the next stage in an evolving society – the family of man in a functional 'neighbourhood of nations' (Toynbee, 1987), then China would sooner find its voice. Distracted by the Western material development paradigm, China's spiritual, philosophical and artistic potential and resources are underestimated. China's appreciation of transcendent understandings is inhibited by an overemphasis on material development and further slowed by a cultural self-deprecating nature. If the next stage in cultural evolution is the establishment of a transnational community, and if that is the purpose of globalisation, then Chinese concept of *Tian Xia Yi Jia* (All under heaven is one family), for example, is an obvious congruence of thought. The essence of Chinese thought is harmony, unity of opposites, reciprocity; its heroes and champions of justice are poets and philosophers. The spirit of China's art, much of its poetry, and especially its garden design prefigure one of the essential concerns of sustainability – harmony between man and nature.

The more China locks itself into a material definition of modernisation, the less it will see its own potential value and the harder it will be for it to find its heritage of any relevance to modern life. The current architectural 'barbarism', including superficial borrowings from the West, is more the result of a lack of China's own development than of emulation of the West; more a bowing to a mechanistic, technical view of development than a consequence of foreign stylistic domination.

As Dr Farzam Arbab (2000) says:

> 'However thrilling the prospects may be, present patterns of behaviour do not inspire confidence in the process. It is only natural to wonder whether globalization will, in fact, unify the human race without imposing uniformity or simply propel the universalization of the culture of consumerism. Is it the bearer of prosperity for the masses or the mere expression of the economic interests of a privileged few? Will

it lead to the establishment of a just order or to the consolidation of existing structures of power?

'. . . [T]he pattern of economic growth being replicated has proven so detrimental to the environment as to call its viability into question. The challenge of bringing prosperity to all the peoples of the world through a process of sustainable development will not be met solely by the application of technology and the expansion of current schemes of organisation. It demands a radical departure from the materialistic philosophies that have created today's concurrence of abject poverty and irresponsible wealth.'

Arbab, 2000

Conclusions

The current situation of architectural and urban design in China has been described as problematic. Many ideas are transferred or transplanted from the West without question into China by architects, developers and government. These ideas and forms are often socially, culturally and environmentally inappropriate. The nature of the built environment has changed from being symbolic and functional to primarily functional. Symbols of modernisation have become Western-style office towers and highway overpasses.

The efficacy of this emphasis on functionality is called into question. Historic parts of cities are destroyed; valuable farmland and environmentally protected areas are consumed by expanding cities; the advantages of a frugal lifestyle and compact cites are abandoned in new suburbs; and the vast scale of the projects frequently contributes to the 'barbaric' and 'chaotic' nature of the urban landscape. In the developers' race to make money, the more thoughtful architects and planners often keep their scruples and doubts to themselves.

As a consequence of China's current rapid change toward a market economy, Chinese people are questioning the relevance of their heritage. It has been difficult to focus on global issues such as sustainability when even young architects and planners are loaded with commissions to design large tracts of the city. The prestige and remuneration, along with the entailed overwhelming workload, leave little time or energy to contemplate a larger view.

Fig. 17.7 Chinese vernacular village architecture in the Nan Xi Jiang area of Zhejiang Province

The current architectural 'barbarism', including borrowings from the West, is the result of a lack of China's internal development. An endogenous process of re-evaluating the emerging Chinese city and urban life will be a necessary part of the solution. There are aspects within China's philosophical and artistic heritage that may contribute to a radical departure from the current materialistic philosophies and the culture of consumerism, which have proven so detrimental to the environment. The more the viability of the current paradigm is questioned, the more China might find itself scanning its own resources and traditions. This will entail redefining 'modern' as sustainable in cultural, economic and aesthetic terms and seeking solutions which are both modern *and* Chinese.

The most potential to influence sustainable ideas positively resides in the first generation of Chinese architects and planners educated after the Cultural Revolution, who may be able to integrate principles and concepts from China's past with contemporary needs. Many in this group have greater theoretical depth by virtue of their travel and exposure to the West and are best equipped to guide its application (or not) to modern China. This generation is also the first to be aware of the environmental challenge, and the need to integrate ecological criteria into human settlement design.

A deeper search for the relevance of China's heritage may be lengthy and follow an uneven course, but it would be wise to commence a programme of research now in order to develop internal and appropriate capabilities and a vocabulary for questioning and adapting external technologies to

China's needs. Strategies are needed for deciding whether to adapt generic principles or specific ideas, or to adopt proven foreign technologies. Research into urban sustainability could include:

- form issues such as density, urban design for higher densities, block size, the relationship between density and transportation
- process issues involving urban development over time e.g. less authoritarian and more participatory methods of urban development, and the application of Agenda 21
- practical techniques now being developed in several Western countries to integrate natural processes and urban development

The complexity and scope of the problem suggest additional support is also needed. The process of forging a Chinese identity of place cannot depend solely upon the inspiration of a few well-travelled architects. The process will have to engage a variety of stakeholders in the built environment from occupants to planners and economists. The significance of 'top-down' decision making in China suggests high-level leadership must also be committed before effective change can be implemented. Therefore, part of the process must include an expansion of persuasive arguments. A review of skills and capabilities within the higher educational system is needed to assist designers to understand and appreciate regional culture, regional identity, and sense of place. Architects, developers and other decision makers in the built environment will need new capabilities to filter the growing possibilities presented by international trade and local aspirations.

This research would provide a practical focus, but in addition would ultimately strengthen the voice of the 'seekers' among China's architects and planners.

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18

A Bioregional Approach to Environmental Building – A Case Study of the KST House

David H. Cohen, Akira Yamaguchi and John D. Spengler

Introduction

Before addressing the bioregional philosophy of Kinoshiro Taisetsu Corporation – Hokkaido (KST) – it is necessary to provide some background and establish the context of the strong bioregional ethic that drives so much of the organisation and operations of this company. KST builds houses in the northern island of Hokkaido, Japan. Its business is built on a strong philosophical foundation, which is universal in scope, and drives all aspects of KST operations including the development, design, construction, and after sales service of all models of their houses (Preston, 1998). This philosophy combines practical applications and actions that address the following four ethical mandates: social/regional concerns, cultural links to tradition and ancient wisdom, the ability to operate an economically viable business and, most of all, environmental concerns. Each of the more than 16000 houses built by KST addresses key aspects of each of these concerns in design, material selection and construction. In turn, each of these concerns, including environmental, are addressed by a core commitment towards bioregional actions. To ensure adherence to this philosophy, referred to as 'the total system' in the company literature, KST is a vertically integrated company controlling all aspects of their business from design, to milling logs and building their own wood materials to operating the factory that creates consistent building com-

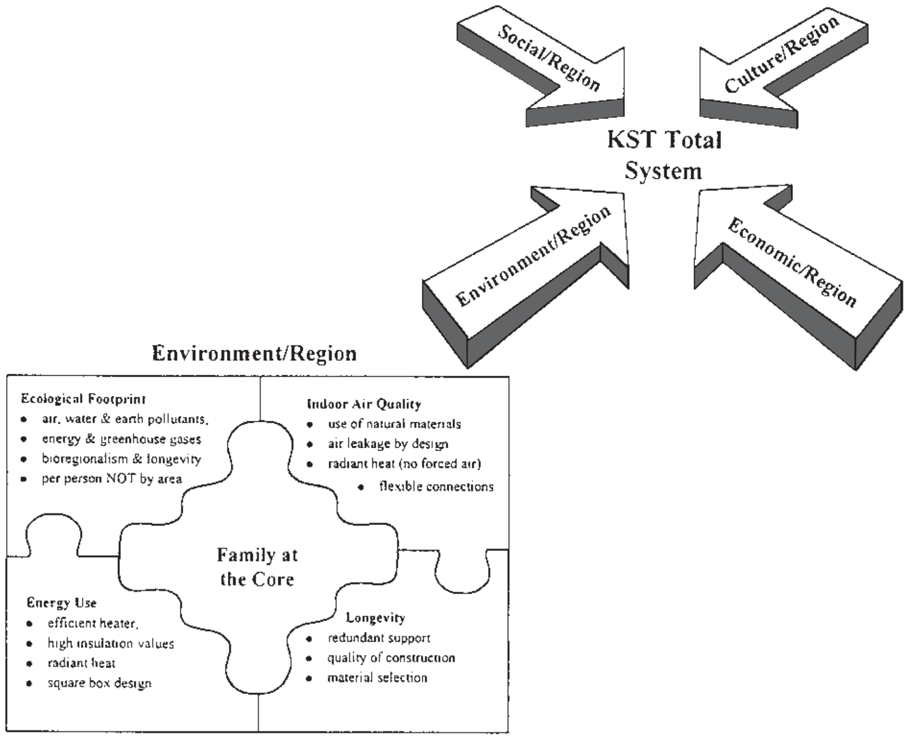

Fig. 18.1 Summary of KST philosophy with expansion of environmental aspects (adapted from Yamaguchi and Cohen, 2000)

ponents to sales, construction and after sales service.[1] This system incorporates many factory-built components as well as traditional construction techniques from historic Japanese temple construction (Cohen *et al.*, 1996). The total system and its environmental components are shown in Fig. 18.1.

While the philosophy is broad, its practical application by KST is limited to the region of Hokkaido, Japan. This philosophy has been developed since the early 1950s by Akira Yamaguchi, the founder and driving force behind this company. These philosophical foundations are extremely complex, marrying antithetical concepts on a normative and practical plane (Preston, 1998). However, the marriage of opposites such as

[1] Much of the information regarding the KST philosophy has been gathered during numerous visits and interviews between the authors and the managers, employees and customers of KST and Fuyosoken (the Winter Research Institute) from 1995 until the present (late 2002).

technology and ancient craft is best left to a more suitable venue, as are other innovations in the design, sales, construction and use of the KST house.

The environmental portion of the 'total system' philosophy consists of four areas of emphasis: minimising the ecological footprint, ensuring a healthy indoor environment particularly indoor air quality, reducing energy consumption, and producing houses with increased longevity (see Yamaguchi and Cohen, 2000, for a fuller discussion). Underlying both the overall philosophy concerning society, economy, the environment and culture and the four environmental cornerstones is a deep commitment to bioregionalism. To better understand the strong commitment to bioregionalism it is necessary to have a basic understanding of Japan and its relationship to Hokkaido.

Hokkaido – background

Japan is a nation of four major islands stretching in an arc of 3000 kilometres from 30° to approximately 46° latitude. The islands, from the south, are Kyushu, Shikoku, Honshu and Hokkaido. These islands are distributed across 16° of latitude, creating a biological and climatic diversity equivalent to the changes from New Orleans to Montreal or from Marrakech to Paris. The northern island of Hokkaido has a sub-arctic climate and experiences six winter months complete with high snow levels and temperatures below freezing point. At the opposite end of Japan, the southern island of Kyushu has a sub-tropical climate and experiences high heat, monsoons and very high humidity (adapted from Anonymous, 1992; 1995a,b; 1998).

Population, climate and area

Hokkaido has an area of 83 500 km^2 (including 5000 km^2 of the disputed Northern Territories), and so is equivalent to the area of Austria. Despite representing half the total land area of Japan, Hokkaido has only 4.6% of the population or 5.65 million people (1999 data).[2] Almost a third of the inhabitants (31%) live in Sapporo, the largest city and the capital of Hokkaido. Another 21% live in the next largest five cities with populations less than 400 000 (Askikawa 360 000; Hokodate 310 000; Kushiro 210 000; Obihiro 170 000; and Otaru 160 000). The low population density

Table 18.1 Land use in Hokkaido (1998)

	km^2	% of total
forests	55 553	70.8%
agriculture	12 263	15.6%
open water	2 663	3.4%
fields	1 843	2.4%
roads	1 669	2.2%
residential	1 090	1.4%
other	3 305	4.2%
total	78 386	

Source: *White Book of Land Use* (1998) Hokkaido Government

(72 per km^2) makes Hokkaido the least crowded region of Japan. Residential land use accounts for only 1.4% of the total (Table 18.1).

Hokkaido is located in the transition zone between the temperate and sub-arctic zones, resulting in it being the only region of Japan to avoid the influence of the hot humid season (*tsuyu*) and have four distinct seasons. Average temperatures range from a low in January of –5°C to a high in August of 27°C. However, temperatures are more severe (2–4°) inland and in the north. On average the first snowfall occurs in October and the last in April, resulting in five to six months of winter.[3] The weather in Hokkaido is similar to that in Stockholm, Copenhagen, Berlin, Toronto and Chicago.

Despite its vast size relative to its population and the relatively harsh climate compared to the rest of Japan, Hokkaido has a very efficient transportation system. Its rail system reaches almost all parts of Hokkaido. Sapporo, the capital, has a modern and efficient subway system and myriad underground shopping malls connecting most of the downtown area.

The natural environment

Hokkaido, the largest of all of Japan's prefectures, is rich in a diverse natural environment consisting of mountains, coastline and plains. The

[2] *Japan Statistical Yearbook* (2001) (CD ROM version) Table 2–3: Population by prefecture. Data from Statistics Bureau, Management and Coordination Agency, Tokyo.

[3] *Japan Statistical Yearbook* (2001) (CD ROM version) Table 1–12: Temperature, relative humidity, duration of sunshine, precipitation, frost and snow (normal values) (av. 1961–90) Observations Department, Meteorological Agency, Tokyo.

flora is a mix of temperate deciduous trees (e.g. oaks, lindens and maples) and sub-arctic evergreens such as the firs. Low population levels and the fact that Hokkaido was only colonised and heavily populated in the late nineteenth century have left an island rich in flora and fauna. The red-crested white cranes, white owls, and sea eagles are officially designated as precious natural products. To quote from *Japan, Profile of a Nation* (Anonymous, 1995a, p. 12): 'Hokkaido is noted for its dramatic and unspoiled scenery, which includes active volcanoes, large lakes and vast virgin forests.' Table 18.1 illustrates the rural nature of the landscape.

The abundance of a relatively untouched natural environment, well developed ski hills, over 200 hot springs and a well developed system of camping grounds makes Hokkaido an important vacation destination for many Japanese from all of the islands. The population of Hokkaido are very proud of their natural heritage, and it is a focal point for much of their promotion and advertising activities.

Industry and economy

The GDP of Hokkaido is almost 14 trillion yen (approximately US$ 100bn), equivalent to that of Denmark or Finland. Hokkaido plays a central role in domestically produced agricultural products. Rice, vegetables and dairy products as well as salmon and scallops are shipped all over Japan. The processing of agricultural products is the backbone of the manufacturing industry in Hokkaido, which represents only 12% of the economy compared to a national average of almost 29%. The fishing industry, while only a shadow of former times, still provides 20% of the national total. Tourism is the main driver for the growing service, wholesale and retail sectors with a growth in resorts based on the natural environment. Winter ski resorts, abundant summer camping and year round hot springs contribute to making tourism, for Japanese residents from all four islands, a growing and vital part of the island's economy. Table 18.2 shows gross domestic product summarised by activity and compared to the national average. It is clear that Hokkaido, which accounts for 4% of Japan's GDP, is more heavily focused on the primary and tertiary industries, as detailed above. This lack of manufacturing contributes to the maintenance of the rural and natural environment, which provides for agriculture, fishing tourism and services.

Most products that leave Hokkaido are shipped to the other, more populated, islands of Japan. However, the availability of good ocean ports leads

Table 18.2 GDP of Hokkaido and Japan for 1998

	1996	1997	1998			
	total	total	total	primary	secondary	tertiary
Japan GDP (billions of yen)	509 931	506 079	498 017	7118	159 752	351 312
as % of total 1998 GDP				1.4%	32.1%	70.5%
Hokkaido (billions of yen)	20 116	19 882	19 747	738	4 684	14 851
as % of 1998 GDP				3.7%	23.7%	75.2%

Source: *Japan Statistical Yearbook* (2001) Table 1-14b Prefectural accounts major components (1996–99) (data from Department of National Accounts, Economic and Social Research Institute, Cabinet Office, Tokyo)
Note: Primary industries refer to the basic extraction of raw materials such as forestry, fishing and agriculture. Secondary industries refer to manufacturing including the manufacturing of the aforementioned raw materials into finished goods. The tertiary industries refer to the service, retail and wholesale sectors.

to relatively high levels of imports, with a ratio of imports to exports of more than 8:1. The major imports are fuel (oil), wood products and seafood. Hokkaido has abundant forests and could be self-sufficient in wood products, but for a multitude of reasons (e.g. currency exchange rates, lack of manufacturing infrastructure, and intense foreign competition) imports much of its wood products from Europe, North America, Russia and New Zealand. The major exports are machinery (mostly automobile), pulp and paper, and fish products (such as fish oil).

Note: Economic and industrial data in this section from Anonymous (1992; 1995b) and SAS (1992).

The Hokkaido way of life

The people of Hokkaido are still connected to the land, as reflected in their economic ties with agriculture, forestry and tourism based on outdoor activities. Compared to many Japanese, they are less focused on materialism and have a strong sense of nature and the environment. The people celebrate nature with winter and summer festivals. To quote from the Hokkaido Long-Term Comprehensive Plan 1998–2007 (http://www.pref.hokkaido.jp/skikaku/sk-kkaku/gaiyo/p02-03.html):

> 'Values are changing, from material wealth to spiritual wealth and quality of life. There is a growing interest in Hokkaido's attractive nature, unique climate and natural features. Based on the results of past

development in Hokkaido, efforts will be made to utilize Hokkaido's characteristics and fulfil its potential by reviewing local resources based on broad perspectives.'

The entire plan continually emphasises a regional (rather than a national) perspective based on the rich natural environment, with a strong thread of environmental responsibility permeating all aspects of the plan. This clearly establishes fertile ground for a bioregional approach based on a strong environmental ethic.

The bioregional philosophy

The basic philosophy of bioregionalism follows the imperative to use regional inputs (such as raw material and labour) to produce regional outputs (such as housing) that are designed specifically for that region. This philosophy is more than just sourcing local materials but incorporates design, production and use (Malin, 1996). The philosophy focuses on developing sustainable bioregions by using the resources of the region to produce products that are designed specifically for that region and retaining the financial and social benefits within that region. This should not create barriers to imported concepts, ideas or even products but instead is inspired by innovation and seeks to replace imports with regionally modified and produced products that are more bioregionally suitable and create a smaller ecological footprint. Thus, it is more of a continuous process in a state of fluidity rather than a static set of rules and regulations. KST includes in its bioregional philosophy a uniquely Japanese model of sustainability or living in harmony with nature. Two factors, increasing use of locally available renewable materials and an emphasis on durability and longevity, both promote sustainability. Implementing these philosophies requires a long-term perspective and redefining 'shareholder value' to incorporate societal values while maintaining profitability to ensure market sustainability.

The KST commitment to bioregionalism was developed in reaction to the importation of housing styles, materials, and organisational structures from the main island of Japan or Western societies. The intense colonisation of Hokkaido by Japanese from the main island during the nineteenth century resulted in a wholesale importation of culture, goods and services. At the same time there was an importation of nineteenth century American architecture as the city of Sapporo was designed and built. Since the Second World War, Western influences are also prominent in

Hokkaido, particularly in housing. The fundamental focus in the design and construction of typical Japanese house styles was to create a comfortable living environment for the hot and humid summer season (Onobayashi, 1965). These styles were imported from Honshu and are much better suited to living conditions free from snow. They are not at all suitable for the harsh winter climate of Hokkaido with its six months of winter (Yamaguchi, 1994). In addition, the house design from the south was designed and built to be almost a temporary structure due to frequent destruction by fire as a result of frequent earthquakes (Morse, 1961). However, Hokkaido, while subject to earthquakes, does not suffer the destructive fires that led to houses built with short longevity. Even today in Japan the average house lasts only 20–30 years, due partly to the traditional impermanence of housing in earthquake zones and the explosion of poorly constructed houses to meet the extreme shortage following the Second World War (Anonymous, 1998).

The bioregional philosophy is a logical next step for a region colonised and settled by powerful neighbours to the south. As with most colonisation, control – both cultural and practical – was external. The logical next step is to develop processes, structures and systems that are more reflective of the biogeoclimactic and cultural realities of Hokkaido.[4] The bioregional philosophy of KST seeks practical regional solutions (both large and small) and permeates all of the philosophical underpinnings of their total system: social, economic, environmental and cultural. One key component of this philosophy is to marry modern manufacturing technologies with building wisdom from the past. However, it is the adoption of some of the traditional underpinnings of traditional Japanese temple construction that forms part of the firm philosophical foundation of the bioregional philosophy of KST.

Traditionally a Japanese carpenter was a mix of architect, engineer and builder. At the apex of the hierarchy of carpenters were the Japanese master temple carpenter, *miya-daiku*, and the highest level of carpenter craftsmen who are always in charge of the construction or repair of temples. They emphasised structures that used only natural materials from local sources due to their potential longevity. For example, wood grown in the same region was better able to last for centuries since it had

[4] Biogeoclimatic classification is a system developed in British Columbia that classifies forest land based on biological, climatic and geological characteristics in order to ensure management regimes that fit within a region's physical parameters. The author applies this term in a broader sense (than just for forest management) to address the development of the physical infrastructure for a region, including housing.

grown in the same climate and under the same natural forces as the building would have to withstand during its life. This use of local natural materials resulted in many existing Japanese temples that are over 1000 years old (e.g. the Horyuji temple complex built in the seventh century). Temple carpenters felt they had a moral obligation to both nature and society that must be paid in each building by ensuring the highest level of craft and durability to fulfil the debt created by exploiting the earth's resources for natural materials. This same sense of obligation has been a driving force behind the philosophical underpinnings of KST and its bioregional philosophy.[5]

The philosophy of bioregionalism that drives KST was developed by Akira Yamaguchi over a long period of time and only became fully developed in the 1990s. As an individual he was less influenced by commonly accepted knowledge but looked to the past, both personal and that of Hokkaido, and to external influences in developing his philosophy. The philosophy incorporates traditional wisdom from both geomancy and temple construction techniques with modern technology to fully design and build houses most suitable for Hokkaido from Hokkaido materials. KST has led efforts in Hokkaido for the region to become more self-sufficient and less tied to the central government of Japan. While KST does not differentiate between the philosophy and the house, many of the people who buy and live in the houses do not link these two. This will be discussed further in the section on Diffusion in society (p. 325).

Demographics and changing family structure

After the Second World War Japan intentionally passed laws to promote the development of the nuclear family and the decline of the extended family. While extended families did not break apart, most new family structures from the 1950s onward were based on the Western concept of the nuclear family.[6] After several generations, the nuclear family is now the norm throughout Japan. House design and construction followed these changes in family structure, with a shift from more traditional open house design with (re)movable furniture and multi-use rooms to more Western style, single use, private rooms with fixed furniture. However, a new

[5] This section adapted from adapted from Brown (1989) and Takigawa (1996–2001).

[6] The extended family usually has a paternalistic structure with many generations under one roof including brothers, sisters, cousins etc. Leadership of the family is passed from father to eldest son. A nuclear family usually consists of just a couple and their offspring. When the children marry they create their own nuclear families.

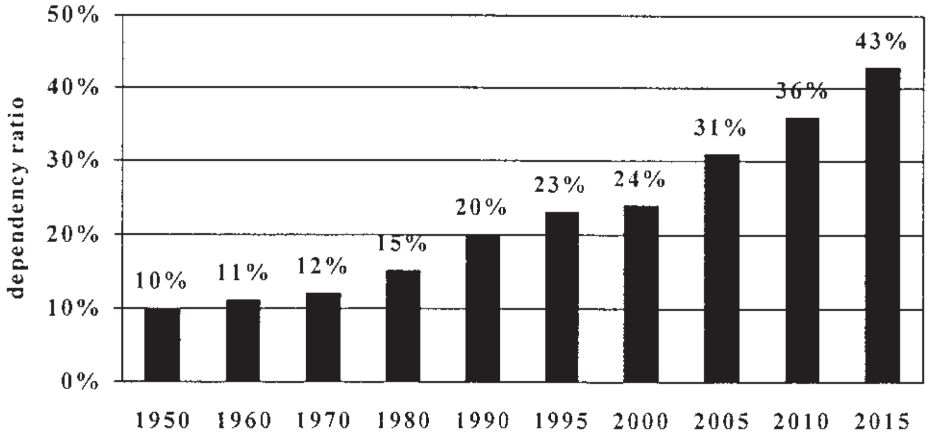

Fig. 18.2 Seniors dependency ratio (ratio of population aged 65+ to population aged 20–64) (Source: Analysis of UN Population Database)

family structure may be emerging (*The Economist*, 2002). In Japan the realities of demographics include both a rapidly ageing senior population and a stable or shrinking population of workers (illustrated in the senior dependency ratios shown in Fig. 18.2). This is accompanied by a high government debt prohibiting increased social spending, escalating unemployment among the younger generation and the erosion of the security of life-long employment indicates that something as fundamental as family structure may be undergoing a dramatic change.

There seems to be a new family structure emerging that tries to combine economic and social advantages of the extended family, along with the traditions inherent in that structure, with some of the advantages of the more modern nuclear family. The expanded family combines elements of both the extended family and nuclear family in the family structure continuum and is shown in Fig. 18.3. Thus, there are three or more generations in one house, similar to the extended family. These types of houses are often referred to as multi-generational homes. However, this structure is not common in Western culture, and the construction and use of 'in-law' suites is the most appropriate North American comparison. But there are numerous differences between the use of 'in-law' suites and the new expanded family in Japan. Surveys completed in spring 1998 among 225 Japanese consumers of the demographic profile (age and marital status) suitable for acquiring a new home provided surprising results. Over 43% of the respondents expected that both their children and one of their parents would live in their new house as an expanded family.

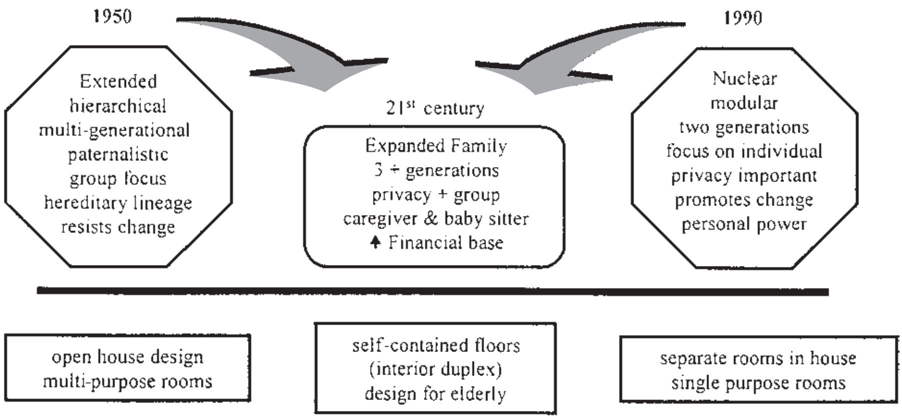

Fig. 18.3 Family structure continuum in Japan

In response to these new realities in Japan the KST house is designed and built to accommodate an expanded family incorporating both Western and traditional Japanese design elements to satisfy both the older and younger generations. The house is larger than the average house in Hokkaido ($200\,m^2$ compared to the average of $120\,m^2$) to accommodate a multigenerational family in a single dwelling more early. The KST house has separate facilities for the two adult generations for cooking (kitchens) and hygiene (bathrooms). In Western terms, the house could be considered a duplex without separate exterior entrances.

The business environment

KST is a privately held company founded and guided by Akira Yamaguchi since its inception. It is a fully vertically integrated company producing almost all its own structural and architectural materials, a philosophy that is evident in all facets of operations. Visionary leadership has directed all decisions regardless of short-term returns. Another way to describe this phenomenon is that the values of the shareholder are paramount but the single shareholder has both practical and metaphysical values. This private company has been able to take more risks by introducing innovations based on a long-term perspective and a deep commitment to regional, social and environmental ethics. This has enabled KST to lead Hokkaido house builders in developing and building more regionally appropriate housing.

The structure of house builders in Hokkaido is diverse. Like the rest of Japan, the industry is dominated by small builders (<20 housing starts per year) but with ample representation of the eight largest house builders (>10000 starts per year in Japan). The preponderance of small builders results in KST being one of the largest 50 homebuilders in Japan (based on number of starts) and one of the 20 largest in Hokkaido. KST is responsible for approximately 1% of all housing starts in Hokkaido or slightly more than 2% of both wood and detached single-family starts. In 1998 KST houses made up 1.6% of the entire Hokkaido housing stock of detached houses of two storeys or higher.

One of the reasons why small builders dominate the industry is that in Japan (and Hokkaido) houses last an average of only 26 years. This contributes to the following realities:

- the land has value but the house is considered as a disposable consumer good to be replaced on a regular basis
- the resale of homes is rare
- there is little maintenance and remodelling of existing homes
- over 75% of new detached single family house construction is based on replacing an existing home with a more modern house.

Until very recently house prices in Japan ranged between 400000 and 800000 yen per tsubo.[7] The houses built by KST were in the mid price range averaging 500000 yen per tsubo. Recently there has been a tremendous growth in 'super low cost' housing ranging from 210000 to 320000 yen per tsubo. This is a direct result of increased competition due to a dramatic decline in housing starts and the impact of the fourth economic recession in 12 years. In Japan housing starts have declined from over 1.6 million (with 801000 detached starts) in 1996 to only 1.2 million (599000 detached) in 2000 and further declines in 2001. KST has recently introduced a smaller version of their house, which was introduced at 300000 yen per tsubo. Note that in Japan the basement area is included in the calculation of the house area while in North America it is not, thereby complicating direct price comparisons.

[7] The tsubo is a measure based on a tatami mat and is equal to 3.3 m^2 or approximately 10 ft^2. Therefore 300000 yen/tsubo is equivalent to 91000 yen/m^2 ($US 700/$m^2$ or $70/$ft^2$) while 500000 yen/tsubo is equivalent to 152000 yen/m^2 ($US1170/$m^2$ or $117/$ft^2$).

The application of bioregional philosophy in KST houses

Design

One of the pillars of the KST philosophy of bioregionalism is to design and construct housing suitable to the climate of Hokkaido, a sub-polar region, where energy efficiency must be addressed without creating the poor air quality too often associated with air tight, energy efficient housing. This dramatic shift in the fundamental design focus based on bioregional needs freed the company from imported design constraints. It allowed the firm to include many unique features in its design including the following.

A three-storey wood house of rectangular shape with a full concrete basement
A view of the KST house is shown in Fig. 18.4. The concrete box offers protection from moisture problems created by the deep snows that often cover the ground floor due to small lot sizes. The two-storey wooden section of the house proper, consisting of prefabricated panels that fit within a precut post-and-beam structure, sits on top of the concrete box and provides the additional space required for changing privacy requirements in the family home. The rectangular box shape is one the most efficient shapes for energy use since it minimises the area of exterior walls relative to internal living space. In addition the rectangular shape aids in

Fig. 18.4 KST house – general view

minimising energy use for heating the house by providing a shape that can be heated using a radiant heating system (described in more detail below). In addition this shape allows the maximum area of a house on the typically small lot sizes in Hokkaido, which facilitates building for multi-generational homes. As long as the foundation is truly square then this shape facilitates the use of factory built panels by simplifying the shape and size of wall sections. The box shape, with proper support provided by the concrete box, provides exceptional performance characteristics in earthquakes. This shape also facilitates an almost flat roof system to provide storage for snow.

An inverted roof system which holds the snow throughout the winter season

This unique cold snowslide-free roof (Fig. 18.5) is covered with inverted metal that slopes downward to a large interior duct or drain. The roof is referred to as 'cold' since the design and construction of the roof prohibit heat from the house from transferring to the roof and melting the snow. Its design allows for the containment and slow melting of the snow. This prevents damage to persons and property due to snow sliding off roofs in the urban areas of Hokkaido. In addition this prevents the build-up of snow that has slid off the roof from packing up against the exterior walls due to small lot sizes and the use of snow fences to keep snow within lot boundaries. This aids in extending the durability and longevity of the house given the regional climate and building environment.

Fig. 18.5 KST house showing inverted roof

A unique radiant heating system
This uses a centrally located modified kerosene petchka (Russian-type) heater. The system minimises fuel consumption while providing heat to the entire house regardless of the availability of power.

A five panel window system
This allows slow air passage (exchange) without fogging or icing, and creates no draughts. The system combines two twin sealed units and a single pane to ensure sufficient air transfer for good indoor air quality without unacceptable heat loss (energy data from Nishioka *et al.*, 2000).

Some of the other design features based on the 'total system' include breathable walls, and an open floor plan to facilitate the heat circulation. Existing research is examining precipitation capture and water purification through reverse osmosis.

The KST house was designed specifically for being built on small lots located in Hokkaido with its harsh winters. While many of the concepts underlying its design are universal (such as the rectangular shape and a flat roof to hold the snow) its application is unique to Hokkaido. For example, in Hokkaido most building lots are small and there is no place on the lot to store snow removed from the roof. This requires either a roof supported with enough strength to hold the several metres of accumulated snow each year or intricate snow fences to prevent snow from damaging neighbours' property. However, in other northern regions, such as Canada, the lot sizes are much larger and provide sufficient space to store the snow, and a peaked roof often is the more suitable solution to the heavy snow loads.

Since Hokkaido has 20% of Japan's land mass but only 5% of its population the KST house designed for this region is a large (averaging 200 m^2) detached, single family, dwelling. In addition, in Japan over 80% of detached house construction is to replace existing older homes. Since each generation of house is larger than the one being replaced, the lot size, relative to the building it supports, continually decreases, creating increasingly complex construction challenges.

Energy and environment

KST is committed to identifying and integrating strategies to reduce energy consumption in the life-cycle of their homes. To quantify the energy and environmental performance, KST has undertaken research on life-cycle inventory analysis, in which the material inputs, production energy and the household use-phase energy consumption of the house are calculated (Nishioka *et al.*, 2000).

Production energy intensities of the KST house have been evaluated based on the material inputs and compared with the conventional counterparts that would use the same construction methods of KST but with fewer material inputs, in accordance with the specifications of a typical conventional home in Hokkaido today. The study shows that the KST house uses more materials per m^2, especially for lumber, concrete and steel, than the conventional house. The estimated production energy of the KST house, most of which comes from the embodied energy of the materials, is approximately 3.9 GJ per m^2 and is higher than that of the conventional house by 59%.

Based on a survey of 12 KST and 13 conventional houses, the annual household energy consumption has been evaluated for kerosene heating and electricity. Although the KST house housed 21% more residents on average, the energy consumption per m^2 is 17% lower than that of the conventional house, in particular because of the lower kerosene consumption for space heating. Compared to an average house in Hokkaido the kerosene heating consumption of the KST house was lower by 37% as shown in Fig. 18.6 (Hokkaido Electric Power Research Corporation, 1993).

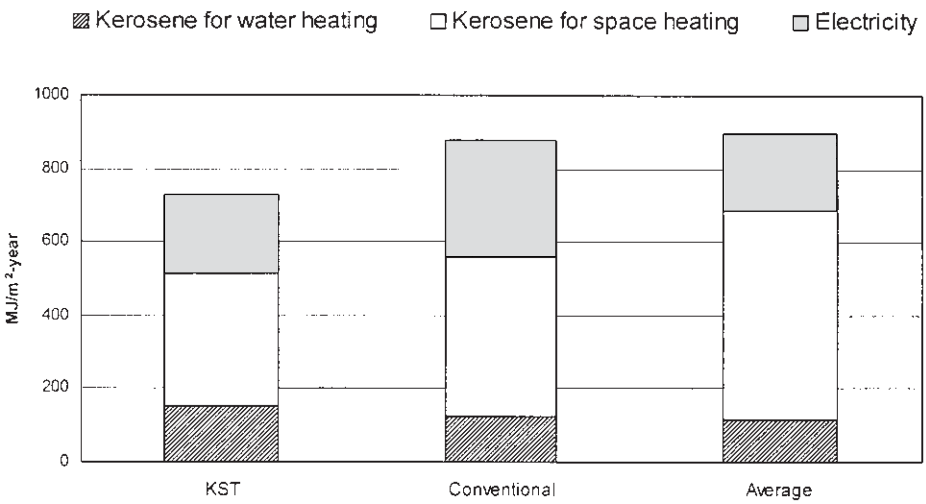

Fig. 18.6 Household annual energy consumption in Hokkaido

Table 18.3 Process, household and cumulative energy of homes in Hokkaido (MJ/m^2/year)

	KST	Conventional	Average
Process energy	3 899	2 449	2 449†
Household energy	725	874	851
Total cumulative energy after 50 years	40 146	46 170	45 018

Source: Hokkaido Electric Power Research Corporation (HEPRC). *Investigation of Residential Energy Consumption in Hokkaido* (1990)
† The process energy of the average house is assumed to be the same as the conventional house

The process and household energy for the KST, conventional and average house are presented in Table 18.3. Based on published figures from the Hokkaido Electric Power Research Corporation (HEPRC), the cumulative household energy consumption of a KST house surpasses the production energy in 5.4 years, while that of a conventional house surpasses its production energy in 2.8 years. The study validates the general trends that increased material inputs that improve the energy efficiency of the final product will be recuperated within a short period of time and will significantly reduce the environmental energy burden of the home over its lifetime.

The study concludes that the increased material inputs can contribute to significant energy conservation during the usage phase. If fewer building materials are used, the process energy of the KST house could easily be reduced. However, the sustainability of such homes may also be reduced, resulting in less energy efficient homes and homes which are not as resistant to the severe climate and natural catastrophes.

Resources and production

In Hokkaido, construction was traditionally restricted to the summer months and provided little full time employment for the residents of this northern region. Construction took place on the building site but the snow and cold prohibited construction from proceeding for half the year. Many of the carpenters would travel north from Honshu and work in construction in Hokkaido during the summer, returning to Honshu during the winter. To apply a regional solution that would ensure full year round employment for residents of Hokkaido and facilitate the use of regional materials and labour KST developed a series of innovative processes. They were one of the first companies to move much of the production of the building components into a factory environment.

Producing high quality building components in the factory instead of fabricating them on site had several impacts. It allowed full time, year round employment for the factory workers which contributed to the social wellbeing of the region. It also allowed a more consistent and rigorous level of quality control. This shift towards factory production was combined with an innovative application of technology to enable year round construction on the building site. KST developed a modified tent that covered the building site during construction in winter. This covering allowed the crews to work throughout the six-month long winter using factory built materials that were assembled on site. However, the most important aspect of this year round operation and complete integration was that it enabled KST to control all aspects of production from procuring materials to processing and assembling these materials into homes. The KST house is a hybrid of structural pre-cuts, panellised walls, and on-site construction. All the interiors, exterior cladding, and roofing are installed on site.

Some aspects of bioregionalism in resources and production spread quickly to other builders in Hokkaido. However, this transfer was often incomplete. For example, many Hokkaido builders switched to using factory-built components for major structural supports (posts and beams) but still built walls on site rather than in a factory. Other innovatory aspects that have been adopted by other builders include the rectangular shape, the flat roof system, sealed window units, emphasis on energy efficiency, use of natural materials and finishes to improve indoor air quality and more. However, no other builders have adopted the 'total system'; they have only imitated some of the most visible parts of it. In addition no other builders are yet committed to bioregionalism in material supply.

The full integration of production and the sole proprietorship of KST empower the company to apply its 'total system' and bioregional philosophy to all aspects of its business. This level of control enabled KST to develop innovative technologies and complete the three important phases in technology development: invention, innovation and diffusion (Grübler, 1998, p. 23). This control of all aspects of production enabled KST to fast track the technology it developed and to operationalise its philosophy in practical housing suited to the Hokkaido region. For example, during the 1990s KST would purchase low quality logs from thinning operations in Hokkaido forests (reflecting its commitment to using regional materials). These logs were run through their sawmill to produce small pieces of lumber and then the small pieces were laminated together using technology developed in-house (reflecting their environmental commitment). By using this laminated lumber for both structural purposes (as beams) and for architectural use (stair rails and mouldings) most waste was eliminated. The cost savings generated by minimising transport time by using local 'waste' wood compensated for the increased cost of manufacturing. Because KST not only produces the building material but also builds the houses (a fully integrated operation), the laminated material had an immediate market. The complete vertical integration and the scale of operations with the construction of 450–700 houses per year enabled a very rapid transition from invention to innovation to diffusion. One result is that other construction firms in Hokkaido have adopted some of the innovative building concepts developed by KST as discussed above. However, as many of the materials are either custom made by KST or designed by KST and produced off site with an exclusive contract (e.g. the siding) other builders cannot easily adopt all physical aspects of KST's total system.

Diffusion in society

Developing and implementing operations based on strong environmental and bioregional philosophies must be more than an academic exercise and must diffuse throughout society to have both local and global impact. As Grübler (1998, p. 98) states: 'Technology assumes significance only through its application (innovation) and subsequent widespread replication (diffusion).' There have been many successes in the diffusion of some of the 'radical' building design and construction developed by KST. The success of changing the standard, heavy pitched roof imported from the rainy regions of the south to a flat or inverted roof system that holds the snow through winter can be measured in two ways. The first is that there have been over 16000 KST dwellings built to date, all with the unique inverted roof structure. Second, as one travels through Sapporo and other regions of Hokkaido, a majority of detached single-family houses built since the early 1990s have utilised the innovation that works with the climate of the region. Almost all builders now construct houses year round often imitating, at least at a superficial level, the methods developed by KST. However, the diffusion of many of the innovative building technologies developed due to the philosophical commitment to bioregionalism have had, and continue to have, cultural and sociological impediments to their technological diffusion and the adoption of performance improvements in housing.[8]

[8] The term 'technology' in this chapter uses the concept of technology developed by Capon and Glazer (1987) that considers process, product and management innovation as the foundation of technological innovation. It is a broad definition of technology and includes both radical and incremental changes (often referred to as continuous and discontinuous). This incorporates the more common science and engineering concepts of technology within a social and business context.

For example, in Japan, the social and cultural expectations are for limited longevity in houses and the consumer focus is on comfort and amenities. Research has indicated that many houses are replaced solely for design considerations despite structural integrity (Gaston *et al.*, 2000). This treatment of houses as almost disposable goods to be replaced rather than maintained results in overuse of materials, a poor living environment due to minimal maintenance, and insufficient emphasis on func-tion. Despite government initiatives, the education of the populace to appreciate and value houses with longevity greater than the duration of the mortgage term is a slow process and impedes an accurate valuation of longevity in housing. This cultural expectation hinders the creation of a housing stock with an intended duration of centuries rather than decades.

In addition to cultural impediments to the diffusion of these sustainable technologies, increasing globalisation, in Japan, particularly of building systems and materials, often retards the acceptance of regionally suitable solutions. In the last third of the twentieth century, new building systems (such as the North American two by four or platform frame system and increased use of reinforced concrete for high-rises) gained rapid acceptance in Japan. The building systems for cold weather imported from abroad emphasise airtight houses, central heating, mechanical air transfer, improved insulation and the increase in use of plastics and vinyl. The adoption of these techniques developed elsewhere but promoted globally is creating a host of new problems, particularly in Japan, and impedes the diffusion of more regionally sensitive solutions. For example, in Japan few houses are built with central heating due to the high cost of imported fuel. Since the oil shocks of the 1970s, Japan, which imports all its oil and derives the remainder of its energy from unpopular nuclear facilities, has resisted adopting central heating. Most rooms have individual heaters that are used only when the occupant is present in the room. In an airtight house this creates very serious mould and mildew problems that lead to poor indoor air quality often referred to as 'sick house syndrome'. The universal trend to value external solutions over internally generated ones is difficult to overcome. The previous discussion addresses diffusion of specific details of the physical manifestation of overall philosophy and not the diffusion of the philosophy itself. In many fields, such as academic research and scientific discovery, only external validation will confirm the reputation of an individual. Thus, it is rarely the idea or concept that garners respect but the recognition of that idea by recognised elites in a global context that will do so.

The bioregional component of the 'total system' philosophy applied at KST is appropriate in many inhabited regions throughout the world.

However, KST is not seeking to transfer the practical and physical rendition of a bioregional house developed for Hokkaido but to transfer the philosophy and encourage the development of bioregional houses developed for other regions. In fact Mr Yamaguchi resists attempts to 'export' the KST house to other regions of Japan, the US and Canada. At the same time, KST is actively engaged in 'exporting' the supporting philosophy of not only bioregionalism but all aspects of the total system. However, the physical manifestation of that philosophy in terms of design, construction and after sales service would differ in other areas due to the variety of bioregional needs caused by both biophysical and cultural differences. Thus KST does not wish to build houses outside of Hokkaido, even in other parts of Japan, but encourages others to apply the bioregional philosophy (as well as the total system) in their own region using design, materials and building most suitable to each region. However, diffusing a philosophy, such as bioregionalism or environmental building, to the end-users can be much more problematical than diffusing its physical manifestations.

Often the public only appreciates the manifestation of implementing the philosophy, i.e. the house itself, but arguably the philosophy driving the design and construction of the house is unimportant to the purchaser. Personal interviews with house buyers confirm that it is house performance, quality, longevity and usefulness of design etc. that resulted in a purchase decision and rarely its philosophical underpinnings. This reality has broad implications for environmental building. The public, while supportive of the philosophy of green building, makes purchasing decisions based on more practical and less esoteric criteria. Currently in North America many green builders are changing the way they promote their buildings. They are de-emphasising the ecological and environmental advantages and emphasising the practical benefits to the users. Examples of user benefits include lower construction costs, reduced annual heating costs, a more comfortable living environment and improved lighting. The promotion of the KST house also relies on addressing the benefits to the user and not just promoting the philosophy.

This reality brings into question both the depth and breadth of support for both bioregionalism and improved environmental buildings. There is a dynamic tension between the strong but metaphysical beliefs that develop, drive and support the philosophical foundation of both bioregionalism and environmental buildings and the more practical requirements of the house buying public. While this tension can impede the diffusion of the philosophy, it does provide impetus to ensure that it is actualised in a manner that is valued by the public. This duality of purpose impedes the global transfer of both the concepts and their physical manifestations. Several questions emerge due to this duality. Will the philosophical integrity be undermined by the need to appeal to more practical benefits in order for successful diffusion across society? Will the balance between theory and practice enhance or dilute the efficacy of both?

In order to promote the bioregional philosophy KST has supported several partnerships with Canadian, US and Japanese academic and research institutions to generate scientific support for its regional solutions. It is interesting that to have many of the bioregionally based technological innovations diffused more rapidly, external, non-Japanese expertise is needed. This expertise can 'culturally' translate many of the ideas, clarify the separation between philosophy and its operationalisation that will differ from region to region, and apply Western scientific techniques (such as life cycle analysis) to evaluate the performance of the practical application of the philosophy in the KST house. It is a constant struggle to have the solutions developed bioregionally for housing in Hokkaido based on traditional wisdom to be considered on an equal footing with the onslaught of European and North American building technologies being promoted as global solutions.

External scientific partnerships serve three key functions. First, they provide technological and practical input into how the philosophy can be better implemented in a practical sense in the KST house. External concepts, techniques, technologies, etc. can be adapted to be regionally incorporated into the physical embodiment of the bioregional philosophy. Second, they validate a 'home-grown' solution both internationally and regionally and assist with the cross-cultural transfer of environmental building ideas. The third key function is to develop both intercultural and interdisciplinary approaches to examine environmental building knowledge. Scientific and social considerations are explored with Western and Eastern approaches at both a theoretical and empirical level. This book is but one example of this melding of multiple approaches.

Summary and conclusion

What is most important to society is not the invention of new 'green building technologies' nor their innovation and when they are first made available in the market but the diffusion of these new green technologies through society. KST represents an example of how a strong ethical and philosophical commitment combined with long-term perseverance can lead to successful diffusion. However, this diffusion is restricted by both parochial reluctance to accept change and the promotion of 'global solutions' regardless of regional efficacy. KST represents a successful model of regional development and diffusion of green building technologies.

The environmental portion of the 'total system' philosophy consists of four areas of emphasis: minimising the ecological footprint; ensuring a healthy indoor environment, particularly indoor air quality; reducing energy consumption; and producing houses with increased longevity. Underlying both the overall philosophy concerning society, economy, the environment and culture and the four environmental cornerstones is a deep commitment to bioregionalism. This commitment precludes the transfer of the physical manifestation of philosophy that is suitable to Hokkaido since this would change when applied in a different region. This leads to the possibility of the transferability of concepts, philosophies and principles that are then operationalised in a different physical manner based on bioregional needs.

However, it is far easier to transfer tangible physical goods across cultures than concepts, philosophies and principles. Often the focus from the audience or reader is 'how can we import one of these bioregional houses?'. This illustrates the disconnection between understanding the philosophy and appreciating its physical manifestation. However, through collaboration and exchange (entailing joint research initiatives, conferences, publications and lectures) it is possible to transfer the actual concepts between cultures and regions more successfully.

The major challenge is to develop global solutions on a conceptual basis that can then be manifested in different ways based on regional culture and realities. This assumes that principles and concepts can be generic and be truly global while their implementation in the physical world must be interpreted through a cultural and regional lens. This approach requires additional study but may provide a solution to what is often considered a conflict between globalisation and its benefits and problems and localisation with its cultural and place sensitivity.

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19

Cultural Aspects of Environmental Housing in Japan

Kazuo Iwamura

Introduction

Since the early 1950s, Japan has enjoyed considerable change and development, especially for the 'baby-boomer' generation born in the immediate period following the Second World War. One of the most impressive cultural transitions of the built environment has been in housing. Post-war housing policies have been one of the major forces for improving social welfare and economic growth in Japan. Although Japan has a historical tradition of creating a sensitive and environmentally responsive housing culture using wood, earth and paper, such values have diminished in post-war Japan. To the Japanese, images of occidental houses seemed much more 'culturally advanced' provoking a growing recognition of a materialisation gap between the 'winner' and 'loser' and an attendant collective sense of shame. Catching up with Western levels of material wealth, therefore, became the clearest and simplest goal as political and social propaganda. These efforts were mainly concentrated on textiles, electrical appliances, automobiles and other mass-production industries, or on the construction of infrastructures. By contrast, housing lagged behind these developments except for the supply of mass housing by the public sector. This was in response to the critical demand of post-war homeless people in urban areas.

Since the early 1990s, the Japanese building industry has maintained an average construction level of approximately 1.4 million dwelling units per year (Fig. 19.1). These homes have an average lifespan of 30 years (Fig. 19.2), quite a short period of usefulness compared to their European or American counterparts. However, this is not particularly surprising for

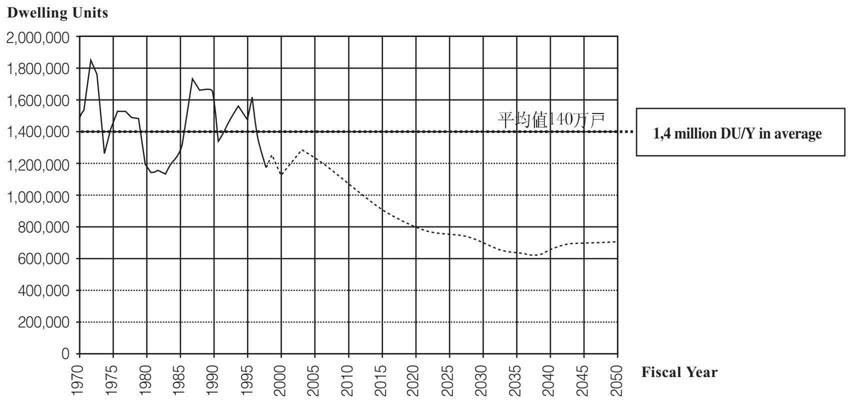

Fig. 19.1 Annual new construction of dwelling units in Japan (Mitsubishi Research Institute)

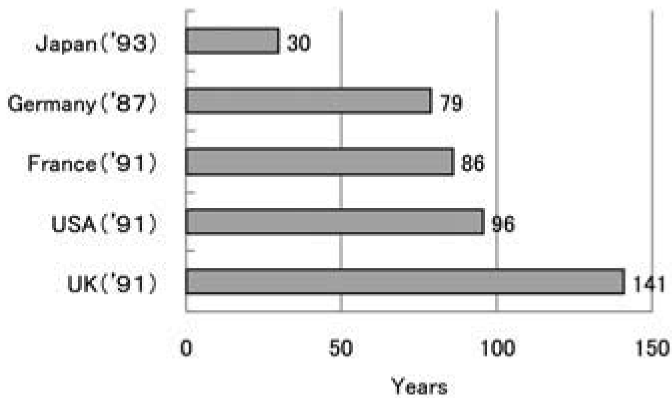

Fig. 19.2 International comparison of the average house life spans (Management & Coordination Agency, 1993)

the Japanese, because the lifespan of urban timber houses has historically always been very short due to frequent fires or to natural disasters (e.g. typhoons and earthquakes). Sugiura (1998), for example, notes that according to accounting reports of carpenters, the average expected lifespan of timber townhouses in Edo Era (former Tokyo during 1600–1868) was as short as three years. However, builders historically had a very quick and prefabricated rebuilding system through a forestry–timber manufacturing and supply industry within a cyclical eco-system (Ishikawa, 1997). Such practice was typically only possible because all the materials used in housing were natural and produced and supplied by the local industry in the adjacent regions. Although this wooden house tradition is one possible reason for the short life-span of Japanese housing, other post-war social and administrative systems have also been major incentives to demolish houses prematurely (e.g., housing loan, pricing and tax systems on real estate as well as the extremely high inheritance tax). The collective result is the current relatively high proportion of new construction (55%) to renewal (45%) in terms of floor area built per year in 1990 (see Fig. 19.5 on p. 336). In sum, the Japanese building industry's enormous output is largely dependent upon what has been called the 'scrap and build' attitude.

This chapter examines the re-emergence of environmentally sensitive housing practices in Japan, and provides a case study example – the Fukasawa Symbiotic Housing Complex – that illustrates some of the key cultural issues associated in its development and use.

Environmentally symbiotic housing

While the rapid rate of housing production has been an indispensable driver of the post-war Japanese economy, it has also been a source of considerable environmental problems. It contributes to the consumption of large amounts of energy and natural resources, more than 90% of which are imported (Fig. 19.3). Moreover, the admixture of contemporary materials employed in contemporary Japanese house construction creates enormous difficulties for effective materials recovery and recycling. These were scarcely recognised as environmental issues by Japanese governments until the beginning of the 1990s when global environmental problems became an internationally political issue.

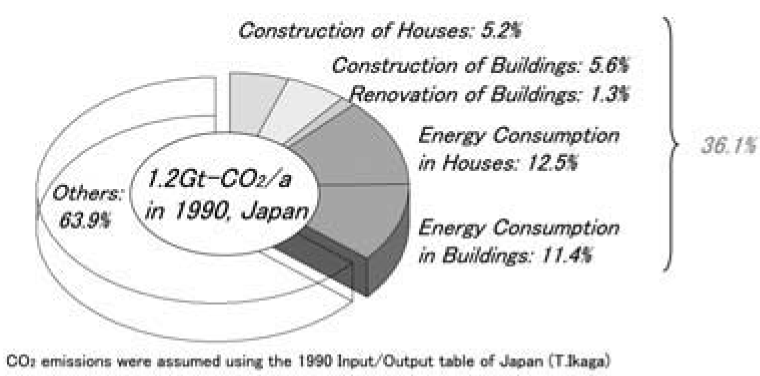

Fig. 19.3 CO_2 emissions by construction and operation of houses and buildings in Japan

While post-war Japanese housing production has developed very rapidly both qualitatively and quantitatively, several issues remain, as follows:

- The size of a dwelling unit (governmental guideline for a household of 4 persons is $72\,m^2$).
- The durability and adaptability in response to the changing requirements of the residents and dictates of the site.
- The appropriateness of housing techniques to the regional climate, culture and user needs.
- The health and comfort conditions both within the dwelling and outdoors.
- The quality of hard and natural landscaping.
- The cost of the strategies and measures related to the above design issues.

Japan has experienced a decade of economic recession, and demographic forecasts show a drastic decrease of population after 2007 (Fig. 19.4). As a consequence, significantly reduced demand is projected for new building construction works in Japan in the long term (Fig. 19.5). Such a situation will invariably create a national demand for high-quality housing that explicitly addresses the performance issues listed above. Within this context, it is the responsibility of all the stakeholders involved in housing production, distribution, construction and use (including clients, owners, developers, users, authorities, designers, industry, contractors, mainte-

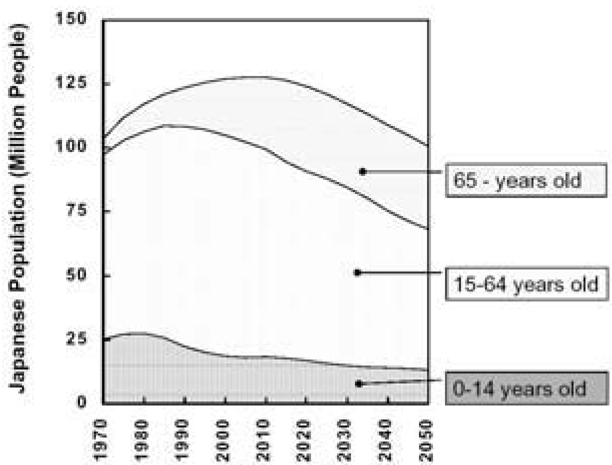

Fig. 19.4 Assumption of Japanese population

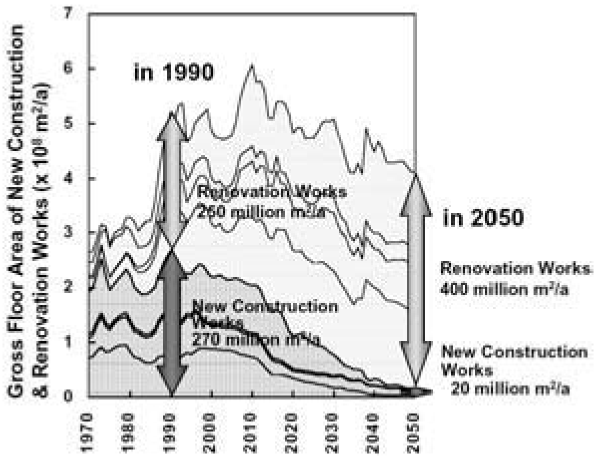

Fig. 19.5 Decrease of new construction works by floor area (T. Ikaga, S. Murakami, University of Tokyo, 1999)

nance organisations and institutions for education and training) to be aware of the environmental problems confronting housing and community development for a sustainable society. The former Japanese Ministry of Construction took the initiative to guide this emerging concern and interest toward the creation of a new national policy, under the banner of *Environmentally Symbiotic Housing* (ESH).

In 1990, a group of professionals and firms from public and private sectors joined forces, first functioning as a research body and later as an organisation for the promotion and realisation of ESH throughout Japan. This R&D group, strongly backed by the Ministry of Construction, included local administrations, a governmental housing loan organisation, a semi-public housing corporation, large general contractors, major industrial housing suppliers, home builders, mechanical equipment suppliers, building materials and components fabricators, housing consultants and design offices, as well as many expert researchers at the principal universities and institutes. Such a unique comprehensive organisation has given a new vision of housing in terms of sustainable built environment. A six-year period of research (Association for ESH, 1997) and study ensued on a wide variety of approaches, technologies and organisational systems that could address problems in housing and community development and, with national subsidy schemes established during this period, the group created over 40 projects around Japan. These projects are primarily executed by public corporations and independent groups, with the completed works playing an important role in furthering the technical, social and economic understanding of ESH as well as creating public and professional awareness. Among them, the Fukasawa Symbiotic Housing Complex, planned and implemented during this early stage, remains the most successful and symbolic project.

The ESH 'movement' was administered by the Association of Environmentally Symbiotic Housing, which combines member groups of diverse business types and conditions, design methods, construction techniques and marketing methods, and now has 12 years of accumulated experience. Whether involved in the planning, design, production, marketing, or maintenance of housing and community, member groups share the common desire to investigate, propose, create, and evaluate ESH and related methods, systems and attitudes. In cooperation with the Ministry of Land, Infrastructure and Transport, as well as with the related Institute of Building Environment and Energy Conservation (IBEC), the labelling and evaluation guideline of ESH was established in March 1999 (Fig. 19.6; Table 19.1). Since then, more than 80 types of houses and housing complexes have been evaluated and labelled.

Definition and objectives of Environmentally Symbiotic Housing

In 1991 the Ministry of Construction determined that Environmentally Symbiotic Housing should be developed from the standpoint of preserving the global environment by conserving energy and resources, while reducing waste at the same time. EHS refers not only to housing itself, but also to the surrounding local environment. Its goal, therefore, is to exist in harmony with both natural and built surroundings, as well as to provide residents with an amenity-rich and healthy life, encouraging them to participate in the construction process, and take responsibility for stewardship of the environment.

The following four themes (1–4: see Table 19.1) correspond to the three basic objectives (A–C: Fig. 19.7) that must be realised to achieve Environmentally Symbiotic Housing:

A. *Global issue:* Protection of the global environment (low impact):
   1. Energy saving
   2. More effective use of natural resources
B. *Local issue:* Harmony with the surrounding environment (high contact):
   3. Compatibility and harmony with the local environment
C. *Residential issue:* A healthy residential environment with amenity (health and amenity):
   4. Health and amenity – be safe and feel safe

The basic ideas behind these objectives are as follows:

Fig. 19.6 Structural image of the Environmentally Symbiotic Housing Evaluation Guideline (Karatsu, 1998). To be labelled as ESH, it shall meet first every compulsory performance requirement, and at the same time shall be provided with higher performances of at least two proposal categories, shown as the columns in Fig. 19.6. The submitted proposals are to be evaluated and judged by the committee of experts, according to the guideline

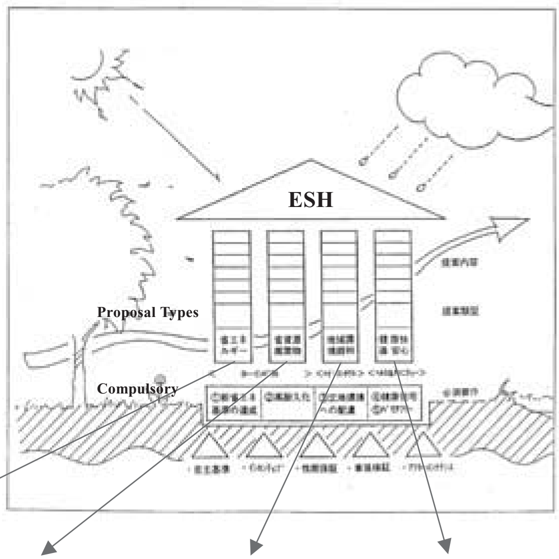

Table 19.1. The Basic Framework of the Environmentally Symbiotic Housing Evaluation Guideline (as of 1999)

Proposal Types	1.Energy Saving	2.More Effective Use of Natural Resources	3.Compatibility and Harmony with the Local Environment	4.Health and Amenity – Be Safe and Feel Safe
Proposal Contents as Examples	1) Greater efficiency in reducing heat losses 2) Greater efficiency in controlling solar radiation capture 3) Passive use of solar energy 4) Active use of solar energy 5) Efficient use of unused energy 6) Use of highly efficient equipment 7) Miscellaneous	1) More durable skeleton 2) Structural and building methods for flexibility 3) Low emission 4) Active use of recycled building materials 5) Highly effective use of water resources 6) Sorting of household wastes 7) Miscellaneous	1) Better harmony with the local ecological system and environment 2) Greater consideration for the natural water system of the area 3) Greening efforts 4) Creating rich buffer spaces between indoor and outdoor 5) Greater consideration of townscape 6) Integration of the local culture and regional industry 7) Miscellaneous	1) Through universal design both indoors and outdoors 2) More suitable and adequate ventilation 3) Through choice of safe and eco-materials 4) High sound insulation efficiency 5) House performance guarantee though ongoing property management 6) Information services on housing 7) Miscellaneous
	Low Impact		**High Contact**	**Health & Amenity**
Compulsory Performances	(1) Conformity to the Energy-Conservation Standard as of 1992	(2) Long-life Durability; Conformity to the GHLC* Standard as of 1998	(3) Consideration regarding the surrounding environment	(4) Conformity to the guideline for indoor air quality (5) Conformity to the barrier-free design standard of GHLC*

*GHLC=The Governmental Housing Loan Corporation

Source: Institute for Built Environment and Energy Conservation, 1999

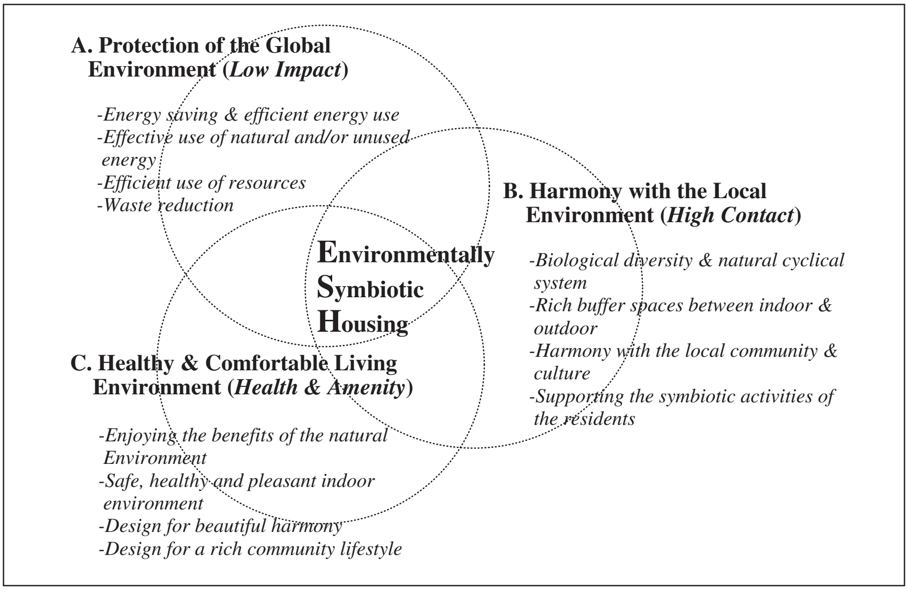

Fig. 19.7 Three objectives of the ESH

A. Global environmental protection (low impact)

This includes energy and resource conservation and minimum waste production in various ways and at various levels. Especially energy and resource consumption of the building construction and operation should be promptly minimised to meet the COP3 requirements to reduce the country's CO_2 emission by 6% of the 1990 level. Such activities already play some part in most people's daily lives, but they should also be organised on a neighbourhood and regional scale, and be considered and practised by every resident. Similarly, an enormous amount of concrete rubble is produced when buildings are demolished and, if recycling is to gain prominence, it must be established as a social system rather than planned and executed on a case-by-case basis:

B. Harmony with the surrounding environment (high contact)

The etymology of the Japanese word 'landscape' suggests not only an attractive scene, but its condition in a more complete sense, including its climate, its geography and the organisms that inhabit it. Building ecology reveals the relationship between human beings, the building and the natural environment as a whole to create an optimum balance of human habitat. Therefore, it is essential to investigate environmental elements such as light, wind, water, earth, and organisms, and to use these as a fundamental basis for the development of design decisions. In other words, building development should be appropriate to the history, landscape, culture and inhabitants of the site and its surrounding area. Such an attitude will result in creating a locally based characteristic habitat, which is to be beloved and sustained by the residents and users.

C. A healthy residential environment with amenity (health and amenity)

Since the mid-1990s, the relationship between housing and residents' health has become a serious social issue, due to toxic chemical substances used in the production and installation of interior building materials and components. These effects are exacerbated as homes have become increasingly air-tight without effective air-management. The air-tightness of housing had historically not been considered a major issue in Japanese building, where openness for summer's hot and humid climate was a high priority. The idea was originally imported from North America, mainly to cope with energy saving for heating in northern areas. A Canadian model of R2000 was an example. Without often noticing it, homes may produce harmful chemical substances, mould, and dust, leading to health problems. Those who spend the longest hours at home (the elderly, handicapped, infants, and housewives) are at increased risk due to high exposure.

Design process

The implementation of Environmentally Symbiotic Housing, based upon the lifecycle process, requires a new holistic vision of the design process. A cyclical process model, similar to the well known environmental management system Plan–Do–Check–Action, has been developed with the similar intention of promoting sustainable improvement of the quality of life (Fig. 19.8). The major goals of this design process are:

1. to investigate and understand the interrelationship between human behaviour and the physical circumstances, during the *pre-design* process;
2. to apply this knowledge to policies, rules, planning, designs, and education programmes, in terms of macro-, meso-, and micro-level

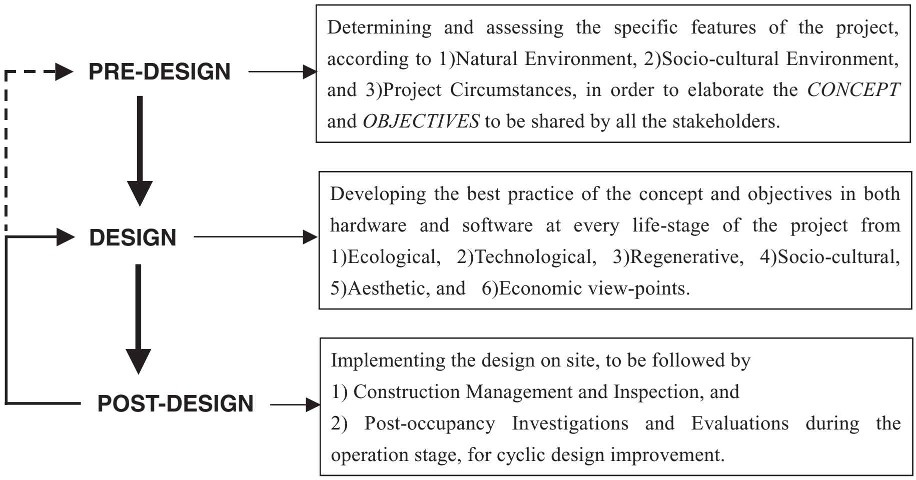

Fig. 19.8 Cyclic design process of sustainable housing

environmental issues, causing the least possible environmental loadings, during the *design* process; and

3. to assess and evaluate the research hypothesis, analysis of the built results during occupancy (the *post-design* process) to ensure a sustainable improvement in quality of life.

The Fukasawa Symbiotic Housing Complex

The Fukasawa Symbiotic Housing Complex rebuilding project began in December 1992, and was completed in March 1997. On a site of 7388 m^2, a complex of five apartment buildings, accommodating 70 leasehold dwelling units, replaced 39 municipally owned wooden detached houses from 1952 (Fig. 19.9). The demolished houses were part of the post-war housing initiative, constructed and administered by the Tokyo Metropolitan Government in a residential district of Tokyo's Setagaya Ward. The administration of the site and housing complex was passed to the Setagaya Ward 40 years later, and the dilapidated houses were to be replaced with a ward-built, ward-owned housing complex.

At the beginning of the pre-design process, efforts were made to analyse the regional context of the site to discover its potential resources and requirements. In addition to the seasonal climate analysis, four other categories, representing the most basic aspects for the architectural and

Fig. 19.9 The designated site of the Fukasawa Complex with original wooden public housing (April 1994)

landscaping design – *water*, *green*, *wind* and *life* – were considered (Fig. 19.10). Based on this analysis, the following design precepts emerged:

- design form and layout of buildings so as not to disturb the water flows
- preserve the existing trees to keep and strengthen the regional green network
- design form and layout of buildings to capture the potential benefits of seasonal winds
- design the landscape to embrace and connect with existing the regional ecological habitats

The existing site itself, though located in a highly urbanised area, flourished with trees, grasses and flowers. The rich greenery provided an agreeable home for the residents, as well as for a diversity of birds and insects. The original wooden houses (Fig. 19.11a,b) were widely spaced, with unpaved paths and gardens in between creating an 'urban oasis' that had been carefully maintained by the long-term residents. Most residents had lived in these houses for more than 40 years, creating a warm, close-knit community. They had formed a self-regulating cleaning rotation, shared gardening duties, and planted a kitchen garden in the site's fertile soil. Both the greenery of the site and the experiences and history of these now elderly residents were central considerations in the rebuilding process. The original residents participated actively in the planning stages. Most

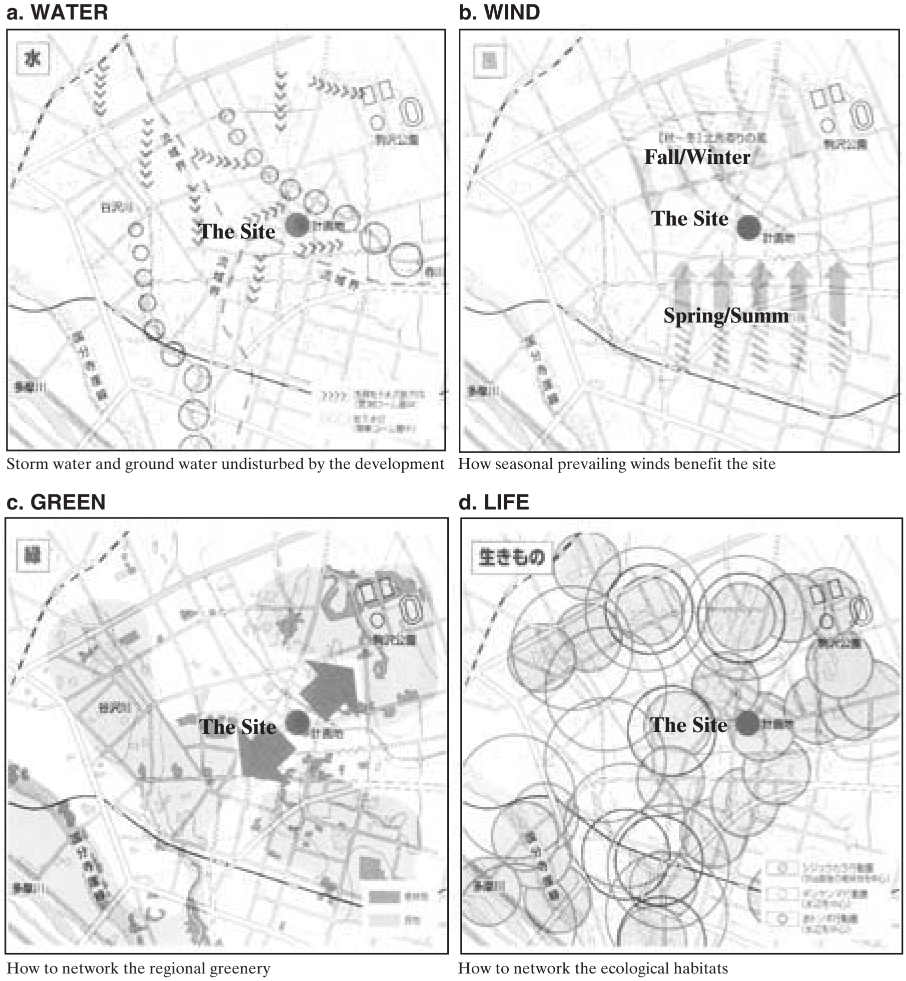

Fig. 19.10 Analysis of the Fukasawa site within the regional context

of them have returned to live in the new apartments, where they have subsequently taken leading roles in forming the new community of 70 households. Such form and sense of social mix used to be quite usual in downtown Tokyo, but disappeared through city renewals and relocations since the early 1960s. In order to materialise this idea, efforts were made to accommodate residents of different physical conditions and ages, i.e. the universal design.

Priority of the rebuilding and the concept

In the rebuilding, it was necessary both to raise the standard of living of the existing residents in terms of apartment size and the facilities for

Fig. 19.11a Very mature condition of former houses before the rebuilding (as of 1993)

amenity, and to increase the density of accommodation (from 39 to 70 units) within the site. According to the concept, two goals for the Symbiotic Housing Complex were to enable future generations of inhabitants to inherit the biologically rich environment of the existing site and to interact with and influence their surroundings. After a number of collective discussions, hearings and group interviews with the existing residents, the stakeholders developed a shared concept for the project of the re-creation of the Fukasawa Biotope Garden. This participatory process,

Fig. 19.11b Lifestyle of the residents reveals key aspects of rebuilding

required by the existing residents, was very positively encouraged by the Ward and executed by the architects.

When the original buildings were demolished, reusable components were retained and incorporated into the new complex, as follows, and as shown in Fig. 19.13a,b,c.

- The trees, earth, wells, and other treasures of the site were left untouched as much as possible. When it was necessary to remove the trees, they were preserved elsewhere during construction and replanted later.
- Soil displacement was kept to a minimum, with any excess soil reused elsewhere within the site.
- The new buildings were situated so as not to disturb the underground water flow, and water-permeable paving and rainwater systems return

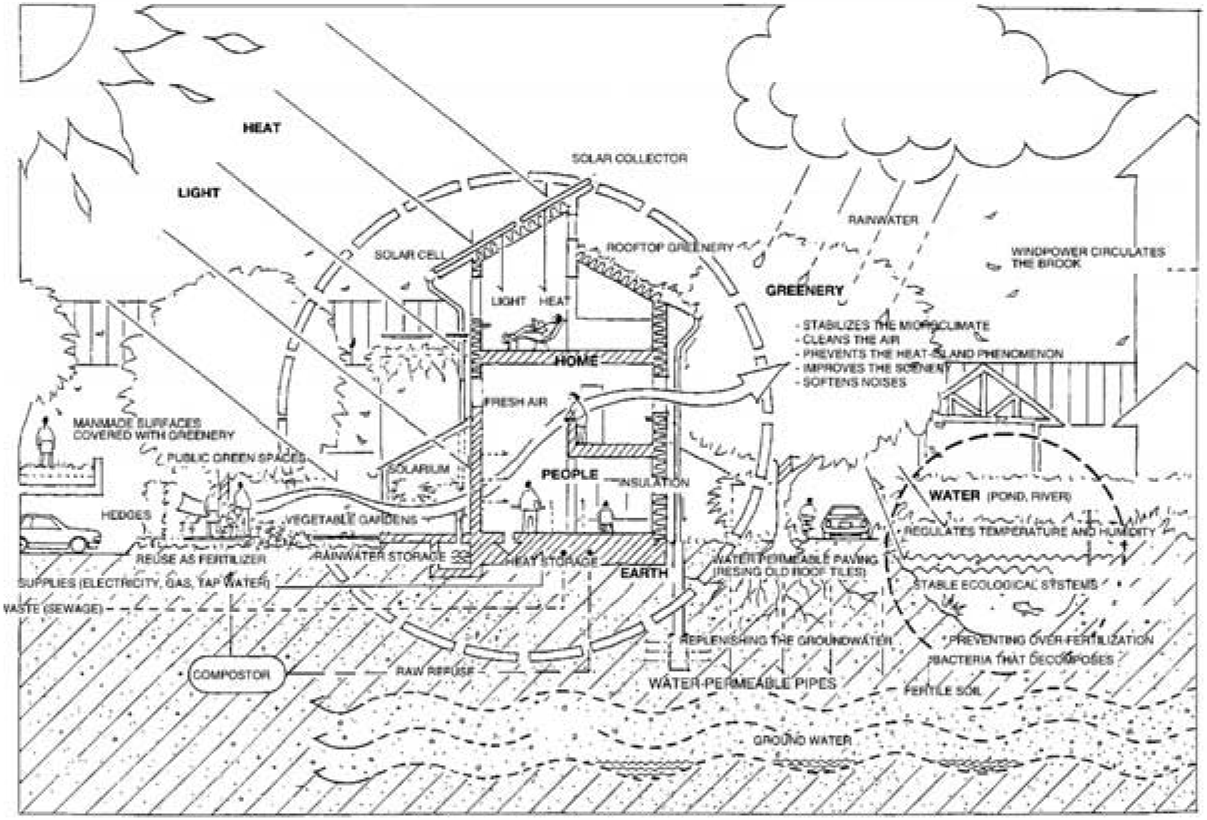

Fig. 19.12 Holistic image of the Fukasawa Symbiotic Housing Complex as 'Biotope Garden'

Fig. 19.13a Preserved trees, well (top) and fertile soil (bottom), as elements of memory, to be reused on site

rainwater into the ground. Most of the flat roof surfaces are covered with greenery, and two wind-powered generators circulate water around a brook and small pond.

Health and comfort of the residents were major priorities in the rebuilding (Fig. 19.14a,b,c,d).

- The new apartments are built with consideration of sunlight and the winds, incorporating various passive lighting, heating, and cooling methods.
- Each unit opens to at least two, often three or four directions, and the form of the complex itself was determined by the local wind patterns.
- The use of open alleys and light/wind voids are based on the traditional plan of the Japanese villages, enabling natural ventilation and aeration.
- The building materials, finishing materials, and facilities of the apartments were selected for their low impact upon the health of the residents and of the environment.

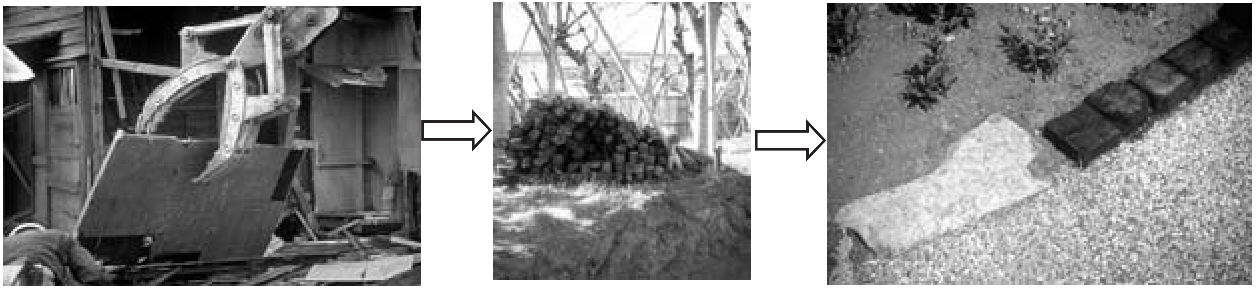

Fig. 19.13b Timbers of the demolished houses, reused as landscape elements of memory

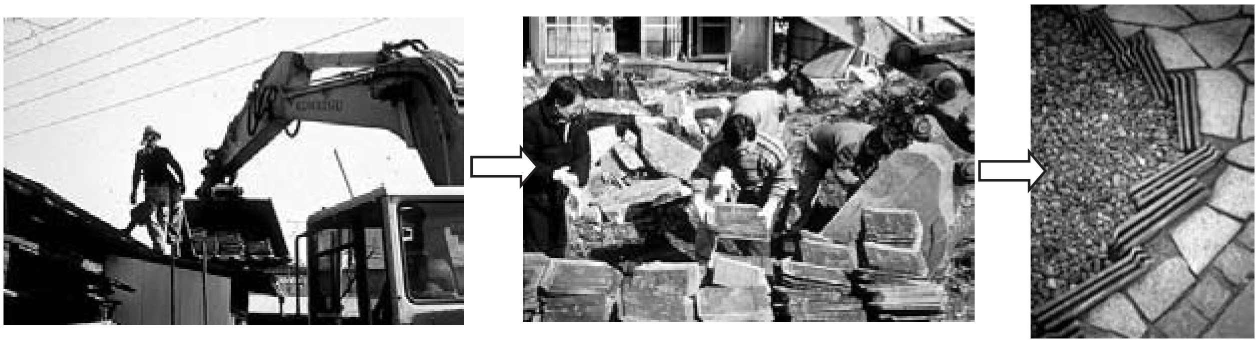

Fig. 19.13c Roof tiles of the demolished houses, reborn as gardening design elements

Fig. 19.14a Elevator tower

Fig. 19.14b 'Sky Walk', leading to the entrances

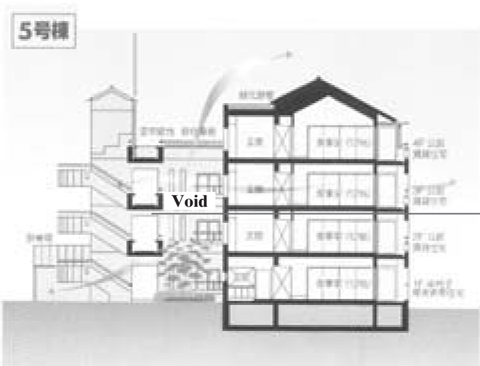

Fig. 19.14c Typical plan and section of apartment

Fig. 19.14d 'Void' for day-lighting and natural ventilation

- Solar collectors provide warm water for the floor-heating system of the Ward's Day Home Centre. Solar cells also power the outdoor lamps and a public clock.

These and other features have helped to make the Fukasawa housing complex a local focus for environmental education and awareness. Not only does the ground floor of one of the apartments accommodate a day care service centre for the elderly of the district, but footpaths across the site are used by people from the surrounding neighbourhood, who enjoy the greenery and comfortable micro-climate.

Environmentally symbiotic building elements

As a model project of the Symbiotic Housing Complex, a series of techniques and building elements were applied to meet the major goals of sustainable building, providing an improved quality of life and reducing resource use and environmental impact. Within the limited cost framework of public housing, the following elements and items were carefully selected (Fig. 19.15 and Table 19.1 on p. 338):

Energy saving

- Governmental guideline levels (as of 1992) of thermal insulation.
- Effective sunlight and daylight control by eaves, pergolas, greenery etc.
- Selection of energy efficient equipment systems and appliances.

More effective use of natural resources

- Solar collector (57.42 m^2) for floor heating (100 m^2) and warm water supply within the Day Home Service Centre (warm water tank capacity: 1.5 m^3).
- Solar cells for garden foot lighting (five sets), street lighting (five sets) and a street clock.
- Wind power generators (1.5 kWh) for circulation of water in brook.
- Groundwater use through the four preserved wells within the complex.
- Rainwater reservoir (60 m^3) in the building foundation for toilet flushing (Day Home Service Centre), and rainwater tanks (0.1 m^3) in each balcony for watering plants.

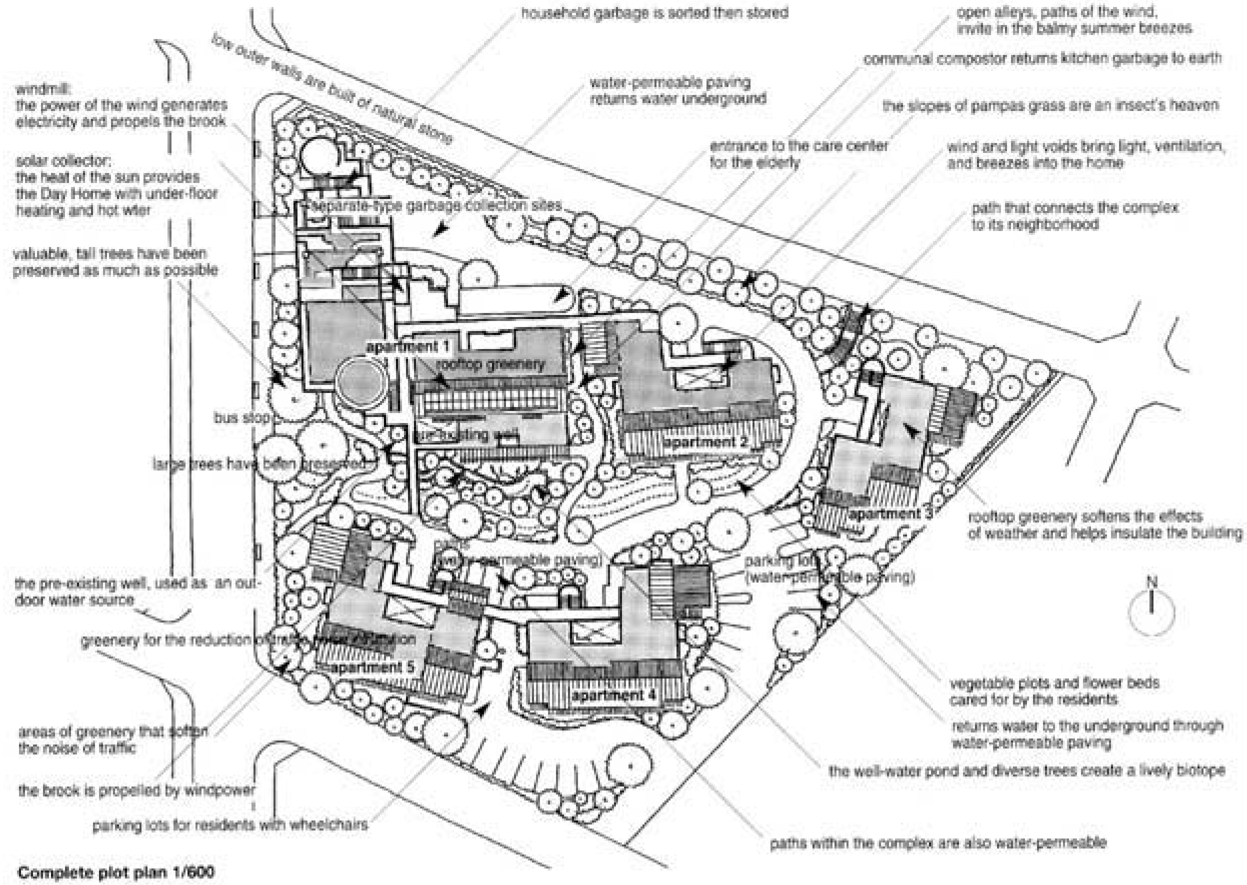

Fig. 19.15 Complete site plan, showing environmentally symbiotic elements

- Water saving equipment (toilets) and faucets.
- Metal mesh formwork for foundation work, which remains on the surface, to reduce the amount of plywood formwork of rainforest wood.
- Supportive system for sorting and storing wastes and garbage.

Compatibility and harmony with the local environment

- Permeable pavement for all the streets and parking lots in the complex.
- Preservation of 17 tall trees and replacement of 160 trees (Fig. 19.13a, p. 347).
- Greening of all the rooftops and the walls facing west (Figs. 19.16 and 19.17).
- Preservation of grass banks from ecological and townscaping viewpoints.
- Creation of the Biotope Garden at the heart of the complex (Fig. 19.18).
- Providing intermediate rich buffer spaces between indoors and outdoors.

Fig. 19.16 North side of Apartment IV, characterised by grass rooftop and the 'Sky Walk'. Rooftop greening was one of the most outstanding characters of this project. Major objectives were to contribute to regional green networking and to improve the urban thermal condition

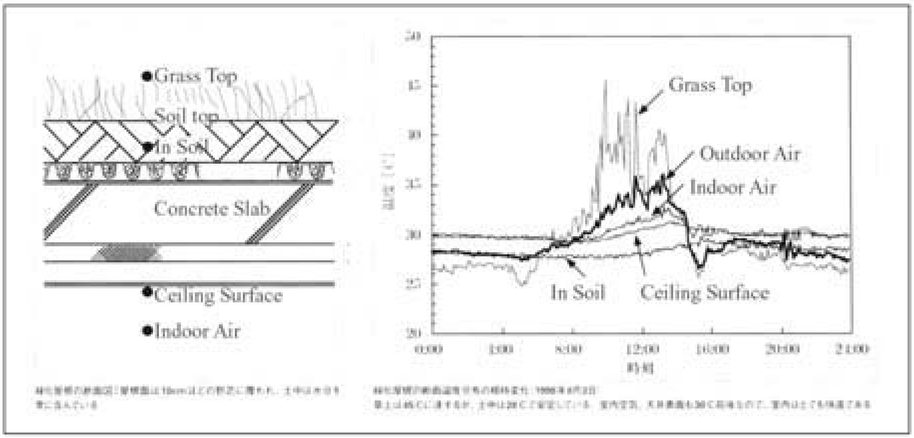

Fig. 19.17 Thermal effect of 'rooftop greening' (Aug. 1998)

Fig. 19.18 'Biotope Garden' shortly after the completion (April 1997). The Biotope Garden is protected topographically and accommodates a variety of plants, birds and insects. The water from the preserved well is circulated by the wind charger behind, only when enough wind blows

Health and amenity

- A variety of the basic passive design of housing for residents' health.
- Symbolic reuse of timbers and roof tiles of demolished houses for memory (see Fig. 19.13b,c, p. 348).
- Thorough consideration for the elderly and the disabled.
- Selection of eco-materials and improvement of indoor air quality.
- Semi-public facilities for supporting community activities.

Operation and administration

At the end of the design process, the design team was requested by the local government client to implement the operational scheme for post-occupancy analysis, examine possible forms of organisation and regulations, and evaluate the share of expenses for the maintenance. The final scheme was made on the basis of residents' participation in major maintenance activities. The architects calculated whole possible annual maintenance costs, including building, equipment and gardening, comparing the merits of outsourcing and an in-house operation. Figure 19.19 illustrates a comprehensive structure for the maintenance and administration of the Fukasawa Symbiotic Housing Complex, associated with the goals and methods to be shared by the stakeholders including the Ward, the residents, visiting users of the public facilities and volunteer supporters. Based on shared understanding and activities, a new close-knit community subsequently developed together with the newcomers of approximately 50 families, and the very high level of maintenance communicates to visitors the outstanding willingness of the residents to create and maintain an environmentally symbiotic atmosphere.

Post-occupancy investigations

As a government-supported pilot project, the Fukasawa complex attracted attention and initiated debate nationally. Its success, problems, and development over time will help improve and influence the future of sustainable public housing in Japan. The design architects of the project, in corporation with the Musashi Institute of Technology, continue to engage in post-occupancy evaluations, both scientific and social, in order to discover and solve problems between design and day-to-day operation.

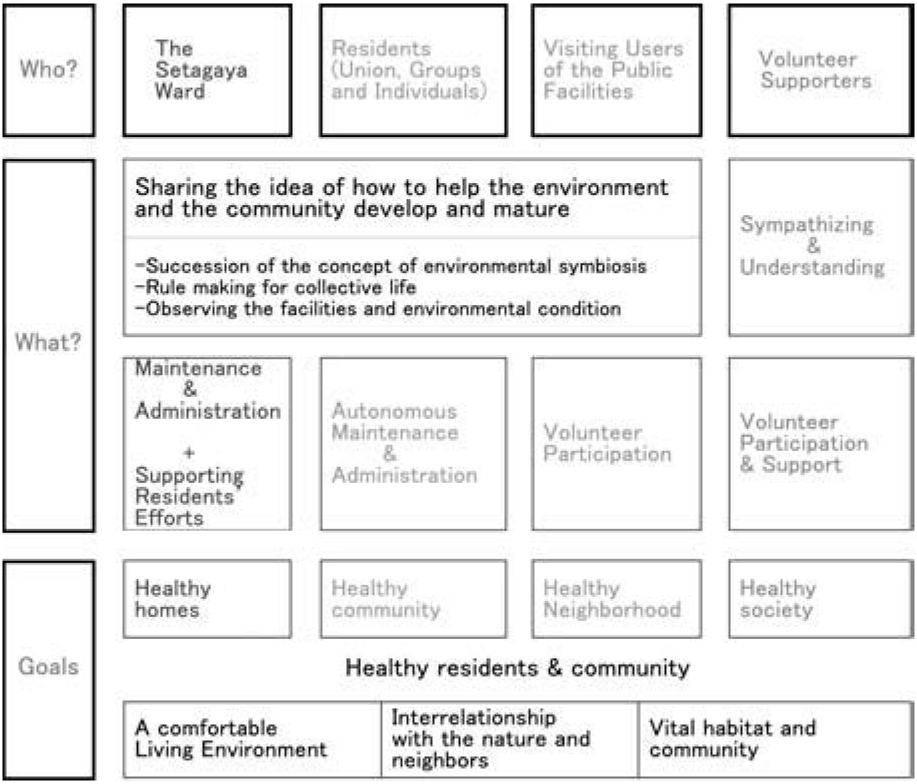

Fig. 19.19 Comprehensive image of the roles for maintenance and administration of the housing complex, to be shared by the stakeholders

These investigations were made by the students for their graduate theses, and financed by the Institute. The results have been disclosed in the proceedings of the annual congress of the Architectural Institute of Japan, and in several architectural magazines. This is how to learn more about housing design, and improve knowledge and skills for further professional developments.

The apartments themselves were planned to integrate a social mix, certain units custom-built for wheelchair users and others for single elderly residents. One unit is reserved for a life support adviser employed by the Ward to care for her elderly neighbours. This is the result of discussions on how to re-create a sense of community among the residents. The importance of this kind of daily cooperation and communication among neighbours was made very clear and helped shape the Fukasawa project. Spacious meeting rooms, for example, were incorporated into the plan, as were areas where children could play safely close to home.

As the Housing Complex approaches its sixth year of operation, it has been developed into a close-knit community, unusual in Tokyo's newer residential district. The Residents' Committee is active, its regular meetings providing a forum for discussion and problem-solving. The committee also organised cleaning, recycling, and gardening rotas, with a monthly Sunday morning being set aside for a communal cleaning effort. Much of the residents' involvement with each other is based upon their pride and enjoyment of the environmentally symbiotic aspects of their individual units and project as a whole. Due to their involvement in the planning and running of the complex, there is a high level of environmental awareness among the residents.

Conclusions

When housing is considered as the integration of ecosystems, the built environment and social issues, the deficiencies that plague modern housing due to a lack of comprehensive perspective become apparent. In the rush for progress, post-war Japanese housing design had discarded or forgotten traditional ways of living that were based on biological knowledge. Older methods protected the richness of the environment and supported the continuity of peoples' lives through the preservation of ecological balance.

In the aftermath of the Great Hanshin Earthquake (January 1995), evidence emerged of how the victims reacted to this hitherto unthinkable disaster with spontaneous local cooperation. It was recognised how important it is to build not only large-scale systems, but also smaller, independent systems of energy and water distribution. It also illustrated, in a extremely striking way, the meaning of 'living together' with one's neighbours, and the importance of developing and maintaining strong ties with each other. When a neighbourhood is created through participation by all the residents, such relationships can develop and flourish. Human values and relationships will be critical in the realisation of a sustainable society. This is one of the most meaningful cultural aspects of Environmentally Symbiotic Housing. The issues concerning ESH touched on above are not extraordinary in themselves. They are even basic ideas from which most discussion on housing and neighbourhood start.

Important lessons from this ESH project are as follows:

- Understanding and harnessing stakeholders' values is a vital component to ensure the viability and social 'fit' of a scheme.

- Buildings and the built environment have functional and symbolic roles to foster a sense of local identity and belonging.
- The success of environmental improvement (and the introduction of environmental technologies) is linked to social understanding and endorsement (a 'bottom-up' approach). Community consultation and participation during the pre-design, design and post-design phases are the basic requirements, and could be effectively done by architects as coordinator or facilitator.
- The existing infrastructure of education and training, administrative systems and attitudes on both the construction supply side and the client procurement systems need reconstruction to accommodate local social and environment concerns. Implementation of feed-back and feed-forward loops is also essential.
- Operation and maintenance issues need consideration at the earliest stages and need to match the limitations of resources and capabilities of those who will be responsible.
- An integrated approach to social, ecological and building issues is possible within the constraints of existing metrics of financial budgets for construction and operation.

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20

Understanding Delivery Processes

Jeffrey Cook

How has the delivery process in the built environment changed with globalisation? What is different about information exchange and newly informed practice in the Information Age?

The term 'technology transfer' is inappropriate because it suggests lineal methods of communication about materials, processes and components of the built environment as driven by globalisation, instead of an integrated delivery. Rather than a 'transfer', the term 'exchange' implies a gradient and a trading relation, not a one-way delivery. The popular new information technologies may provide the potential fast track vehicles for topic experts to accelerate learning and communicate the exploding quantity of new information generated by the industrial age. However, if used unwisely, IT can exacerbate the problem by merely transferring information (and ultimately, delivery systems and inappropriate products). The increased urgency of addressing the information explosion of the impending post-industrial era is unspoken. All global societies will require new knowledge to survive and thrive. The challenge is to ensure that the knowledge created and used is embedded within the local culture. The alternative is a world with new ignorance, fragmented by alien technologies, within an increasingly polluted globe, compounded by resource depletion.

Defining the territory

Oliver's chapter, Technology Transfer – A Vernacular View, defines the global territory of the pre-industrialised built environment and identifies the many ways new information, new materials, and new practices are accommodated in traditional societies. These processes of ‘borrowing’, ‘handing down’, necessity, diffusion, intrusion, and resistance in their several forms are brought into focus by careful cultural research. Oliver’s succinct summaries of these different studies serve as potent metaphors that apply equally to industrial and post-industrial societies, and to globalisation. More critically, Oliver asserts that technology and culture are fused and essentially inseparable. This idea seems to have escaped most modernists, who imagine that technology is neutral and that modern industrialised technology is culturally anonymous.

One aspect of the cultural attribute of all technologies is their associated agent (or agencies) and their agenda. Often the cultural value of the new and the industrialised in the built environment seems a ‘no man’s land’, lacking specific identity and context. The increasing sameness of the world’s cities is shocking to some, and responsibility seems elusive. Such adoptions of sameness are the deliberate product of specific agents. Sometimes they are simply the product of an ambitious materials salesman, or of a designer attempting to be up to date. But a provincial bank may want to emulate the image of international banking culture if it wants to participate in international trade. Thus, superficially, the appearance of sameness announces participation in a similar global culture. However, what appear to be neutral global (or universal) materials, processes or forms can also assume local meaning with assimilation. For instance, precast concrete is an economic universal wall treatment for warehouses and medium-sized buildings. But it assumes a special local appropriateness in Phoenix, USA, where heavy walls are a traditional climatic response, and where local industry has refined the factory technology of concrete forming and finishes. Thus, in spite of reduced on-site construction during the extensive hot season, attractive, low maintenance buildings are provided that have custom individuality.

Oliver’s descriptions at the personal scale of tool and shelter suggest a delivery concept by example and narrative. His distinction between colonists and settlers emphasises the transition between an ‘implant’ and an ‘indigenous’ culture. The ethical question of the appropriateness of introducing a different technology is also raised. Two fundamental questions need to be addressed. On what basis should an intervention into a stable traditional society be made? In whose best interest is technology transfer being pursued? For instance, the introduction of bottled or canned soft drinks in the Third World in the last generation was clearly a commercial development of new markets. This often displaced healthier local, traditional drinks, while it introduced new standards of disease control. How appropriate are those new methods or standards of controlling disease? On a personal level, these may be relatively easy ethical propositions to address. However, institutions, corporations, and religions each have their own collective agendas, which require reaffirmation within their originating culture. When transported to another context these agendas and goals may dislodge or exploit the integrity of the local culture. Outside influences are usually transformative, and not always for the worst.

Within the context of all human cultures, regardless of gross domestic product, Oliver provides important lessons:

- vernacular technologies are rarely environmentally or resource damaging, until the context changes
- the extraordinary persistence of certain technologies confirms their time-tested values
- all technologies, including those used in the built environment, have meaning and symbolic functions to inform us about our local identity and culture (while we simultaneously participate in a larger international culture)
- a lack of understanding local needs/local culture seriously impairs the opportunity of any introduction or intervention
- recycling and interlocking processes are life-affirming practices of traditional and long-lived cultures (qualities that are often missing in new interventions).

Local versus universal knowledge

Well developed local or regional construction technologies, such as the KST house innovations in Hokkaido, can directly challenge international 'common knowledge'. The performance characteristics of the KST system can be verified by universal building science, but cannot be generated by that science. Parts of the 'Total System' of KST include heating which contradicts usual logic since the construction is deliberately leaky. Air infiltration is considered desirable for reasons of health, but this would never pass a Canadian or US test for energy efficiency as it would fail the national standards and codes of practice for air-tightness. Yet KST house energy efficiency is proved by monitored fuel use, along with a different cultural definition of comfort. Thus, universal standards must be questioned and examined to ascertain the validity of their benefit within a cultural context.

What passes for common interest in health and safety often serves special interests. Paradoxically, these special interests may deny general public benefit. For example, adobe construction in the southwest of the USA has prehistoric traditions that go back over a thousand years. Yet adobe became outlawed by city building codes (e.g. Phoenix, Arizona and elsewhere) in the 1940s. The arguments were plausibly based on structural safety, health and hygiene. On closer inspection, this change in construction regulation was spearheaded by the emerging concrete block industry. The historical traditions and evidence of its appropriateness were ignored and special interests were served. After a ban of 60 years, adobe construction has been allowed again by regulation. Fortunately, the technology and culture of adobe survived in rural backwaters, where codes (or enforcement) did not reach. As governance (regulations, standards, codes, financial instruments, etc.) changes to become more international and pervasive, local practices may be sacrificed, even when the codes are based on performance. Regulations and other forms of governance will require close scrutiny to ensure they do accommodate local culture and do not homogenise the built environment. In 1899 John Dewey, the American educational protagonist, had already written that 'the school has been so set apart, so isolated from ordinary conditions and motives of life' and that children cannot 'get experience – the mother of all discipline' (Dewey, 1990). This critique is relevant to adult life in much of the world's urban populations. Learning by doing is thwarted by lack of apprenticeship, by specialisation, by book learning, and by other meditated and isolating exposures that substitute for first-hand knowledge. Local and vernacular knowledge can resist industrial and post-industrial methods of information transfer since local knowledge operates in parallel to the culture of the industrial/post-industrial world. This raises an interesting problem for industrialised societies. How can a local knowledge base be developed for universal building materials such as glass, concrete, or steel? What would be local about that knowledge? Knowledge would have to be locally based first-hand experience, within those contexts that distinguish the local climate and culture. The resurgence of interest in (local but universal) alternative construction materials (e.g. straw and mud) within industrialised regions has required a fresh look at interfaces – both at universal industrially produced construction materials and at the universal codes that tend to support them.

Capitalising on the local

The discovery of design challenges, delivery mechanisms, and performance possibilities that capitalise on local or vernacular knowledge is a resource supporting sustainability. Urban centres, with their rich access to materials, crafts, and ideas, may appear to be the most productive arena. However, provincial towns and cities, with their supportive countryside (outside the 'great cities'), have more potential because native populations can persist, and traditional methods and materials are more difficult to dislodge. One example is Hungary in the 1970s and 1980s, where a 'living architecture' evolved in the provincial and rural centres. Budapest was perhaps too international or cosmopolitan to participate. Often under the direction of architects from Budapest, local materials and craftsmen shaped a richly creative sustainable architecture that was deeply culturally based. Realisation of the virtues of local and indigenous building materials also fuels regional economic engines, as it did in Hungary, as well as the evolution of more bio-climatically suitable buildings. Reinforced by access to industrialised anonymous construction materials (e.g. glass, steel and aluminium), a global architecture may be anonymous in many of its materials, but can become locally distinctive in its response to craft, culture, and indigenous building materials. This new vision of *glocal* architecture is congruent with new professional visions and responsibilities.

Green standards for materials

Within the built environment where the benefits of industrialised mass production have provided low-cost materials of known specification, we should expect increasing challenges of viability, coming from many quarters. In particular, social cost and environmental cost need new accountability. In the USA and Canada, professional designers have been stimulated to examine the 'greenness' of materials and their applications. These aspirations and demands have created new assessment systems, and thus new criteria. Some designers respond enthusiastically, seeing new opportunities, not just to be good global citizens, but also for creative openings, particularly for aesthetic expression of new values.

One of the most ubiquitous materials, drywall (plasterboard or gypsum board), has been challenged for not being green. Its universal availability and anonymity implied it was soulless, as well as without place. Aesthetic observations, rather than any particular environmental facts drove this view. By 1999, the 11 gypsum board manufacturers in Canada and the

USA mounted a response. The Gypsum Association publicised a green environmental story: over 90% of gypsum board paper comes from recycled materials. 'Synthetic' gypsum, a desulphurisation by-product of reducing flue gases in fossil-fuelled power plants, is increasingly used. Most importantly, drywall is non-toxic, has almost unlimited sources and so represents a poor environmental scapegoat.

However, each building material has its own socio-economic entourage. Drywall technology supplanted the thriving wet plaster trade with simpler construction techniques. The wet plaster trade offered regional variations of skill, based on the field experience of apprenticeship and local climatic and other factors. Wet plaster offered many aesthetic opportunities for surface, form, colour and texture that cannot be matched by drywall. The death of wet plaster as a delivery system was the result of a number of factors including cost, convenience, and ultimately culture. The dilemma for modern drywall is that it has become an international product used consistently – there is little opportunity for local variation or expression.

The new scale and its monumental displacements

The project-based delivery process of huge infrastructure constructions was analysed by Michaud. These projects have regional, national, and international scope and include a variety of large-scale infrastructure investments (power plants, transport links, etc). They are the great facility provisions of the industrial and post-industrial age and are also its monuments.

Both the capital investments, and the human and environmental displacements, are monumental. Michaud points out that these projects may take as little as three or four years to construct, but more than a dozen years for 'front-end' arrangements. It is at the 'front end' that innovation and evolution are encouraged by 'opportunistic behaviour'. By definition these larger projects are intended to jump-start the economy and efficiency of regions and nations; the electric productivity or the transportation capacity of such projects is predictable. But their process of delivery also makes them active agents for change in institutions and society. Michaud correctly advocates that the 'front-end' engagements should not be short changed. The cultural traditions of banking, investments, ownership, and government become the target of the 'visionary explorations' that can create new viability for large infrastructure projects. Unlike the lineal best-practice delivery process characteristic of production line thinking, Michaud recommends design as a multi-dimensional variable to capture the many measurable values latent in such vast enterprises. The implication is that the delivery team needs a much more diverse composition than the usual engineers and accountants. At the 'front end' new talents would complement the bankers and political specialists. Such specialists might include ethnographers, micro-economists, adult educators, hydrologists, and conflict counsellors, as well as architects, village and rural planners, and agricultural specialists.

A significant lesson from Michaud is that value is added from the 'front end' of the (lengthy) delivery process. This may be transferable from major infrastructure projects to the urban and building scale to enable a fuller consideration of cultural and environmental implications and solutions. This post-industrial thinking also embraces new time scales, and new territorial dislocations. At all scales, modern development will be increasingly disruptive, even in the most rural places. Oliver proposes that three generations are needed for a new tradition to become established. The ethical 'necessity' for such disruptive projects is not determined by local people, but they are declared abstractly from remote bastions. However, the scale of major projects also requires regional and local engagement and participation. This implies a new cadre of specialists, trained and experienced in social advocacy and regional intervention. Local advocacy needs to be exercised in questioning validity and in actively directing positive outcomes.

How does one exercise conscience and learn to participate at the grass roots in such major projects? How do you learn to manage the multi-dimensional mix? Beyond the technology 'transfer' and the anticipation of outcomes, where does the broad-based conscience come from? These are not new questions, although now it may be easier to avoid the responsibility of providing appropriate solutions. The exercise of human values in a foreign culture is a challenge for individuals, and is even more loaded with risk for institutions and corporations. In this respect, Michaud raises the most challenging horizon concerning the new inclusiveness for vehicles of vast change, which contribute to global stability and enhancement through large-scale infrastructure projects. The locally affected populations are often a sacrificed resource. While they may need 'development', it must be with a conscience.

Models of delivery: China

Carter's profile of contemporary China is surprising. The identification of qualities of pragmatism, moderation, and frugality with regard to attitudes toward sustainability is provocative. Superficially, one may not think that the new China has placed emphasis on sustainability. From a distance, new China appears to have forgotten four millennia of survival experience, and is rapaciously 'building without thinking'. The same observation of 'building without thinking' could as easily be applied to many dynamic American cities such as Los Angeles, Phoenix, Houston, and Miami with their exotic and explosive development, as well as indulgent excesses.

While using American density standards to understand how large Chinese housing estates really are, Carter correctly does not recommend either as the model for Chinese urban sustainability. Yet his statement is judgemental:

> 'If the compact high-density city is a valid sustainable urban form, then, in this aspect at least, Chinese cities have the potential to be more sustainable than most North American cities.'

This assertion should be challenged for omitting critical parts of the argument. Carter does not identify the economy of the city or transportation modes as contributing factors. Compact high-density cities thrive on rapid transit. However, low-density cities based on market and family gardens, with distributed industry based on internet and piecework, could be as resilient because they depend less on a hinterland for support. While these descriptions appear to be based on the hardware of their built environments, they are also cultural choices. Each may have a strong potential for sustainability.

China is a large country in terms of both population and geography that Carter assumes to have a unified political climate. With him, we may assume that the form of the rapid build-out of Beijing is characteristic of all Chinese cities. But we forget that China is very diverse linguistically, culturally and climatically. And while admitting the need to avoid 'a one size fits all', Carter does not expand his Chinese scope beyond his own horizon of Beijing. Thus Carter whitewashes one of the elementary principles of sustainability, that it is most logical when locally based. And beyond the potential diversity of Chinese cities, is what is assumed to be the complete backwardness of the countryside and rural villages, providing another time warp of technology, and opportunity in catching up.

Carter's review of China is a different search for a universal footprint for sustainability, applicable anywhere.

Models of delivery: Hokkaido

The narrow Chinese understanding of the 'modern' in terms of technical and scientific progress, comfort, and wealth identified by Carter is not part of the Japanese vocabulary. From a distance Japan has that admirable appearance of looking modern while simultaneously respecting her great traditions. The case study of the KST house is convincing in its synergetic 'glocal' demonstration of bioregionalism. But its creation is less inspired by a delivery system than by its evolution as a regional philosophy of building construction, and its fit to place.

In comparison with North American house builders with their commercial goals of moving 'product', the KST package provides intimate concern, not just for comfort, but for longevity of both its product (the house) and its environmentally sensitive process, the working organisation relative to its material, environmental, and social region. The four ethical mandates are stated at the beginning. The implication is that KST has a delivery system similar to an extended family where there are assigned and assumed roles, a well understood hierarchy, and a web of responsibility and of extended stability.

The vertical organisational model is identified as the process of delivery. The senior officer and sole proprietor adds experience to the extended family model, takes a long-term view and delivers the company ethos throughout the organisation. The Japanese tradition of a job commitment for life allows KST to use employment stability to provide long-term responsibility.

As a regional enterprise KST represents certain contrasting characteristics based on its colder Hokkaido climate, as well as shifts in cultural values derived from a strong philosophical relationship to the natural environment. A lesson here may be that any export or import of construction techniques must have a double fit. First, is there a good physical fit for the proposed new house technology? The Hokkaido ideas respond to long, cold, snowy winters and small plots of land. Of equal importance is the social and spiritual fit. If the KST products embody ideas of environmental appropriateness, long life for buildings, and multi-generational accommodation, will these be priorities in a new location such as Russia, Norway, Canada, or Argentina? Their climates may be similar but will there be a social fit? The authors' summary statements serve to underline the dilemma. Green building technologies may have a great original regional efficacy, but if based so strongly on a bioregional philosophy, can they be transferred? Building technologies are not goods, but should instead be understood as principles and concepts with generic traits that may not have many global fits. KST represents green building technologies that are neither a materials list nor a series of distinct ways of doing things, but an integrated pattern of thinking and doing that is particular to place. Can thinking patterns be exported? Potentially the thinking pattern will only fit where already there is similar thinking. The ethical question, 'For whom is it necessary?' may have a ready answer. Yet exporting the KST house may also stimulate new thinking that will provide a better fit for the KST idea, and for the values it represents.

Case study: symbiotic housing, Tokyo

Positive demonstrations of delivery are also powerful in another project from Japan. Built examples of environmentally symbiotic housing illustrate a surprisingly global spectrum of design strategies to encourage sustainability that include continued use of the universal cyclic design process. It is the same repetitive circular architectural design process found among professionals everywhere, of iteration–analysis–reiteration, in continuity. Feedback and feedforward loops are based on past experience and projected performance.

Iwamura describes one particular case, the Fukasawa complex in Tokyo. This design of housing as an integration of ecosystems exemplifies global goals. The most surprising aspect is how universal both the goals and the solution are. There appears to be little that makes the Fukasawa complex to be generally Japanese or particular to Tokyo.

One of the most attractive aspects of the Fukasawa complex is that it is a redevelopment. The rediscovery of the original site and how its ecosystems were remade are exemplary. The earlier neighbourhood had also evolved natural features that were reinterpreted. Salvaged materials from the earlier neighbourhood were reused, especially in public spaces, tying together two human ages on the site. An added feature was the retention of people: some of the former residents were among the new inhabitants, and became active in social and care-taking roles for the new site. Initiated in 1992 and completed in 1997, five years of occupation provide a realistic period of assessment for what was accomplished. The project appears to have no innovative materials, construction, or appliance technologies. Rather, it is new or better ways of thinking – operational and delivery techniques – not hardware that is illustrated.

Missing from Iwamura's chapter is a better definition of the accommodation specification. At this latitude of 36° north, what are the seasonal climatic requirements that need to be provided and how were they met? What are the parasitic energy needs of the new community? How is the Fukasawa complex particular and local, not a 'one size fits all'? Is human identity only expressed in the personalisation of the gardens? Little is provided on the process of implementation and how participation specifically informed the design of the dwellings. One assumes that architect, housing authority, builder, etc., are operating within traditional roles, but exchanging ideas with a new sensitivity. It would be interesting to know more about the changed role of the municipal housing authority. Presumably a special office facilitated this project; could the knowledge gained from that pilot be applied to the whole municipal organisation? The reassurance is this project is one among many Environmentally Symbiotic Housing complexes in Japan, a movement that began in 1990. Although only a microscopic part of new housing in Japan, it has profound potential as a seed.

Conclusions

These five chapters are very divergent in scope, scale and setting, but their messages about process seem convergent. The general observation is that the delivery process in the built environment has not changed with globalisation, only that it has become much larger, and more complex. Even small projects require many more levels of understanding and participation. The differences in information exchange and newly informed practice in the information age stem from the density of information, and the increased depth of responsibility. This does not represent a change of kind or type, but a shift of quality – a heightening of engagement at every level of delivery.

Increased levels of education, including field apprenticeship, are an implied mandate for increased effectiveness. The importance of the generalist who operates comprehensively at many levels, both vertically and horizontally, seems to be an increased necessity for integration.

What is missing in all these chapters, but touched upon by Michaud, is the delivery role of the specialist, the consulting expert, who provides the missing dimensions necessary for comprehensive integration. Is the specialist's contribution a responsibility exercised by parallel contract, or by a forced marriage within decision-making teams? As a researcher, Oliver demonstrates how specialist knowledge reinforces field observations in the culture of vernacular built environments. How can these roles be proactive, particularly with the increased recognition of local knowledge and culture?

These five chapters are case studies, and, as samples, definitive only within their own distinct spheres of inquiry. Their collective goals were the delivery of a built environment that also best accommodates the needs of the natural environment. How can the delivery process of the built environment be improved to accommodate sustainability? Implicit, especially in the KST chapter, is the continuous need for feedback and feedforward on actual performance as well as social issues. The prototypical practice is one that exercises continuity, documents its projects, and uses critical assessment of experience to inform new practices. It does not reinvent a process or result each time, but evolves conscious practice. Individuals might be expected to have extended field experience before assuming lead responsibilities. Lengthy apprenticeships would be a return to more traditional learning modes and would help to embed an understanding and appreciation of local culture. The lengthy and transferable lessons from large institutional and international projects such as planning time, risk assessment, path-dependency, political aspects, corporate responsibility and liability, and ecological price are present in smaller quantities in more modest sized interventions, and just as necessary as tools of delivery. Allowing sufficient time at the 'front end' of smaller projects is needed.

There do not appear to be new instruments, but rather a need for better professional skills, achieved with greater depth. New capabilities and levels of professionalism, and especially of accountability, are the evident discoveries, along with the realisation that all things are connected. New models of delivery have not been created, except for new levels of sensitivity. Both horizontal and vertical organisation patterns seem appropriate. Although vertical organisations are rare, the KST project demonstrates how this method heightens delivery conscience and integrity. It is reassuring that the old delivery methods, the old universal iterative design process, are the best we know. Improved people-to-people skills appear to be a common denominator to assist with better delivery.

If then there are no new methods of delivery, no new instruments of processes, how can we achieve new levels of performance? Architects' professional skills are surprisingly universal and accessible, yet to date these have provided insufficient results. The buyer (clients and users) should be more demanding. Then by what means can responsible design and delivery be catapulted into new territories? The first level is recognition of the cultural value attributed to all technologies. Culture is much better understood when lived, not studied abstractly, an idea that eliminates the universal designer or architect. This reinforces the concept that only conscientious processes of delivery can be universal, those based on first-hand intelligence.

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Section IV

Afterword

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Afterword: Towards a New Social Contract?

Steve Curwell

Introduction

One unexpected but important by-product of the NASA space programme was not a technical innovation, but a cross-cultural insight. Although most people had been taught that the earth is round and that the planet orbits the sun in the continuum of space, the high quality images of the earth from space (photographed by astronauts) changed the collective consciousness of humankind. This new perspective (literally and metaphorically) highlighted the potential fragility of the basis of all life on the planet. The image of 'spaceship Earth' reinforces the concept that we are 'all in it together'. These images are icons of the twentieth century and this is arguably *the* most important cross-cultural insight of recent times. The reason these images have been seen by so many is precisely because of the existence of modern communication technologies and global international trade. These images are now used so ubiquitously in advertising that to some extent their power is being undermined. Nevertheless, this vision continues to give a clear impetus to the idea of global environmental protection and to the concept of planetary husbandry, to which we refer loosely as sustainable development. It represents an important positive dimension of the global socio-economic phenomenon – now referred to as 'globalisation'.

Although this example should really be seen as part of the emerging 'global culture', it marks the importance of a shared cross-cultural, common understanding as a necessary foundation for collective or collaborative action. Interest in the potential advantages of, and impediments to, cross-cultural information exchange has been enhanced because of two factors:

- The environmental pressures currently facing the planet and the associated sustainable development objectives. Cross-cultural understanding and international agreements are becoming vital to 'save to planet' and to enable humankind to live more harmoniously with nature.
- Globalisation of the world economy, which is criticised for legitimising economic and cultural imperialism, exacerbating the unequal distribution of wealth and accelerating cultural homogenisation.

Cross-cultural information and knowledge exchange is seen as important to humankind's development, to peaceful co-existence and thus to long-term sustainable prosperity (Smeets, 1999). In the specific context of this book, as a majority of the world's population is now urban, the built environment represents the core of the problem due to high resource consumption, pollution and lifestyles as well as the long-term 'lock-in' consequent on the very slow evolution of the built environment.

This commentary identifies some of the key lessons that can be drawn from the considerable contribution on these themes made by the authors. Three main areas of discourse as identified in the preface will be explored:

- user expectations
- global versus local
- cross-cultural transfer of know-how.

These themes focus observations drawn from a range of experiences and expertise and lead to the insights created by this book which instigate actions for the future.

User expectations

These are the ways in which human/social/cultural expectations and acceptance limit technological advances and performance improvements at the level of individual buildings.

A wide range of technology is ready and available for use today. If applied routinely in both new build and refurbishment of buildings, it would go a long way to enabling those involved in the building process to meet the ecological challenges. These challenges are identified in detail by Wackernagel *et al.* (2002) and Loh (2002) (see Cooper, page 116). Humankind is collectively overdrawn at the eco-bank to the tune of 20% over income, and we have less than 50 years to turn this around. Building projects in the Scandinavia and UK have demonstrated 50% energy reductions for space heating in dwellings at no additional capital cost as early as the 1960s and 1970s respectively. Von Weizsäcker *et al.* (1997) have catalogued a very wide range of resource-efficient technologies meeting Factor 4 criteria (50% reductions in resources and doubling of wealth/outputs). More recent building case studies presented at various conferences (Green Building Challenge, 1998; Sustainable Building, 2000; etc) have illustrated a number of green technologies that can make significant reductions in resource use and pollution, many reaching Factor 10 and some beyond.

In addition, sensitive 'green' designers are increasingly rediscovering, adapting and reinterpreting less resource-intensive traditional techniques, drawn from diverse cultures. Various forms of passive cooling methods incorporated into new buildings form good examples of the results of this search. Together with new ideas for the more efficient use of the built environment generally, through extending product life, reuse of existing buildings, repair and maintenance, reuse and recycling now open up the real possibility of reaching Factor 20.

So why do these green, sustainable technologies remain largely at the margins? Cole (Chapter 5) has explored a number of social and cultural barriers to universal implementation in some detail. Most are related to the negative perception of the technology and the types of buildings that have used it, by both users and mainstream professionals. However, there are also questions concerning appropriate 'fit' between culture and introduced technology, as well as the cultural and environmental repercussions from inappropriate technology.

Negative perceptions

There is the widespread (false) perception that environmentally friendly solutions create unusual, cranky forms, cost more and may compromise users' existing lifestyles. This perception is reinforced by demonstration projects that become 'architectural statements', e.g. using fully glazed south facing 'solar' facades coupled with other complex, 'advanced' control features: what Cook (Chapter 14) refers to as 'strange looking contraptions'. Both Cole (Chapter 5) and Leaman (Chapter 10) refer to negative user experiences with overcomplicated operational systems. Simple forms, super-insulated, with appropriately proportioned triple glazed south facing windows and well thought-out simple controls have been shown to offer similar or even better energy performance. This type of 'thick' building[1] is much more familiar and less challenging to users' aesthetic perceptions. In mild temperate climates (such as in the UK) such houses do not need full central heating. However, users are so accustomed to a radiator in each room and the responsive control this provides that they find it difficult to believe that super-insulated houses do not need radiators. The result is that a full system with handkerchief-sized radiators is included. In light of this experience, it does not come as a shock to find Brager and de Dear (Chapter 11) describing North American users' dependency on air conditioning as an 'addiction'. This serves as another illustration of how affluent societies have become habituated to various types of technology. The motor car 'enjoys' the same position. As Cole (Chapter 5) identifies (quoting Shove), the technology has become ingrained in the culture; it is considered 'essential' to the way of life, and any proposal that challenges continued use is seen as a threat to personal freedom.

So how can designers and construction educators assist in reconciling environmentally benign technologies with user expectations? In the context of the briefing and design processes, in Chapter 10 Leaman offers very pertinent observations, not just in terms of overcoming negative perceptions and encouraging 'greener' solutions, but as a means of increasing user satisfaction generally. The clear advice developed from a number of post-occupancy studies (see Figs. 10.3, 10.4 and 10.7 on pp. 164, 165 and 174) is essential reading for designers and students. It can be distilled into a flexible, inclusive, approach to understanding user needs and preferences, and offers a practical way of tackling the unacceptable levels of dissatisfaction with the products of the construction industry identified by Seaden.

Cohen *et al.*'s description of the bioregional approach of KST in Hokkaido (Chapter 19) suggests that Japanese users are primarily interested in the overall outcome – a well-performing functional product/service. Seaden refers to UK studies that reveal corporate customers are looking for precisely the same thing. In this context it is clearly advantageous for construction professionals to promote green technologies and green buildings

[1] Architects Vale and Vale coined the phrase 'thick' building to refer both to its ease of use and to its highly insulated envelope.

on the basis of higher quality, enhanced performance and lower running costs, in preference to the fact that they will reduce environmental impact *per se*.

Recent experience with some UK contractors and material suppliers is similar, in that it has been more fruitful to seek improved environmental performance as part of the overall corporate responsibility and quality management agenda of a company. This approach concentrates on seeking the 'synergies' in overall 'sustainable system' performance, in the way identified by Kohler in Chapter 6, rather than seeking to overcoming the 'obstacles' presented by individual environmental problems.

Market perceptions

Seaden (Chapter 9) reminds us of the free-market dictum – the customer is king. This implies that if 'green' technologies function effectively, can be given the right image that appeals to fashionable taste, offered at a competitive price then demand will be stimulated and the market will decide what is best. The KST example shows the importance of a related aspect – customer after-sales service. This essential support for users is taken for granted for consumer durables, but rarely seen in the construction sector as important to sustainability. The full-life service of the built environment has the potential to reduce consumption (energy, materials, less waste, etc.) as well as extending system life Despite increasing prefabrication, each building differs, if only slightly, by virtue of site and location, from its peers. Therefore commissioning of the active and passive systems, as well as user instruction and support over operation, is essential to achieving optimal comfort conditions and in maintaining this over the long term.

Kohler (Chapter 6) identifies the importance of the built heritage to maintaining cultural continuity. Design for flexibility and long-life form good sustainability characteristics and are part of the KST philosophy and approach to the full-life service of the house to extended durability. As the churn-rate in buildings is so slow, further research is required to improve understanding of how to economically retrofit the existing building stock to meet higher performance standards and on more effective reuse at end of life. Barriers to recycling can be overcome, for example by fiscal incentives such as landfill taxes, so that the resource input made to the built environment by previous generations is not squandered.

Lack of incentives

Baker's commentary (Chapter 13) identifies the important disincentive to action. Energy is cheaper now, in real terms, than at any time in the last quarter of the twentieth century. This is compounded by the lack of international agreements on targets for CO_2 abatement. The Kyoto proposal for an average of around 5% in CO_2 reductions is inadequate, but nevertheless should be ratified by all nations simply on the basis of making a start. That Kyoto has not been ratified by all is a testament to the fact that 'as the world sails into the new millennium, transnational corporations can be found at the helm, piloting and propelling global geopolitics and the process of economic globalisation' (Karliner, 1999). Carbon dioxide abatement and energy pricing are not a simple supply and demand equation but also a political issue. In this context politics and politicians are increasingly strait-jacketed. On the one hand, they are criticised for lack of vision and leadership when they fail to set rigorous environmental targets. On the other hand, they are criticised for any action that might threaten citizens' existing lifestyles and expectations. The Netherlands has shown leadership through setting a good national example with the objective of Factor 20 by 2050, based upon both environmental and international equity grounds.

In recent years, a wide number of European cities have used the Agenda 21 process to monitor consumption and set resource efficiency targets. This usually includes a basket of measures embracing energy, water, waste reduction and recycling. However, these rarely include targets approaching Factor 4 (50% reductions). There is little evidence that these measures lead on to resource reduction/efficiency targets for individual buildings and urban projects, beyond those set by international, national or regional regulations.

By their very nature, regulations tend to lag behind advances in knowledge. Current regulations on the quality or performance of construction products are actively discouraging the use of reclaimed and recycled materials and products. Many new (re)developments of traditional or indigenous techniques such as straw bale construction have emerged from an era that preceded that of regulation and the present technical 'frame of thinking'. So in an industry climate framed by a wider 'claim culture' it is very difficult to ensure that such techniques and recycled products can meet standards, and this effectively keeps them at the margin. This raises questions and challenges for the function and nature of built environment regulatory processes. How can regulation respond flexibly and in a timely manner to the current pace of technical change?

To some degree each of the various regulatory processes (fire, health and safety, minimum performance standards, material quality, etc.) represents a microcosm of the wider questions already explored. Obvious improvements in, for example, thermal insulation standards that would reduce pollution and save fossil fuel resources can be resisted by a consortium of vested interests in the preservation of the status quo. When discussing the need for more intensive action, manufacturers, constructors and their designers often refer to the need for a 'level playing field' set by regulation. However, science can be used to marshal evidence both for and against regulatory changes. In this context politicians and civil authorities should seek incremental change strategies in order to transform the regulatory process into a much more flexible, dynamic tool responsive to, rather than resisting, change.

Incremental change

An immediate step change to Factor 20 reductions would bring with it a number of undesirable short-term commercial consequences for the construction industry and have significant lifestyle implications for users. However, the introduction of year-on-year, aggregated improvements, such as those suggested by the Wuppertal Institute's *Modelling a Socially and Environmentally Sustainable Europe* (Wuppertal, 1998), appears to offer a much more viable route forward. Incremental change is being used in other sectors.[2] Fiscal incentives, such as gradually scaling up the excise duty on Freons (CFCs) in the US in the 1980s, show how effective this can be in stimulating change. However, this example underscores the importance of an international agreement (in this case the Montreal Protocol) as a stimulant to action and the need to act in concert regionally and globally.

The implications of this type of performance improvement for the construction sector are only now beginning to become an area of serious debate, let alone practical action. Underlying what Cole (Chapter 5) recognises as 'most national construction industries' procrastination' is the lack of fully binding global agreements about what targets should be set and upon the indicators of progress towards a more sustainable society. Seaden (Chapter 9) states categorically:

[2] For example, Marks and Spencer (a major clothing retailer in the UK) is increasing the organic fibre/decreasing the inorganic fibre content of its clothing by 1% per annum (Barry, 2002). This seems to offer the least challenging approach in both social and economic terms.

> 'There are few construction customers that will voluntarily reduce their competitive position by incurring additional costs and few countries that are willing to impose on their citizens additional expenses for the benefit of the global community. Thus general consensus and concerted action is required to advance the cause of sustainability in construction.'

Whilst this is a Western free-market perspective, the lack of such consensus continues to be a seriously disabling factor in all sectors and at all scales of action, be it global, regional, local or in terms of individual buildings.

Global versus local

This section explores the conflict between regionally appropriate environmental building practices within an increasingly global technical and economic culture.

Questioning the Western status quo?

Recent interest in 'alternative' medicine, the serious concerns over genetic engineering and the general increase in mistrust of science are all manifestations of a loss of confidence in the pursuit of technological advancement and the global economy that seeks to exploit it. This has led to the rediscovery of many 'traditional' practices in the belief that they offer another way of living that is more satisfying and/or fulfilling. Thus an emerging trend in the West is to question the underlying assumption that the pursuit or advancement of technological knowledge is a virtue, that will automatically lead to advancement in the quality or condition of human life.

Not questioning the Western status quo

Oliver (Chapter 15) vividly illustrates the damage that well meaning but insensitive introduction of so called 'more advanced' or 'more efficient' Western technologies can have in a foreign cultural context. Carter (Chapter 17) also makes this very clear in the case of Beijing and illustrates how many of the choices currently being made are rapidly closing off options for what can be described as a potentially more sustainable 'new Chinese way of living'. Architect Richard Rogers in a public RIBA lecture in the early 1990s described some difficulties over his urban design competition entry for a large area of Shanghai (Pudong), due to the fact that the chief civil engineer for the city was pressing for bicycles to be banned from the main roads 'because they got in the way of the cars'. Although this book does not try to address the particular problems of the developing world, these examples illustrate the attraction of the Western lifestyle and the pressure in the developing world to acquire it as soon as possible.

Pros and cons

Cooper (Chapter 2) points out that the pros and cons of the current manifestations of globalisation are hotly contested. The introduction above hinted at some of the positive aspects of a global perspective. On the other hand, very serious concerns have been expressed about the negative trends in the globalisation of trade and its impact on local culture and environments. Shiva (1999, p. 19), from a developing world perspective, refers to the present manifestation of so called free trade as '. . . not freedom for people but the right of corporations to force their rules on countries and societies'. As Cole, Kohler and Cooper (Chapters 5, 6 and 7) imply, the way the global economy functions forms the root cause of most aspects of the unsustainable lifestyle of the urban citizenry of the affluent countries.

Competitiveness between countries, regions, cities and even local districts within a city is an important component of globalisation. The holy grail of inward investment appears to be paramount, essential to short- and medium-term prosperity, resulting in various efforts to 'improve' the image of the place. Better transportation (a new runway at the airport, expressways), environment (more green space), quality of life (recreation and entertainment facilities) or fiscal and legal incentives such as tax rebates, free land or buildings, cheap energy, pollution permits are applied singularly or severally, to encourage investors and the economically powerful corporations through which they operate, to re/locate. This leads to what BEQUEST (Bentivegna *et al.*, 2002) has styled the *regeneration imperative*, which is most marked in the post-industrial cities. Sustainability analysis, if considered at all, is based on inappropriate political boundaries that do not reflect the true extent of, nor likely implications of change, for example, to a river catchment or in an adjoining community. The large infrastructure projects described by Michaud (Chapter 16) represent examples of this problem and although this form of development seeks to reap the technical advantages and economies of scale in such large 'institutional breaker projects' a number of important questions are raised in this context. Should this form of development be undertaken at all because they encapsulate many of the negative aspects of globalisation? This includes the following:

- The power of large international financial and consulting interests.
- The adoption of new governance measures and their imposition on the weakest members of society as well as the dislocation this incurs in both social and governance terms.
- Inappropriate measures resulting from project management innovation and expertise from other cultural traditions.
- A large scale of operation that inevitably leads to significant long-term social and environmental consequences, no matter what efforts are made to minimise or accommodate such effects, aptly described as 'monumental displacements' by Cook (Chapter 20).

This approach is of very questionable advantage over other development options undertaken at a smaller community scale, particularly when viewed from the emerging paradigm of sustainable development. It raises a number of questions for those involved in cross-cultural work across the entire range from mega-projects to single buildings. How can the procurement approach be substantially modified to include wider stakeholder and environmental interests, and who will pay for the more inclusive processes this implies? What lessons in creative front-end planning and procurement can be harnessed for other (smaller) built environment projects to create innovative rules, standards and institutions? Are changes in governance necessary? How can funding be facilitated and financial incentives (e.g. lower interest rates) given for more environmentally friendly solutions?

Reversing the trend

Sholtes' point 8 (see Box 7.1 on p. 111), 'globalisation is largely the result of human decisions, it can be debated and changed', reminds us that, in principle, we can reverse the trend. There are countervailing tendencies but they are weak. Michaud (Chapter 16) indicates that usually governments invite or actively collaborate in the types of mega-project described. This is often motivated by the urge to modernise, described above as the regeneration imperative (in the developing world context this is a euphemism for Westernisation).

Construction consultants should also question their own record in this area. Almost 80% of the design fees for projects in the developing world are earned by firms in the seven richest countries (Booth, 2002). This article, referring to the 'Western grip on Africa', expresses multiple concerns. There are fears that Western architects tend to design short-life 'disposable buildings' inappropriate to the cultural context, which as Kohler remarks tend to undermine the existing cultural value of building stock, as well as the post-colonial fears of stifling a new African identity. The dangers of cultural homogenisation have long been recognised in architecture (Shields, page 18) and have been the basis of policy making in the European Union (Curwell, page 202). Gann (Chapter 4) identifies the underlying cause as the misapplication of implicit knowledge, i.e. the things from our own culture and technology taken for granted and unwittingly exported (or forgotten) when we work in another. To avoid cultural or technological imperialism, consultants will have to understand and externalise what is embedded within them and seek new ways of working.

From a top-down perspective, trying to reverse trends for modernisation or Westernisation, and the risk of cultural homogenisation that this contains, leads back to international politics. The nature of the fora where important international consensus can be achieved (UN, World Summits, Habitat Conventions, the World Trade Organisation, International Energy Agency, etc.) indicates how ineffective and irresponsive such weak forms of global representation are and are likely to remain in the future. Although it is tempting to blame globalisation in the abstract for many of the world's woes, it is essential to understand that the real driving mechanism of the global economy is the *demand* for a very comfortable lifestyle in the affluent countries and the implied goods, services and resources. In some cases this demand has become such a strong expectation that it borders on the 'right to have', which is the cause of the political impasse referred to earlier. If the combined economic power of the OECD countries (effectively North America, Japan and Europe) continues to mean that, *de facto*, their actions (collective or not) effectively control the world's 'progress' then the vast majority of the citizens of the world remain disenfranchised.

A bottom-up perspective leads to the celebration and reinforcement of the nature and value of the local cultural context and of local building traditions. Carter's approach (Chapter 17) of long-term association with the 'new' culture by, in his case, living in China for 20 years is one very effective way of addressing the problem. The wider consultative methods adopted in community architecture and in 'planning for real' may offer alternatives that rely on a shorter time commitment. Nevertheless this calls into question the cross-cultural transfer of know-how from other cultures and places. This is the important challenge of the book – for architects, planners, clients, researchers and educators. The core question is whether it is possible to understand a culture properly without living within it for a long period of time so that interventions from 'outside' can be made in an appropriate manner. If the answer to this is no, then the free-market in building consultancy services, technologies and components must be questioned. In turn, a further question is raised whether design teams should seek, or be permitted to work in other cultures. If the answer is yes, how can design and development teams begin to understand the local milieu, and what aspects of other technologies should be used and how can their use be legitimised? The following section seeks to identify where answers to these questions might be found.

Cross-cultural transfer of know-how

This section discusses how knowledge of environmentally progressive building can be legitimately transferred across cultures without compromising regional and local practices.

Information versus real know-how

A number of the authors reflect more or less explicitly upon the difference between information and knowledge (Gann, Chapter 4; Cooper, Chapter 7; Cole, Chapter 5; Kohler, Chapter 6; Oliver, Chapter 15; and Cohen, Chapter 19). The failure of the users of 'global' information to understand the implications of the application of a technology in a 'foreign' context implies inadequate knowledge or full know-how. The term 'know-how' is a useful term meaning 'practical knowledge of methods' (OID, 1981). It is used here to signify both the information about the technology and the proper understanding of its use in the original local cultural context, in a way that should provide greater sensitivity in its application in a new context. Know-how includes the information of the technology as well as the tacit information identified by Gann (Chapter 4). As Oliver (Chapter 15) makes clear, this includes both the process by which the technology 'arrived' and the complete details of the cultural context(s) which developed it. So what is necessary to convey know-how to others and what format should be used? Presentation of know-how is usually handled through case studies, as this method appears to offer a feasible way of representing the rich complexity of the interacting technical, environmental, social, economic, political an institutional parameters.

Case studies as the vehicle for exchanging know-how?

In reality, full case studies with the necessary level of detail are rarely created due to the effort required and the recognised difficulty of achieving high quality. A wide range of criteria requires *representation*, *assessment* and *interpretation*. These include:

- climatic conditions, temperature, rainfall, topography, geology, etc.
- the environmental impact of the technology (e.g., the footprint and the units of assessment used)
- the socio-economic impact and 'fit', the jobs potentially created locally, the effect on other communities and the constraints created by the political context of the community and/or region. All are likely to be relevant.

Significant questions are what to include and leave out, the range of spatial scale(s) of action, time frames (where to begin and where to stop in time). BEQUEST provides a detailed framework for considering the range of development activities and sustainability issues for urban development in space and time, but was not able to address the wider cultural issues adequately (Kohler, 2002). So this writer hesitates to identify a complete recipe, but it is clear from Kohler, Oliver, Cook and Carter that methods and insights from anthropology may offer a guide.

The need for a standard reporting format for case studies has been discussed in the 'cluster'[3] of urban sustainability research projects funded through the Fifth Framework programme of the EU. The concept of the story, as an integrating mechanism (Cook) to help decide what is relevant to report, is also worthy of further investigation. However, as researchers are aware, case studies have inherent dangers. There is the risk of lack of objectivity and of post-rationalisation (i.e., identifying the positive outcomes without addressing the negative). From a construction perspective there is also the problem of confidentiality and responsibility. Individuals

[3] The 'Cluster' is a group of research projects addressing broadly similar issues. The object of the European Commission in 'clustering' is to increase cross-fertilisation between projects, to enhance overall impact, application and implementation of results.

and organisations rarely want their mistakes to be revealed. This often means that access to the complete story may be denied. Finally, end-users of case studies tend to 'cherry pick' those parts that interest them, such as iconic images, and often miss the essential contextual aspects. The nature and use of an enhanced case study methodology is an important question for future research in the wider context of cross-cultural studies in the built environment.

Diffusion or intrusion – the need to 'know why'

Can and should the patterns of thought that such detailed culturally rich case studies imply be exported? Implicit in this discussion is that by providing a body of know-how that can be used by others (i.e., that will 'travel' from the person who prepares it to a user located in a different context) case studies are a form of intrusion (Oliver). To avoid or manage this problem, 'know-how' transfer is dependent not just on proper understanding of the cultural context of the giver (i.e., where the technology originated) but also on getting under the cultural skin of the receiver, achieving the 'know why'. Even where a common language exists, with which to express and discuss these issues, the risk of misunderstanding is high (Cooper, 2002). This illustrates the importance of *understanding* both the commonalties and differences in underlying philosophies and value systems. As well as 'exporting' patterns of thought, the task involves mediation between different 'ways of doing things'. Carter identifies this intuitively when he questions the nature of recent developments in Beijing. When consultants take from another culture to use in their own, or give of their own in another, they are mediating between the universalising influences of the emerging global culture and the peculiarities of place. This is reflected in the celebrated 'think globally – act locally' philosophy that underpins the Agenda for the 21st Century developed at the Rio Summit. More recently it has been adapted as *glocalism* (noted by Shields and Cook), as well as the concerns of Ricoeur and Frampton (identified by Cooper in Chapter 7) known as critical regionalism and the similar bioregionalist ideas of KST.

Critical regionalism for a sustainable world?

Shields's dismissal in Chapter 3 of critical regionalist architectural thought is based on its being too narrowly drawn in the spatial and aesthetic preoccupations of architecture, thereby missing the wider social aspects. In contrast, Cooper (Chapter 7) argues that the 're-articulation' of critical regionalism as a philosophical basis of an architecture of sustainable places has the potential to reintegrate the local with the global. Adoption of such ideas by all members of the construction professions would be a significant step forward. Realistically, this philosophy would have to extend outside architectural confines to society in general, where it is unlikely to be appreciated, especially as the aspects of the current affluent lifestyle and its associated 'anonymous non-places' are deeply ingrained (Shields). Although architects can often influence clients' choices, effective defence of, and respect for, local ideals will require a wider recognition and power beyond that of architecture. Whilst supply side initiatives are important, the reactionary power of Nimbyism (NIMBY: acronym for Not In My Back Yard) needs to be given a more creative community focus, so that it can be harnessed to the critical regionalist cause and help challenge market forces.

Community values

Community architecture techniques, which in essence place architecture as a local (social?) service that seeks to help individuals and small self-help groups (re)develop their environment, is a very necessary adjunct to critical regionalism. The methods adopted in community architecture and in its urban planning counterpart, 'planning for real,' provide the means for wider community consultation over urban development options and the implied lifestyle choices. The expanding electronic superhighway offers many more possibilities for more effective local democracy. Soon we may all be able to vote electronically as in California over development plans for our city. The environmental symbiotic housing described by Iwamura (Chapter 19) provides a very good example of a sensitive consultative process that emphasises the relationship with place in terms of physiological as well as spiritual needs. Iwamura's chapter does not provide a full case study (in all the detailed aspects discussed above) but the consultation with and between residents, and the steps taken to provide cultural continuity and links with the past display exemplary characteristics.

In order to provide additional support to development of a critical regionalist movement and understanding in the wider community, national government and city authorities will have to take back certain power ceded to the multi-nationals. This will subordinate their brand to local identity, as expressed explicitly or implicitly through architectural form, aesthetics and graphics. In some cases this may need to include the way they operate, such as their transport methods, range of products/services or working conditions. This 'supplication' is to more regionally appropriate forms. Most private property developers are alert to the economic advantages of creating high-quality local environments, which are the basis of tourism in the heritage cities. In certain heritage cities, such as the historic centre of Florence, international fast food chains (and other international retail chains) have had to fit within the existing urban grain and so moderate their impact, when compared with other locations. This begs the question as to why anyone might want to eat burgers in Florence. Once more, we are back at the paradox of demand for goods and services. Increasingly, leisure travel is used to seek places (landscape, urban areas, cultural events) of specific identity which is in the process of being eroded in most modern cities.

Beyond a technical fix – towards a sustainable E-topia?

Most of the above comments are based on an environmental or ecological systems view of sustainable development, (e.g. humankind must not use resources faster than they can be substituted or replenished, nor generate pollution faster than it can be assimilated by the natural systems). The implications of this in terms of limits to growth, curbs on demand, and 'trade-offs' between growth and protection of the environment are being challenged. This is founded on a vision of a new 'knowledge economy', based on exploiting information and communication technologies in ways yet to be imagined (Mitchell, 2000; Johnston, 2002). Potential win–win scenarios are anticipated, which it is thought can achieve both prosperous and sustainable growth through the interaction of:

- accelerated communication technological development (the super highway)
- business process innovation
- a more service orientated economy based on knowledge rather than goods.

Along with the implied structural and social changes, the dematerialisation of affluent nations will result in new city and building forms – an E-topia (Mitchell, 2002; INTELCITY, 2002). As the US position on Kyoto shows, measures that may impose limits to growth are unacceptable to the free market global economic culture and too dangerous for some politicians as they challenge citizens' life style. Policy-makers, particularly in Europe, are rapidly pursuing the knowledge economy concept because it appears to offer a route to enhanced quality of life *without* increased resource use. This is clearly an option for the more pan-cultural affluent nations. However, if this develops in an entirely unfettered manner there is a serious risk that it will accelerate the negative aspects of globalisation and further increase the gap between the 'connected' haves and the 'unconnected' have-nots.

Concluding observations

Cultural and social expectations determine the nature of technological change. In the affluent countries this can be a limiting factor in slowing or restraining the application of new technologies that would have clear environmental benefits and in the longer term improve the quality of life. In the developing world there are clear conflicts between building practices developed globally and locally.

Gann's distinction (Chapter 4) between information and the fuller understanding implied by the term know-how indicates the nub of the problem in cross-cultural transfer. Inquisitiveness, the natural human instinct to explore, to discover, to know and understand how that world works in all its aspects has been the driving force in human scientific development. Oliver refers to other motivations in this natural diffusion: admiration, envy and desire to emulate. The local context in which people find themselves, the climate, topography, local flora and fauna and the way man has used his intelligence to manipulate his environment and survive, are the major shapers and indicators of the local culture. Thus understanding the nature and importance of the local context, the people and their culture is the *first law of cultural dynamics*.

The hunger for new insights and discoveries, now referred to collectively as *innovation*, leads on to technological advance which, when combined with the first law creates a powerful potential for inter-cultural exchange (i.e., to learn from others), be it from another country or another discipline. This potential is can be considered the *second law of cultural dynamics*, i.e., information will naturally flow from a technologically advanced culture to that which is, or feels itself to be, less advanced.

This book provides a number of detailed explorations into the nature of cultural dynamics in the context of the built environment. Given the strength of the second law it seems pointless to resist the natural hunger for and consequent flow of environmental building information that modern travel and the communication media can now facilitate. Thus it seems to be an inevitable flood and cannot be stemmed, but can only be channelled. The nature and form of the channel is dependent of understanding and sensibility to the first law, i.e., the *genius loci*. Balancing the positive outcomes of cross-cultural exchange whilst minimising its negative outcomes forms an essential challenge of our time and will be a major determining factor in whether we are able to manage the planet successfully.

In the context of the built environment, professional actors are the gatekeepers, they are filters of building technological knowledge. At the moment, cultural issues remain addressed primarily through the physical form of architectural heritage viewed through the Western perspective of 'the history of architecture by the comparative method'. As a result, construction professionals continue to lack sufficient understanding of the anthropological and socio-economic aspects to properly manage the balancing act between symbol, meaning and substance, which has major implications for practice and education. Reconfiguration of critical regionalism with a more community, consensual focus could provide a new paradigm, a new social contract for the construction industry. This can provide the basis of a system of shared values between professionals and users, for a more sustainable architecture that mediates between the global market pressures and the *genius loci*.

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