ADVANCES IN MANAGEMENT ACCOUNTING

VOLUME 15

MARC J. EPSTEIN
JOHN Y. LEE
Editors

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ADVANCES IN MANAGEMENT ACCOUNTING VOLUME 15

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INTRODUCTION

This volume of *Advances in Management Accounting* (AIMA) begins with a paper by Kowalczyk, Rafai, and Taylor on a new budgeting format, strategic budgeting, based on the notion that incorporating information symmetry into budgeting processes can reduce slack. This study incorporates information symmetry via mutual monitoring through a "group budget buffer." They compare this budget format to a traditional format, which does not incorporate information symmetry, and investigate differences in spending decisions among managers. The results show that groups using Strategic Budgeting spent less of the budget excess than those using Traditional Budgeting. This study is the first to experimentally examine the effects of this new type of budgeting technique, as compared to Traditional Budgeting, on managerial budgeting behavior.

The next paper by Silvola investigates the extent to which formal capital budgeting methods are used in small high-tech firms. High-tech firms are defined by their R&D intensity. They focus on the methods that are used by the small high-tech firms in evaluating the profitability of investment projects, estimating the cost of capital and making decisions related to the capital structure. The paper by Bento and White reports on a study of a new performance management model that encompasses budgeting, performance evaluation, and incentive compensation. To illustrate the model, survey data were examined using path analysis. The empirical evidence supports the model, and suggests several intervening variables that mediate the direct and indirect effects of budgeting, performance evaluation, and incentives on gaming behaviors and individual performance.

The paper by Bayou and Jeffries deals with the difficulty created by the absence of the reasoning stage in the analysis of long-term investment decisions. The traditional analysis focuses on the evaluation stage, using capital budgeting tools to rank alternative investment proposals. It tacitly assumes that the decision is to be made, thereby bypassing the reasoning stage. However, the reasoning stage may reveal that there is no sufficient justification (reasoning) to consider searching for and evaluating alternative proposals for this decision. Focusing on the reasoning component, the paper combines the "creative tension" and the "challenges" as the driving forces for the problem-finding step. To demonstrate the significance of filling the reasoning gap in the long-term investment decisions, the paper selects the modular manufacturing system and the complex investment decision required for its adoption.

In the next paper, Nourayi attempts to gain additional insights into the nature of the relationship between CEO compensation and firm performance. This empirical study examines the relatively unexplored areas of the non-linearity in the relationship. The study finds strong evidence that the relationship between executive compensation and firm performance is non-linear and asymmetric. Additionally, the structure of asymmetry is found to be dependent upon the measure of performance. The paper by Boulianne examines the empirical reliability and validity of the balanced scorecard framework and its associated measures. With reference to content validity, internal consistency reliability, and factorial validity, results show that the balanced scorecard, with measures grouped into its four dimensions, is a valid performance model. This study may help in the design and implementation of Balance Scorecards in business units.

The next paper by Hwang and Wu shows whether the emergence of specialized journals has affected management accounting research paradigms. Articles published in eight leading accounting journals from 1991 to 2000 are analyzed. The study finds that the overall percentage of management accounting research published in five non-specialized accounting journals has remained relatively constant, since the establishment of three specialized journals oriented to management accounting research, and the editorial boards of specialized journals appear to have broader interests in research topics, to be more flexible with regard to research methods, and are more willing to accept manuscripts adopting various theories. Overall, the results of this study support that the emergence of management accounting research journals impacted research paradigms gradually during the 1990s.

The paper by Harrison and Killough reports on a study using an interactive computer simulation, under controlled laboratory conditions, to test the decision and usefulness of activity-based costing information. The effects of presentation format (theory of cognitive fit and decision framing), decision commitment (cognitive dissonance), and their interactions were also examined. The results indicate that Activity Based Costing information yielded better profitability decisions, requiring no additional decision time. Presentation formats did not significantly affect decision quality and decision commitment beneficially affected profitability decisions.

The next paper by Wright and Elias attempts to identify the general risks knowledge-based organizations face and the additional risks unique to Knowledge Products Organizations (KPOs) using a survey. The general risks of managing knowledge include inappropriate corporate information policies, employee turnover, and lack of data transferability. Additional risks unique to KPOs include the short life span (shelf-life) of knowledge products, the challenging nature of knowledge experts, and the vulnerable nature of intellectual property. In the next paper, Abdel-Kader and Luther describe an operationalization of International Federation of Accountants's conception of the evolution of management accounting. The model is intrinsically interesting and has the potential for replication in other contexts and in comparative cross-national, inter-industry, or longitudinal studies.

The paper by Brierley, Cowton, and Drury reports on an exploratory study of the importance of product costs in decision making. The results of this survey-based research reveal the following: product costs that were used directly in decision-making were more important than those that were used as attention directing information and they were more important in product mix, output level, and product discontinuation decisions in continuous production processes manufacturing. In general, the importance of product costs in decision-making did not vary between the methods used to allocate and assign overheads to product costs, and it was not related to operating unit size, product differentiation, competition, and the level of satisfaction with the product costing system.

The next paper by Kee and Matherly examines the decision control aspects of target costing, which consist of ratifying product proposals and monitoring the products implementation. The study develops an equation for determining a product's net present value based on the same accounting data used during the initiation process. The article also describes monitoring a products implementation through periodic comparisons to flexible budgets and a post-audit review at the end of the product's economic life. The paper by Kote and Latham employs trust and commitment as two critical intangibles existing between organizations that directly and indirectly influence performance metrics, and tests a causal model where formal and informal interorganizational relationship structures impact trust and commitment, which then stimulates performance outcomes in the healthcare industry. Results demonstrate that relationship dynamics are vital drivers of tangible outcomes. Trust and commitment emerge as variables to be explicitly managed to improve performance.

We believe the 13 articles in Volume 15 represent relevant, theoretically sound, and practical studies that the discipline can greatly benefit from. These manifest our commitment to providing a high level of contributions to management accounting research and practice.

Marc J. Epstein
John Y.Lee
Editors

AN EXPERIMENTAL INVESTIGATION OF STRATEGIC BUDGETING: A TECHNIQUE FOR INTEGRATING INFORMATION SYMMETRY

Tamara Kowalczyk, Savya Rafai and Audrey Taylor

ABSTRACT

Prior research indicates that incorporating information symmetry into budgeting processes can reduce slack. This study investigates a new budgeting format, Strategic Budgeting, which incorporates information symmetry via mutual monitoring through a "group budget buffer", or pool, that supports funding non-budgeted expenditures. Department managers must seek approval from other managers to use pooled funds. We compare this budget format to a traditional format, which does not incorporate information symmetry, and investigate differences in spending decisions among managers. The results overwhelmingly show that groups using Strategic Budgeting spent less of a budget excess than those using Traditional Budgeting. The effect of the availability of unspent funds for a subsequent year's budget was also compared, with results indicating that this factor may potentially mitigate benefits gained from information symmetry over time. This study is the first to experimentally examine the

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effects of this new type of budgeting technique, as compared to Traditional Budgeting, on managerial budgeting behavior.

The ideal budget increases funding only in those areas needing extra funding, while simultaneously decreases funding in those areas where excesses exist. To do this, the upper manager would either have to be all-knowing, or would have managers willing to yield the excess. Since omniscient managers are rare at best, the most we can hope for is a budgeting technique that encourages managers to yield unneeded funds whenever they exist. How could this happen? Past research has linked information symmetry between peers (Fisher, Maines, Peffer, & Sprinkle, 2002b) and between agents and principles (Fisher, Frederickson, & Peffer, 2002a) to a willingness to reduce slack. However, past research has not operationalized methods for producing that information symmetry as a continual factor in the budgeting process.

The purpose of this paper is to test an emerging budgeting format built on the principle of information symmetry and peer monitoring. We will quantify the impact of these two conditions on the expenditure of excess budget funds. The comparison format is a traditional budget with information asymmetry on the principal-agent level as well as on the peer level.

In an experiment using 40 managers in service departments of a major manufacturing firm, it was observed that the tested format, Strategic Budgeting, produced significantly less expenditures of excess funds than did the traditional budget format. The experiment also tested the willingness of managers to share departmental funds with other needy departments given the difference in budget format. The results indicate that a budgeting format characterized by information symmetry and peer monitoring can reduce the propensity to build slack. The use of a group budget pool, the feature of Strategic Budgeting used to create these characteristics, was successful in reducing spending as compared to the traditional format distinguished by information asymmetry.

We also investigated how budget format, typified by the absence of information asymmetry and with peer monitoring, affects spending when excess unspent funds are not returned. Specifically, we use two manipulations of a variable where excess funds are either returned or not returned to the budget for the subsequent year. We found that when managers were given the knowledge that unspent funds would not be available in a subsequent year's budget, the spending behavior of managers in the Strategic Budgeting group was indeed different from those using the traditional format. While not significant at conventional levels, the descriptive results show that restrictive budget controls, which penalize managers for not spending excess budget funds could increase the propensity to create slack in the Strategic Budgeting group, while the opposite is true for the traditional format. Thus, the benefit of reduced spending associated with the elimination of information asymmetry via mutual monitoring may be negated when managers are fearful of future budget cuts associated with unspent funds.

Following suggestions by Kaplan (1993) on changes needed in managerial accounting research, this paper tests a practitioner "prototype" to see if it will work in a broader arena. The sample size is relatively small (40 managers) and tests what Kaplan labels, "What's New" research. We contribute to the literature evidence on the viability of a means for removing information asymmetry and utilizing peer monitoring in budgeting processes, which has a favorable effect on slack-building behavior. The remainder of this paper is organized in the following manner: the theoretical background and hypothesis development, description of the research method, discussion of results, and concluding remarks.

THEORETICAL DEVELOPMENT

Effects of Information Symmetry on Budgeting Behavior

The extant research has demonstrated evidence of the link between budget slack and information asymmetry. In general, studies have shown that budgets contained more slack under conditions of information asymmetry. For example, Merchant (1985) showed that when a superior can detect slack, managers are less likely to create slack. Similarly, the reduction or removal of information asymmetry between peers reduces slack-building (Fisher et al., 2002b). Finally, Chow, Cooper, and Waller (1988) and Chow, Cooper, and Haddad (1991) provide evidence that slack increases with the degree of information asymmetry that exists between agent and owner.

Recently, research has begun to focus on the fact that information asymmetry is less likely to exist between peers than between a superior and a subordinate. In recent studies, the effect of mutual monitoring of peers has been investigated. Mutual monitoring of peer behavior was shown to have a positive effect on reducing slack (Chow, Deng, & Ho, 2000; Fisher et al., 2002b; Stevens, 2002). In addition, Towry (2003) discovered that a system of mutual monitoring of peers improved the profit generating performance of managers when horizontal incentives were in place. This genre of research provides additional evidence of the benefits of reducing information asymmetry in budgeting processes.

Development of Strategic Budgeting: Origins in Project Management

Strategic Budgeting is a prototype budgeting technique that finds its roots in a project management technique named Critical Chain, developed by Eliyahu Goldratt. This methodology focuses on reducing the time it takes to complete projects. The technique is based on several assumptions.

The first assumption is that all project estimates contain a great deal of slack. Goldratt assumed that each task of a project is overestimated by a minimum of 100%, primarily because managers are held responsible for meeting project deadlines, which are "set in stone" (Goldratt, 1997). Heavy penalties are assessed for missing due dates, but no rewards are provided for early delivery of either a segment or the entire project. In fact, time saved on a feeder task may provide little benefit overall if managers on subsequent tasks are not prepared to take advantage of the extra time. Thus, managers overestimate individual task times to ensure that the project is delivered on time.

The second assumption is that forecasts in the aggregate are much more accurate than forecasts for individual segments; it is easier to predict the entire time needed for a project than to correctly estimate each task step. This assumption is validated by Otley (1985) who found that the aggregation of estimates reduces the skewness of those estimates. This is aligned with the premises of the Central Limit Theorem, which states that for large samples, distributions tend to be normally distributed, and any inaccuracies of the lower level forecasts are muted when the forecasts are combined.

The final assumption is based on Parkinson's Law, which states that work will grow to fill the time allotted for it (Parkinson, 1957). Simply put, even when task time estimates contain a large amount of slack, all of the allocated time will be used. Parkinson observed that while ships in the British Navy decreased from 1914 to 1928 by almost 68%, the number of dockyard and Admiralty personnel increased by over 40 and 78%, respectively. Using a formula he developed, Parkinson hypothesized that administrative staffing will increase by over 5% annually, regardless of the level of the entity's workload.

Using Parkinson's Law as the base, Goldratt theorized that, regardless of the time allotted to any particular task in a project, all of the time would be used in most cases. In fact, due to a phenomenon known as the "Student Syndrome", time spent on tasks will exceed allotted amounts (Goldratt, 1997, 1999). This phenomenon is characterized by procrastination in starting tasks due to the excessive padding of time budgeted for each task step. Thus, delay in starting the task, combined with unforeseen events which cause further postponement, results in tasks completed past deadlines and over time budgets.

In order to counteract the unnecessary padding of time and the Student Syndrome, Dr. Goldratt recommended cutting time estimates for each project task in half and then grouping all of the time saved from individual tasks into one "project buffer" placed at the end of the project's estimated time sequence. The "project buffer" was then reduced by one half in order to reduce the overall project time allowed by one third of its original estimate. For any task that required more time than allotted, extra time could be pulled from the project buffer. In this way, the entire project could be completed within the aggregate allotted time. Using simulations to test the Critical Chain methodology, Goldratt showed a significant decrease in the total time needed to complete a task. Similar results were found in actual industry applications, where companies experienced dramatic reductions in the time necessary to complete projects, validating the assumptions for Critical Chain Project Management techniques.

From Critical Chain to Strategic Budgeting

In 1999, a manager of a service department in a major manufacturing company invented a new budgeting technique, called Strategic Budgeting, in order to deal with cost reduction mandates from upper management. The manager's goal was to reduce the budget without reducing headcount or decreasing the outputs of the service departments. The budgeting technique appropriated the model provided by Critical Chain for project management and applied it to budget estimates (documented in Taylor & Rafai, 2003). Following the assumption that large amounts of slack existed in departmental budgets and using the idea of a group project buffer from Critical Chain, the budgets of each department were cut in half and the halves were gathered into a Group Budget Buffer (GBB) for utilization by the entire group if needed. The structure of the Strategic Budgeting method as compared to a Traditional Budgeting format can be seen in Fig. 1.

Access to extra funds in the GBB could only be obtained by agreement among all of the department heads and the division manager. In this way, information symmetry was a condition of using the excess funds. Similar to the profit increasing results Towry (2003) reported in her experiment using

Strategic Budgeting Format Departmental Budget Allocations	
Service Budget = $5,000,000	
Applications Development Budget = $2,000,000	
	Group Budget Buffer = $10,000,000
Systems Hardware = $1,500,000	
Program Management Budget = $900,000	
Systems Integration Budget = $ 600,000	
Testing Division Total Budget = $20,000,000	

Traditional Budget Format Departmental Budget Allocations	
Service	$10,000,000
Applications Development	$4,000,000
Systems Hardware	$3,000,000
Program Management	$1,800,000
Systems Integration	$1,200,000
Total Testing Division Budget	$20,000,000

Fig. 1. Comparison of Strategic Budgeting to Traditional Budgeting.

peer monitoring, the managers in this implementation spent less than the funds available and found synergies among the departments to enable the division to increase and/or maintain the service levels by providing needed services to each other and by reducing redundancies. The end result was a reduction by 37.6% in expenditures (Taylor & Rafai, 2003). Thus, just as transparency of information was a boon to profitability in Towry's experiment (Towry, 2003), so it was to innovation and cost reduction in the Strategic Budgeting implementation.

The term Strategic Budgeting was coined despite the reduction across the board in each department's budget by 50%. The strategy in Strategic Budgeting comes into play as peers negotiate for the use of GBB funds. To justify using shared GBB funds, a department head would have to demonstrate the justifiable need for those funds in light of the divisional goals. It is the justification process that focuses all participants on the divisional and corporate goals, thus the title, Strategic Budgeting. For example, in the case study the department heads negotiating for group funds found synergies to supply the resources needed by the department requesting the extra funding, without dipping into the funds. However, when one department required equipment to reduce warranty related issues the other department managers approved the fund transfer. Due to the fund transfer, the receiving department actually *doubled its original funding* prior to the original reductions. Thus, the Strategic Budgeting method fostered collaboration and strategic problem solving to achieve corporate goals for reduced spending.

The Strategic Budgeting method recognizes the slack reducing behaviors brought about by information symmetry, and incorporates a mechanism to address the assumption that aggregate forecasts are more accurate than at the task level. Since each department is allowed to draw from the GBB, any misallocation of funds is easily corrected at mid-year by reallocation of shared funds. Simultaneously, the information symmetry and peer monitoring involved in any withdrawal reduces the chances of any one manager withdrawing funds for frivolous expenditures.

Prior to this study, the empirical analysis on Strategic Budgeting as a viable means to reduce spending and slack-building through the benefits of information symmetry was limited to simulations and one case study. This paper contributes experimental investigation of the effects of Strategic Budgeting as compared to a traditional budget format, which does not incorporate information symmetry or peer monitoring.

HYPOTHESES

Hypothesis 1: Format of the Budget

In prior research, budget format has been shown to have a strong impact on budgeting behavior (Franklin, 2002; Grizzle, 1986; Hopwood, 1972). Format was also found to have an impact on the amount of money spent in governmental budgets. Aggregate budgets resulted in less money being appropriated than did those which followed the traditional line by line itemization format (Franklin, 2002).

In this paper we test two different forms of budgeting. The differences are primarily the size of the individual budgets for each department, the existence or non-existence of a group monetary pool and the resulting amount of information asymmetry that exists between departmental managers in the same division. The managers for both budgeting forms participate at the year end in deciding how much of their slack to return to the corporation.

In our study, the Strategic Budgeting method (SB) highlights the availability of funds unspent in the transparent GBB. Therefore, divisions using

SB have greater information symmetry. For divisions using SB, all department heads know what is in the buffer and any proposals to spend buffer funds. As a result, managers should be more reluctant to spend the buffer funds for unnecessary expenditures. In contrast, for divisions using Traditional Budgeting (TB), only the head of the department knows how much excess exists in his or her own department. Therefore, due to greater information asymmetry, managers should be more likely to spend excess funds than those using the SB format. This leads to our expectation that the SB format, representative of information symmetry, is linked to reduced spending, which in turn, leads to reduced slack, i.e., better performance. The following hypothesis investigates this expectation:

H1. Spending of excess funds available will be less for those using Strategic Budgeting as compared to Traditional Budgeting.

Hypothesis 2: The Availability of Unspent Slack

There have been contradictory results regarding the effect of a budget excess on managerial spending patterns. Some studies have demonstrated that the tighter the budget, i.e., restricted funding, the lower the levels of slack (Dunk, 1993; Van der Stede, 2000). In contrast, Merchant (1985) determined that slack increased as budgetary controls tightened. Similarly, Onsi (1973) interviewed managers to determine if they created slack in their budget estimates. Although none of the managers interviewed admitted to creating slack, they stated that they spend every dollar they are allocated. In fact, several managers emphatically stated that they made sure that every dollar was spent! So managers tend to spend the entire budgeted amount, even if excesses are available to refund to the company at year end (Otley, 1978; Onsi, 1973). Thus, fear of budget cuts in future years may be a larger motivator than tightness of budgets in reducing unnecessary expenditures. As a result, managers faced with losing future funds will be highly motivated to spend excess funds rather than lose them.

This study extends the literature by investigating the effect of the availability of excess funds on spending behavior, as moderated by the type of budget format used: one with information symmetry and one without. Following the literature, plentiful evidence supports the notion that information symmetry is associated with a lower propensity to spend funds unnecessarily. Where there is the ability for others to observe spending behavior, managers are cognizant of the need to appear frugal. For example, Stevens (2002) discovered that reputation concerns were more evident in an environment with information symmetry. Specifically, managers who were worried about their reputations tended to build less slack. Thus, it is likely where information symmetry exists, the availability of excess funds will not have an impact on spending behavior, as unnecessary spending would be avoided.

Our experiment spans a hypothetical period of four years. All managers have sufficient funds to complete their required tasks. For half of the groups the budget amounts are constant for both years. For the remainder of the budget groups the budgets are cut from year 1 to year 2 and in each subsequent year, dependent upon how much of the previous year's appropriation was not spent. Due to this condition, half of the budgets had plenty of funding and the other half had fewer dollars to spend. The predominant theory would predict that those with fewer dollars to spend would have tighter budgets. Therefore, those with tighter budgets should spend less of their available excess than those with "looser" budgets.

Alternatively, if managers suspected that the unspent amounts would be available year after year, unlike the managers Onsi interviewed (1973), they should be more reluctant to spend amounts, which they know are not needed for the current year. Thus, managers receiving unspent funds back in their budgets each year would potentially spend less than those having their budgets cut each year by the amount not spent or by some minimum amount.

While there is evidence to support the notion that the availability of unspent funds does affect spending decisions, the conflicting results in the extant literature prevent a definitive statement of the expected direction of the difference in behavior between tight and loose budgets. The following hypothesis investigates this relationship:

H2. Spending *will differ* between those receiving all of their unspent funds back (loose budgets) and those with budgets that are reduced by the amount not spent (tight budgets).

RESEARCH METHOD

Task

To test our questions, we developed an experiment covering four hypothetical years, using a task that involved several budgetary decisions on spending and allocating funds. Over the hypothetical 4-year period, participants were asked to make decisions about whether to spend excess budget funds. The task was administered using a computerized program where responses were captured from data input, and users were only allowed to go forward, i.e., prior decisions could not be changed. The experiment was given over a one-week period on site at the corporate headquarters in the United States of a large international manufacturing company. The managers came to a central location where computer stations were available.

Experimental Design

The experimental design and illustrative depiction of the treatment groups are shown in Fig. 2.

Participants were randomly assigned to one of four treatment groups, characterized by 2 independent variables, each with 2 manipulations. The first variable was budget format, consisting of the use of either Strategic Budgeting (SB) or Traditional Budgeting (TB). The manipulation of the second variable, availability of unspent funds, was introduced in the second year. This manipulation operationalized the tightness of budgetary control. Using the computer program, participants read instructions for completing the task, and were given a hypothetical role as a departmental manager in a non-production division of a large manufacturing firm. The structures of the initial budgets provided to the treatment groups are illustrated in Fig. 1. In each of the four years, participants were given information about how much of their budget had been spent by the last month of the year, and were asked to decide how much of their remaining excess budget they would spend before year end. At the beginning of each subsequent year, participants were

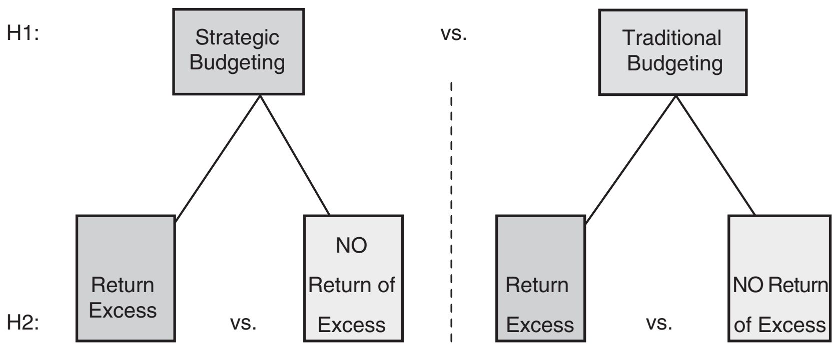

Fig. 2. Experimental Design and Treatment Groups.

given a new budget for the year, which for half of the groups with the tighter budget manipulation, was contingent on prior year spending decisions. The same spending decisions were made for each year.

Dependent Variables

The dependent variable of primary interest in this study was the level of spending, measured as a percentage of funds available. The primary means for measuring this variable was from responses on how much of an excess budget amount, available at the beginning of the last month of the year, would be spent before the end of the year. The excess available budget varied between the groups, depending on assignment of budget type and availability of unspent budgeted funds.

Another dependent variable was also measured in this study, but is not the focus of this paper. This variable was sharing of funds with other departments in need, a concept we refer to as collaboration. This variable was measured by providing participants with a scenario where another department had insufficient funds for an unforeseen expenditure. Participants were asked whether they would share some or the entire requested amount with the other department. For the TB group, this amount would come from department funds, while for the SB group it would be requested from the GBB. It is relevant to mention this variable as it was measured each year *before* the spending of excess decision was made. However, statistical analysis showed no significant effect of this variable in our analysis of the spending variable discussed above.

Independent Variables

To investigate the hypotheses previously discussed, the utilization of two independent variables was required. For each variable there were two manipulations, and other factors were held constant so that appropriate comparisons could be made between the two treatments. The first independent variable was format of budget, Strategic Budgeting (SB) vs. Traditional Budgeting (TB). All scenario information provided to the treatment groups was identical with the exception of the availability of a GBB in the SB group. Instead of an excess departmental budget amount, which was available in the TB group, the SB group had funds available in a group pool, which could only be accessed by approval from other departmental managers within the same division.

Table 1. Participant Demographics.

	n	Mean	Standard Deviation	Minimum	Maximum
Age[a]	36	46.1	6.98	32	62
Years educated	40	16.5	2.24	12	21
Budgeting experience (years)	37	8.2	8.52	0	30
Perceived difficulty of task[b]	40	2.5	1.12	1	6

[a]In addition, 20% of the participants were female.
[b]Perceived difficulty of task was measured on a 7-point Likert scale with 7 being the most difficult.

The second independent variable, introduced in year 2, was the availability of unspent funds from the prior year's budget. The manipulation of the variable was that a group either had their unspent funds returned to their department budget each year (loose budgets), or had their budgets reduced by the lesser of their unspent funds or by a minimum fixed amount (tight budgets). The manipulation of this variable resulted in the creation of 4 treatment groups (2 within each budgeting format).

Subjects

The subjects for this study were 41 managers in a non-production department at a large manufacturing company. A significant outlier was eliminated, leaving 40 useable responses. To promote conscientious effort in completing the task, participants were told that the results of the study would provide useful information about an alternative budgeting process, which could be helpful in their future budgeting decisions. To compensate participation, subjects were given a coupon for a free lunch in the company cafeteria.

The homogeneity of the groups was evaluated by testing for differences in demographic data collected from the participants. Demographic information included age, gender, title, managerial experience, and budgeting experience. Because there were no statistically significant differences between treatment groups, none of the demographic variables were included as control variables in subsequent analyses. A summary of the overall means of the demographic variables is provided in Table 1.

RESULTS AND DISCUSSION

The most notable result overall was the significantly lesser amount of spending by the SB groups than the TB groups. The mean responses for the spending of excess funds by year and manipulation of the independent variables are provided in Table 2.

Format of Budget: Hypotheses H1

Hypotheses H1 states that format of the budget, Strategic vs. Traditional, will affect the comparison of spending between groups. Notably, in each of the four years, the Traditional Budgeting groups spent significantly more than the Strategic Budgeting groups. Overall, the TB groups spent approximately 26% more, on average, than the SB groups ($p < 0.001$). As anticipated, the availability of the GBB appears to reduce overall spending among the SB groups. Conversely, those using the Traditional budgeting format, lacking information symmetry, appear to create more slack in their budgets. The results for the first hypothesis are in Table 3.

These results are aligned with prior literature, which found that the existence of information symmetry is associated with reduced spending. Apparently, even in the face of department budget cuts, managers were motivated to avoid unnecessary spending under the umbrella of mutual monitoring associated with the division's GBB. Indeed, anecdotal evidence from explanations for decisions provided by participants revealed that

Table 2. Descriptive Statistics for Spending.

	Percentage Spent out of Total Available						
	n	Year 1 (%)	Year 2 (%)	Year 3 (%)	Year 4 (%)	Avg Spent[a] (%)	Total Spent[b]
Strategic budget	20	2.45	2.94	2.99	3.83	3.06	567,500
Traditional budget	20	36.56	31.72	26.41	25.18	29.97	3,958,500
SB – Unspent avail (UA)	9		2.44	1.20	1.20	1.51	555,556
SB – Unspent not avail (UNA)	11		3.36	4.45	5.98	4.32	577,273
TB – Unspent avail	10		41.03	31.25	32.92	36.97	6,000,000
TB – Unspent not avail	10		22.42	21.57	17.45	22.97	1,917,000

[a]Avg spent represents the average percentage of available funds spent (the Spend variable) over all 4 years.

[b]Total Spent is the total dollars of excess budget (or slack) spent over all 4 years.

Table 3. Results for Hypothesis 1: Effect of Budget Format.

Univariate Tests						
Dependent Variable		Sum of Squares	df	Mean Square	*F*	Sig.
% Spent – Year 1	Contrast	11527.209	1	11527.209	18.399	0.000
	Error	22554.946	36	626.526		
% Spent – Year 2	Contrast	8319.834	1	8319.834	13.286	0.001
	Error	22543.110	36	626.197		
% Spent – Year 3	Contrast	5319.032	1	5319.032	7.751	0.008
	Error	24703.119	36	686.198		
% Spent – Year 4	Contrast	4148.876	1	4148.876	7.207	0.011
	Error	20724.467	36	575.680		
Average % Spent	Contrast	7075.124	1	7075.124	17.202	0.000
	Error	15217.864	37	411.294		
Total Spent	Contrast	1.08E +14	1	1.078E +14	13.314	0.001
	Error	3.00E +14	37	8.097E +12		

Pairwise Comparisons for SB vs. TB			
Dependent Variable	Mean Difference (SB – TB) (%)	Std. Error	Sig.
% Spent – Year 1	−34.03	7.935	0.000
% Spent – Year 2	−28.92	7.933	0.001
% Spent – Year 3	−23.12	8.305	0.008
% Spent – Year 4	−20.42	7.606	0.011
Average % Spent	−26.63	6.421	0.000
Total Spent	−3,287,520	900,964	0.001

managers did not spend excess funds because they did not ‘‘need’’ the extra funding and, therefore, would not spend it. In fact, in the first year, over 75% of the SB managers stated, in some form, that the reason they did not spend any or much of the GBB excess was simply because they did not need it. In contrast, only 35% of the TB managers made similar statements. Instead the TB managers explained their end of the year spending by either stating that they were buffering for risk (20%) or that they were protecting their personal metrics in their own department (45%). The results validate the findings of previous studies on the impact of information symmetry between peers and are especially interesting in light of Steven's 2002 study documenting the desire of monitored managers to appear to be ethical. Thus, it appears that the Strategic Budgeting format may be a viable means for implementing the characteristic of information symmetry via mutual monitoring for budget goals that include reducing unnecessary spending.

Availability of Unspent Budget Funds: Hypotheses H2

Hypothesis H2 states that the availability of unspent budget funds will affect the decision to spend excess budget funds. Our expectation was that groups who lost prior year unspent funds in a subsequent year's budget would be more inclined to spend future excess funds to insure against further budget cuts. Within the SB groups, the descriptive statistics suggest that this effect did occur. That is, as excess unspent funds were taken away from the GBB, managers appeared to increase unnecessary spending to retain future funds. While the differences were not statistically significant at conventional levels, given smaller sample cell sizes, it is noteworthy to examine the trends between groups suggested by the descriptive results. The results for the tests of Hypothesis H2 are in Table 4.

The lack of statistical significance in the comparison of the SB groups requires a rejection of Hypothesis 2 in favor of a conclusion that there is no effect from restrictive budget controls among those using the Strategic Budgeting. Such a result is quite interesting. The fact that the managers in the two SB groups spent similar amounts (from a statistical standpoint) regardless of the size of the GBB demonstrates the power of a budgeting format which includes information symmetry as an integral factor in the spending decisions for that excess.

On the other hand, within the TB groups, the evidence suggests that the availability of unspent funds increases spending. While this comparison was only statistically significant in year 2, this is important as it was in this year that the manipulation of this variable was introduced. In particular, the group not penalized for underspending (i.e., retained unspent funds) spent significantly more than did the group penalized for underspending. The managers had been informed that management was rewarding them with good performance reviews if they contained or reduced their costs. The results indicate that managers in the TB group having funding cut each year placed greater weight on management's directives to reduce cost than did those having their budgets returned each year even when the funds were not needed. This result gives weight to previous studies by Locke and Latham (1990), Merchant and Manzoni (1989) and Fisher et al. (2003) showing that tighter budgets are more motivational than are looser budgets when a traditional departmental budgeting format is used. However, when the SB

Table 4. Hypothesis 2 – Effect of Availability of Unspent Funds.

Analysis of Variance

		Sum of Squares	df	Mean Square	*F*	Sig.
% Spent – Year 1	Between groups	12407.881	3	4135.960	6.720	0.001
	Within groups	22157.856	36	615.496		
	Total	34565.737	39			
% Spent – Year 2	Between groups	10018.137	3	3339.379	5.242	0.004
	Within groups	22931.574	36	636.988		
	Total	32949.711	39			
% Spent – Year 3	Between groups	6005.376	3	2001.792	2.959	0.045
	Within groups	24358.067	36	676.613		
	Total	30363.443	39			
% Spent – Year 4	Between groups	5868.067	3	1956.022	3.286	0.032
	Within groups	21427.788	36	595.216		
	Total	27295.855	39			
Average % Spent (Years 2–4)	Between groups	7118.422	3	2372.807	5.817	0.002
	Within groups	14685.649	36	407.935		
	Total	21804.072	39			

Multiple Comparisons

	Groups[a]		Mean Difference (I–J) (%)	Std. Error (%)	Sig.	95% Confidence Interval	
	I	J				Lower Bound (%)	Upper Bound (%)
% Spent – Year 2	1	2	−0.92	11.344	0.936	−20.07	18.23
	3	4	18.61	11.287	0.108	−0.45	37.67
% Spent – Year 3	1	2	−3.25	11.691	0.783	−22.99	16.49
	3	4	9.68	11.633	0.411	−9.95	29.32
% Spent – Year 4	1	2	−4.78	10.966	0.665	−23.30	13.73
	3	4	15.47	10.911	0.165	−2.95	33.89
Average % Spent (Years 2–4)	1	2	−2.9859	9.07805	0.744	−21.3971	15.4252
	3	4	14.5872	9.03255	0.115	−3.7317	32.9060

[a]Group Numbers: 1 = SB with excess funds returned; 2 = SB without excess funds returned; 3 = TB with funds returned; 4 = TB without excess funds returned.

format is used, spending is slightly higher in the groups penalized for underspending. This difference is not significant, but interesting. The SB managers having all unspent funds returned behaved dramatically different than did those in the TB groups when their funds were returned. Managers with plenty to spend in the SB groups appeared to spend less than their counterpart TB managers.

Limitations

As with any controlled experiment, potential limitations of this study could affect the interpretation of the results. The use of participants at only one company limits the generalizability of results. In addition, the hypothetical division only had five departments, and it was a relatively simple structure. The scope of control of the GBB and the ability to mutually monitor it should be easier in a simple organizational structure as compared to a more complex one. Similarly, lack of an actual reward for performance on the task may not provide the same incentive to perform as that provided in an actual management setting, even though participants were well aware of the emphasis on good budget performance. However, the company surveyed in this experiment was in a cost cutting mode, having had news the week prior to our experiment that profit projections were overstated by 90%. Therefore, the attitude of all managers should have been to take cost cutting very seriously.

As with experimental research, our findings should be taken in light of uncontrollable weaknesses to both internal and external validity. On the other hand, according to Hogarth et al. (1993), as research is compiled across a number of different settings, the validity of specific results can take shape. We are hopeful that future research examining Strategic Budgeting in different budgetary environments with varying participants will provide additional insights on this new budget method.

CONCLUSIONS

Prior literature has provided sufficient evidence that information symmetry and peer monitoring have positive impacts on a budgeting process by reducing spending and the propensity to create slack. This study investigates a budgeting technique, which can be used to integrate these characteristics into budgeting environments. Specifically, the Strategic Budgeting format incorporates a mechanism for information symmetry via mutual monitoring of the GBB. The results of this study provide support that this budget format can be successful in reducing unnecessary spending and slack building. Even though the actual external environment of the managers in the surveyed company was such that cost reduction was considered critical to the company's future, the difference in the amounts spent in the two primary groups was still significant. Evidently, the SB format can produce significantly higher cost reductions among managers already highly motivated to contain costs than can a Traditional Budgeting format.

However restrictive controls that penalize underspending of excess funds could, over time, produce behavior, which negates the benefits gained by the SB format. Indeed, even information symmetry may not mitigate the fear of future budget cuts when managers are penalized for strategic spending and reducing costs. Implementation of budget formats based on the Strategic Budgeting technique should consider potential consequences of controls that are too restrictive on the availability of unspent budgeted funds. It should be reiterated, however, that managers in both SB groups did not spend significantly different amounts regardless of the amount of the unspent funds returned from the GBB. Therefore, there should be no downside to returning unspent funds to managers using the SB format. In addition, future research should focus on other factors, such as individual vs. group performance incentives, or the nature of the surveyed company's external competitive market, that could interact with the mutual monitoring characteristic of Strategic Budgeting.

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LOW-INTENSITY R&D AND CAPITAL BUDGETING DECISIONS IN IT FIRMS

Hanna Silvola

ABSTRACT

This paper investigates the extent to which formal capital budgeting methods are used in small high-tech firms. We define high-tech firms by their R&D intensity. In addition, we define software industry as a special type of R&D-intensive firm. We focus on the methods that are used by the small high-tech firms in evaluating the profitability of investment projects, estimating the cost of capital and making decisions related to the capital structure. Our results based on two surveys of Finnish firms indicate that the high-tech firms use similar capital budgeting methods and estimate their cost of capital in a similar way to other small-sized firms in other industries. Moreover, high-tech firms seek external financing and co-owners.

1. INTRODUCTION

In the accounting literature, much research effort has been devoted to the investigation of the investment and financing decisions of the firm. There are two main issues involved in capital budgeting decisions, i.e. the decision

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which investment projects should be accepted and how the accepted projects should be financed. A large number of methods are available for the evaluation of the profitability of the investment projects, and the firm has to choose the most appropriate to its purpose. A contingency theory assumes that firm characteristics such as size of the firm affect the firm's decision in choosing method. On the other hand, the life-cycle theory (e.g. Miller & Friesen, 1983, 1984; Churchill & Lewis, 1983; Greiner, 1972) suggests that firms at the same stage of their life-cycle use similar methods to evaluate investment proposals.

Empirical research has attempted to identify the factors that affect the firm's choice of investment evaluation method. Graham and Harvey (2001) find that the use of specific investment evaluation techniques is linked to firm size, which is also commonly used as an indicator of the life-cycle of the firm (e.g. Moores & Yuen, 2001; Miller & Friesen, 1983). Previous studies focusing mainly on large firms suggest that the internal rate of return is the most frequently used method in such evaluation (e.g. Stanley & Block, 1984; Gitman & Forrester, 1977). Graham and Harvey (2001) find that large firms rely heavily on the net present value techniques, while small firms more frequently use the payback method. Similar results are reported by Sangster (1993) who finds that small firms prefer the payback method instead of the net present value method or internal rate of return despite their theoretical superiority. The net present value method is generally considered to provide the most accurate basis for decisions, because it takes into account the discount rate and considers the whole lifetime of the investment project. The cost of capital plays an important role when discounted cash flow techniques are used. Several studies (e.g. Graham & Harvey, 2001; Bruner, Eades, Harris, & Higgins, 1998) report that firms calculate the cost of capital with the Capital Asset Pricing Model (CAPM, henceforth). Graham and Harvey (2001) find that large public firms, CEOs with an MBA degree, firms with a low degree of financial leverage and firms with high foreign sales are more likely to use the CAPM than are small-sized firms.

Most of the previous studies in the area investigate capital budgeting decisions of large firms without any special focus on the branch of industry of the firm. Results regarding the capital budgeting decisions of high-tech firms are limited, even though the industry has grown rapidly and there are certain special characteristics that are likely to affect their capital budgeting decisions. To illustrate, high-tech firms make substantial R&D investments. These investments are often particularly uncertain and the cash flows are expected to be earned far in the future, because the products to be sold do not even exist when the investment proposal is analyzed. This calls for analytical tools for analyzing investment decisions. In addition, high-tech firms often have well-educated, technically proficient managers, who have capabilities and knowledge to use sophisticated decision-making tools (e.g. Laitinen, 2001). High-tech firms also need to invest heavily in intangible assets without collateral, meaning that they need risk (equity) financing including venture capital financing (e.g. Cassar, 2004; Davila, Foster, & Gupta, 2003; Amir & Lev, 1996). Equity investors often require that the firms should use reliable and sophisticated management control and reporting systems (e.g. Granlund & Taipaleenmaki, 2005; Lerner, Shane, & Tsai, 2003; Mitchell, Reid, & Terry, 1997; Robbie, Wright, & Chiplin, 1997).

This paper investigates capital budgeting decisions in small high-tech firms. We focus on the methods these firms use for evaluating the profitability of investment projects, estimating the cost of capital and making decisions related to their capital structure. Our aim is to identify the capital budgeting methods typically applied in small high-tech firms. We classify firms as high tech based on their R&D intensity. In addition, we analyze the software industry as a special case of the high-tech industry. The empirical analyses are based on the surveys of the Finnish small high-tech firms.

This paper extends the current literature in three main respects. First, it contributes to the literature on the capital budgeting decisions of the firms by providing evidence on the capital budgeting methods used by small-sized high-tech firms, while most of the papers in the area investigate large public firms (e.g. Graham & Harvey, 2001; Stanley & Block, 1984; Sangster, 1993; Gitman & Forrester, 1977). Second, the paper investigates how the special characteristics of the high-tech firms affect their capital budgeting decisions. There is very little research on capital budgeting decisions in small high-tech firms, although they are faced with the more complex challenges than are the small firms in other industries. Third, the paper contributes to the literature by using a sample of Finnish firms and, therefore, by providing results from outside the US. The high-tech industry is rapidly growing in Finland and the paper provides unique results from the field.

The rest of the paper is organized as follows. The next section reviews the relevant literature on capital budgeting decisions in high-tech firms. The third section describes the data and provides preliminary data analysis. Empirical results are presented in the fourth section. The fifth section concludes the paper.

2. CAPITAL BUDGETING DECISIONS IN HIGH-TECH FIRMS

2.1. Managing High-Tech Firms

A high-tech firm can be defined as a firm that systematically develops, produces, or uses new technological skills and invests money in R&D activities (Laitinen, 2001). High-tech firms have certain special characteristics that affect their business operations. High-tech firms have a strong scientific–technical base and they are established for the purpose of exploiting a technological innovation (Berry, 1998). These firms operate on fast-changing markets where they need to respond quickly to technological and market developments (Ackroyd, 1995). In addition to high R&D intensity, high-tech firms are characterized by knowledge intensity, high business risk, high growth potential and the need for venture capital financing (e.g. Granlund & Taipaleenmaki, 2005; Cassar, 2004; Davila et al., 2003).

Previous findings in the financial accounting literature indicate that R&D expenditures can be seen as an investment rather than a cost (e.g. Chan, Lakonishok, & Sougiannis, 2001; Lev & Sougiannis, 1996). Investors view R&D expenditures as investments rather than as costs because R&D expenditures increase the current market value and the future earnings of the firms. Knowledge-based firms have a lot of intangible assets and their profits in future years are generated slowly. The time lag between the R&D investment and the realization of benefits is generally unknown and usually long. Therefore, R&D investments involve an exceptionally high risk. The outcome of these investment projects is more uncertain than that of other capital expenditures.

Previous studies that pay attention on technology industries show that the size of the firm is not the main determinant of the accounting systems used by the firms in these industries. Several studies indicate that the accounting systems of high-tech firms are mainly determined by the previous experience of the managers and the balance of skills within the management team. Usually, small firms face a certain difficulties with adopting accounting systems, because they have little or no in-house accounting expertise. However, small high-tech firms typically have expertise in information technology and new production technologies. These technically proficient managers are well educated and use information technology in very innovative ways. Therefore, it is not difficult for high-tech firms to adopt new accounting systems that are closely related to their production systems and modern technology (e.g. Laitinen, 2001; Berry, 1998; Malhotra, Grover, & Desilvio, 1996; Ackroyd, 1995). In addition, high-tech firms are forced to change and improve their accounting systems to maintain a reasonable probability of survival because of stiff competition and shorter customer relationships (Laitinen, 2001).

The special characteristics of high-tech firms are likely to create differences in the decision-making on the capital budgeting between the high-tech and other firms. Decision-making is more egalitarian in high-tech firms than it is in other firms. In high-tech firms, managers frequently employ such methods as project management and group or participative management in the process (Malhotra et al., 1996; Doran & Gunn, 2002). Decision making related to R&D intensity can be improved by asking whether the projects are strategically appropriate (Ronsley & Rogers, 1994). However, Granlund and Taipaleenmaki (2005) find that capital budgeting calculations have been made only occasionally in Finnish new economy firms, because major investments are intangible and strategic in nature. Corporate resources can be allocated to R&D investments more efficiently and achieve the best return on investment when strategic management and R&D activities are integrated (Liao & Cheung, 2002; Chester, 1994). Successful small-sized high-tech firms use strategic planning to direct their long-term growth and development, and the planning processes become more sophisticated as the firm grows. Financial performance is tightly controlled and monitored, and long-term financial objectives are clearly specified over a relatively short planning horizon in these firms. However, previous studies indicate that the planning horizon covers two to five years in small high-tech companies (Berry, 1998).

2.2. Capital Budgeting Methods

A contingency theory assumes that the use of specific profitability evaluation techniques is linked to firm characteristics, such as the size of the firm. Previous capital budgeting studies indicate that small firms do not use the net present value method as their primary capital budgeting method but tend to use the payback criterion as their primary capital budgeting method (e.g. Graham & Harvey, 2001). In addition, a life-cycle theory supposes that small high-tech firms are likely to use simple methods to evaluate the profitability of the investment projects because of the size of the firm (e.g. Moores & Yuen, 2001; Miller & Friesen, 1983).

It can be assumed that the capital budgeting methods in small high-tech firms differ from those used by other firms for at least three main reasons. First, previous findings in financial accounting literature indicate that the R&D expenditures can be seen as an investment rather than a cost (e.g. Chan et al., 2001; Lev & Sougiannis, 1996). Therefore, the R&D intensity should play an important role in small-sized firms, in which simple methods are usually used. Second, it can be assumed that small high-tech firms tend to use the net present value method, because these firms rely on equity financing, meaning that the risk capital providers require information on future income and the net present value of investment proposals. We assume that the high-tech firms are likely to use the capital budgeting methods that put emphasis on the assessment of the risk of the investment in terms of the cost of capital. If that is the case, the pressure from equity investors may influence the choice of methods in small high-tech firms. Third, previous studies indicate that young and well-educated CEOs are likely to use sophisticated capital budgeting methods, such as the net present value method, instead of the simple payback method (Graham & Harvey, 2001).

We assume that the special characteristics of the high-tech firms, such as R&D investments, equity investors' role and well-educated managers, influence their choice of capital budgeting methods more than the firm size. Therefore, our hypothesis on capital budgeting methods is stated as follows:

H1. Small high-tech firms prefer to use sophisticated capital budgeting methods.

2.3. Cost of Capital

The evidence on methods to estimate the cost of capital in the small high-tech firms is limited, even though previous studies indicate that small and start-up firms in R&D-intensive industries face a higher cost of capital than their larger competitors and firms in other industries (Hall, 2002). Entrepreneurial companies in high-tech industries pay a remarkable price for many benefits provided by equity investors, because investors require a sufficient return on the risk investment. Therefore, it could be assumed that small high-tech firms are likely to use the sophisticated methods, such as CAPM, to estimate the cost of capital. In addition, previous findings also suggest that well-educated CEOs are more likely to use CAPM when calculating the cost of capital (Graham & Harvey, 2001). Laitinen (2001) also reports that the education of CEO drives high-tech firms to adopt new accounting systems. Therefore, our hypothesis on methods to evaluate the cost of capital can be defined as follows:

H2. Small high-tech firms prefer to use formal methods to measure the cost of capital.

2.4. Capital Structure

Most theoretical and empirical studies on the capital structure of the firm focus on public corporations. Only a limited number of studies on capital structure have been conducted on small-sized enterprises and, especially on small and growing high-tech firms. One of the most important events in the early life-cycle of any enterprise with serious growth ambitions is the infusion of external capital (Reid, 1996). However, previous studies indicate that small high-tech firms face certain problems when financing business start-ups (e.g. Cassar, 2004). In addition, the lack of collateral will be a problem because of the limited tangible assets of high-tech firms. Science-based and high-growth companies have limited tangible assets, high-risk and -growth potential because they invest heavily in intangibles, such as R&D, customer-base creation, franchise and brand development (Cassar, 2004; Amir & Lev, 1996).

One possible solution for the financing problems faced by small high-tech firms is equity financing, including venture capital financing. Previous studies indicate that the growth before but mainly after the financing event is significantly greater than in other months in software firms (Davila et al., 2003). The role of investors affects the management issues of the firms, because the external pressure caused by investors drives towards more reliable control and reporting systems in new technology-oriented firms (e.g. Granlund & Taipaleenmaki, 2005; Lerner et al., 2003; Mitchell et al., 1997; Robbie et al., 1997).

We anticipate that small high-tech firms face certain difficulties in executing their investment projects because fast-growing firms usually have financing problems at the early stage of the business life cycle, sources of capital are limited and competition equity funding is stiff in small high-tech firms. It can be argued that high-tech firms avoid running into debt and prefer to use long-term debt rather than short-term debt. It is also assumed that at the early stage of the business life cycle small high-tech firms seek co-owners and business partners for growth purposes. We summarize our hypothesis on capital structure as follows:

H3. Small high-tech firms seek new equity financing and therefore need external equity investors.

3. DATA ENVIRONMENT AND PRELIMINARY DATA ANALYSIS

3.1. Data Description

Our empirical analyses are based on two surveys of Finnish firms. The data were gathered by questionnaires in April 2002 using random sampling. All the firms included in the surveys are located in the southern part of Finland, including the Greater Helsinki Area. Finland provides a good empirical setting for the study because it is a small but technologically advanced country. We sent identical questionnaires to two different groups of firms. The first group of firms includes small software firms and the second group of firms covers small firms in other industries. The surveys are identical and were conducted at the same time.

The survey contains 23 questions and is three pages long. The survey focuses on three areas of capital budgeting, i.e. the use of capital budgeting methods, the measurement of the cost of capital and decision-making related to the capital structure. The main questions are presented in the appendix. The survey is based, in part, on previous surveys of capital budgeting methods (e.g. Graham & Harvey, 2001; Sangster, 1993; Stanley & Block, 1984; Gitman & Forrester, 1977). The questions are related to broad categories of capital budgeting decisions as well as to more detailed aspects of the methods (e.g. when those methods are used, the reasons for the abandonment of investment projects, etc.). In the questionnaire, a five-point Likert scale ranging from (1) "Not used at all/not important" to (5) "Used to a great extent/very important" was used to elicit the respondents' views on the importance of various areas of the capital budgeting decisions. Respondents were asked to choose the alternative that best described the capital budgeting decisions of the firm.

The respondent, who is typically the financial manager, chief accountant, senior management accountant or chief executive of the firm, is the most eligible person in the firm to complete the questionnaire. The survey package includes a questionnaire and an introductory letter explaining the purpose of the research. Respondents can answer anonymously and mail the questionnaire. We sent the questionnaire to 217 software firms and to 250 small-sized firms in other industries. We received a total of 100 responses giving an average response rate of 21.4%. More precisely, we received 22 responses from software firms and 78 responses from other small-sized firms giving the response rates of 10.1% for software firms and 32.0% for other small-sized firms. The sample of software firms represents the characteristics of Finnish software firms very well despite the response rate (e.g. Hietala et al., 2002).

In the preliminary data analysis, we divided the sample into three groups based on the reported R&D intensity of the firm. Following previous literature, we use the ratio of R&D costs to sales as a measure of R&D intensity. The first group contains 30% of the firms for which the ratio of R&D costs to sales is more than 3% and these are defined as high R&D-intensity firms. The second group contains 33% of the firms for which the ratio of R&D costs to sales is more than one but less than 3%. Finally, the third group contains 36% of the firms for which the ratio of R&D costs to sales is less than 1% and these are defined as low R&D-intensity firms.

Fig. 1 depicts the summary statistics of the firms. A remarkable difference between the R&D-intensive firms and other firms is the amount of human resources. More than 40% of the R&D-intensive firms employ fewer than 10 employees. The R&D-intensive firms are also relatively small in size because almost half of them have net sales less than million euros. The results indicate that the ratio of exports to net sales is usually quite low in all groups of firms. One-third of the R&D-intensive firms have no export activity at all. The results, therefore, indicate that the firms in all groups are relatively small and operate mainly on their home markets. However, the R&D-intensive firms are the most active in export business. The ratio of gross investment to net sales seems to be higher in the R&D-intensive firms than in the other groups. We can conclude that the R&D-intensive firms are relatively small, make significant investments and try to operate on foreign markets.

Fig. 2 reveals that the R&D-intensive firms have younger CEOs than the other firms. Almost half of the CEOs are under 40 years of age in the R&D-intensive firms. The age distribution in the other firms is reversed; most of the CEOs are older. The duration of the CEO's employment has an even distribution in the R&D-intensive firms. On the other hand, about 60% of the CEOs in the other firms have worked for more than nine years and only 20% of them have worked for less than four years in their current positions. The CEOs in the R&D-intensive firms are better educated than the CEOs in other firms; more than half of the CEOs in the R&D-intensive firms have a

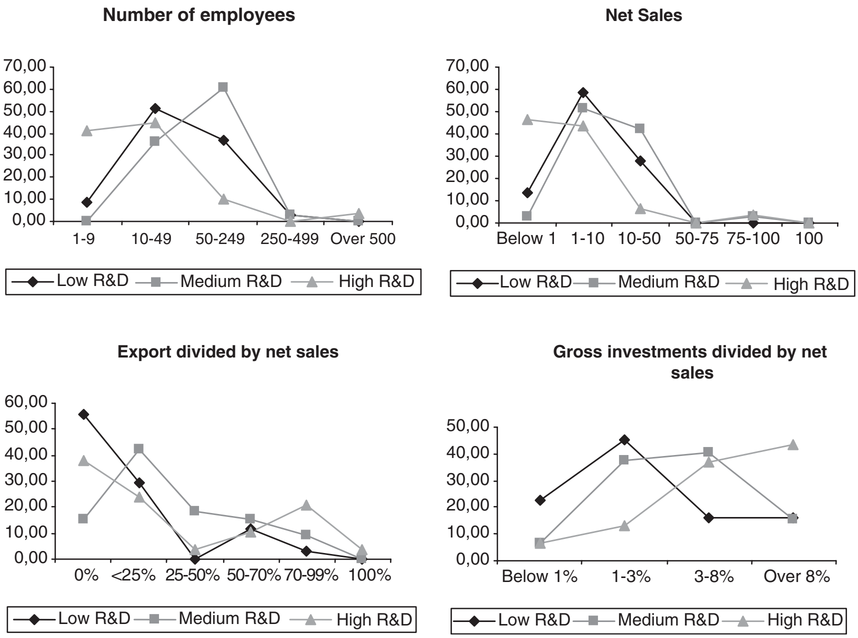

Fig. 1. Summary Statistics of the Firms Clustered by the Research and Development Costs Divided by Net Sales. The Panels are Based on Background Information of the Firms Provided by the CEOs. The Upper Left Panel Depicts the Number of Employers and the Upper Right Panel Depicts the Net Sales. The Lower Left Panel Depicts the Export Divided by Net Sales. The Last Graph Depicts the Gross Investments Divided by Net Sales.

university degree and as many as 20% of them have a doctoral degree. This supports the view that high-tech firms have well-educated managers.

We also gathered some other background information on the firms. Almost all firms are incorporated companies. Even though most of the R&D-intensive firms are incorporated companies, they operate like entrepreneurs, because the main owner usually owns a large part of the firm's stock and the firm does not have many employees. In almost half of the firms in all groups all shares are owned by management. The diversity in industries illustrates that all firms, including the R&D-intensive firms, are largely diversified over several industries. We look more closely at software firms in order to investigate the role of R&D intensity in the high-tech firms. Software firms are mainly registered for telecommunications and other services. Most of the

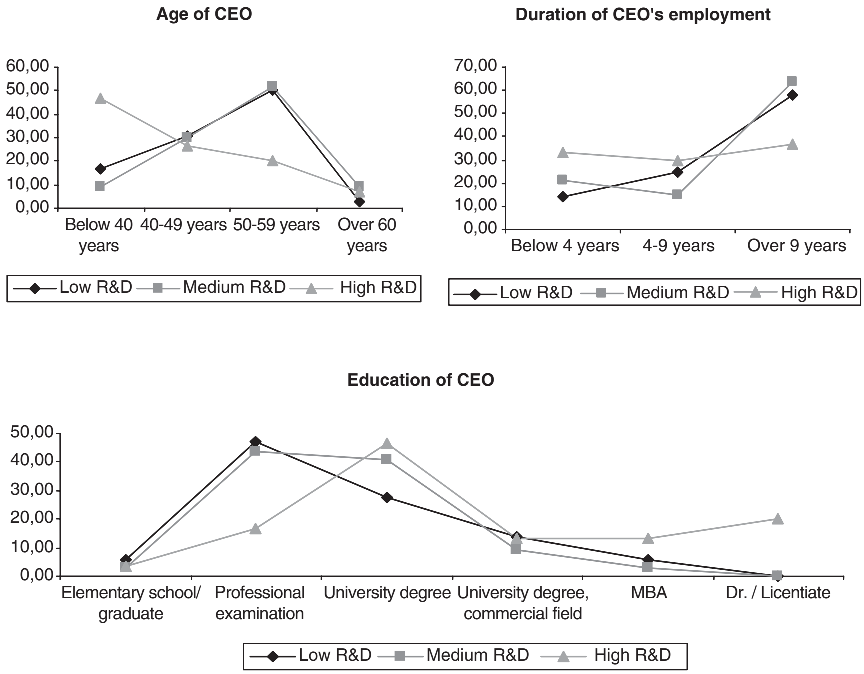

Fig. 2. Summary Statistics Regarding the Characteristics of the CEOs of the Survey Firms. The Panels are Based on Background Information Provided by the CEOs. The Upper Left Panel Depicts the Age Distribution of CEO and the Upper Right Panel Depicts the Gross Duration of the CEO's Employment. The Lower Panel Depicts the Education of the CEO.

software firms produce mainly software products and one-third of the software firms produce mainly customer-specific software services. Therefore, the software firms are representative of the R&D-intensive and science-based firms in the field of high technology.

3.2. Preliminary Data Analysis

The main questions of the survey, i.e. the use of capital budgeting methods, the measurement of the cost of capital and decision-making related to capital structure, are presented in the appendix. It also presents the results of the preliminary data analysis. A *t*-test is used to test whether the sample mean of a response is statistically different from three. The value of three is the mean value describing the alternative of respondents' neutral opinion. The Kruskal–Wallis test is used to test whether the mean values differ across the three groups of firms.

The planning horizon refers to the time period of how far into the future the firm plans its financial needs. The results for Question 1 reported in the appendix indicate that the planning horizon typically covers the next five years in all firms.[1] The R&D-intensive firms prepare their capital budgeting decisions very often for at least the next two years and often for the next five years. The planning horizon is longest in the medium R&D-intensity firms, because after the first two years there is a significant difference in the planning horizon between the medium R&D-intensity and other firms. The R&D-intensive firms seldom plan their capital budgeting decisions over the next five years and never over a 10-year period. This is understandable in a rapidly changing business environment. The results of the planning horizon of the R&D-intensive firms reported here are similar to those reported by Berry (1998), who finds that the planning horizon covers two to five years in small high-tech companies.

The systematic use of capital budgeting methods is as popular in the R&D-intensive firms as it is in the other firms. The results indicate that only 53% of the high R&D-intensity firms, 68% of the medium R&D-intensity firms and 60% of the low R&D-intensity firms use formal capital budgeting methods.[2] Therefore, the preliminary results do not support Hypothesis 1. The results for Question 2 regarding the use of the capital budgeting methods reported in the appendix indicate that the return on investment and the payback period method are the most important capital budgeting methods in the R&D-intensive firms. The results are consistent with previous studies (e.g. Graham & Harvey, 2001) claiming that small firms are generally less likely to use the net present value method than the payback period method when evaluating their investment proposals.

The results for Question 3 indicate that the capital budgeting methods are typically used in the R&D-intensive firms when an investment is new or strategically important, the nature of the investment requires calculations and the size of the investment is large enough. The comparison of groups of firms reveals that all groups of firms use capital budgeting methods in almost the same situations except for the R&D-intensive firms, which are not likely to use capital budgeting methods when the investment is necessary and the investment entails repairs. The results for Question 4 indicate that the capital budgeting methods are typically used in the R&D-intensive firms because of the business culture, the project is international in nature or the final decision-makers require formal calculations.

The results on the use of different methods to determine the cost of capital reported in Question 5 indicate that the sample firms seldom use sophisticated methods such as CAPM and the weighted-average cost of capital (WACC, henceforth).[3] The results indicate that measuring the cost of capital is usually based on experience. Quite often owner's return requirement or cost of liabilities is used in calculating the cost of capital. The results are consistent with those of Graham and Harvey (2001), who report that firms usually calculate the cost of capital with CAPM, but that small firms are less likely to use CAPM. Since there is no significant difference between the high-tech and other firms, we can conclude that both groups of firms define the cost of capital in a similar way.

The results for Question 6 reveal the reasons why firms have given up on their capital budgeting decisions. The most common problems in the R&D-intensive firms are financing problems and budget constraints. Such problems are typical for fast growing firms. The vision of the future is the only significant reason why the other firms have to given up on their investment decisions, but that seems not to be such a significant problem in the high R&D-intensity firms.[4] The results for Question 7 indicate reasons for adjusting the capital structure. The capital structure of the R&D-intensive firms is marked by a tendency to avoid running into debt.[5] Avoidance of debt and, on the other hand, if necessary using long-term debt are specific characteristics of the firms in other industries. There is a significant difference between the groups of firms, i.e. seeking co-owners and main financiers is more important to the R&D-intensive firms but insignificant to other firms. High-tech firms especially have more problems and, on the other hand, challenges in their capital structures than the other firms have. The results indicate that the R&D-intensive firms are young enterprises at the beginning of the business life cycle with little internal financing. In addition, these enterprises will not get enough debt because of lack of collateral, which causes financial problems. Therefore they must seek venture capitalists more often than other firms. Previous studies (e.g. Cassar, 2004) indicate that financing business start-ups is more problematic in small firms than in large firms. The results indicate that financing business start-ups seems to be a problem for R&D-intensive firms especially. The results of capital structure are consistent with the third hypothesis.

4. EMPIRICAL RESULTS

4.1. Factor Analyses

We begin the empirical analyses by using factor analysis to reduce the number of items in the questionnaire to a more manageable and interpretable set of factors. The use of factor analysis is appropriate, because the questionnaire includes various questions for each dimension of capital budgeting decisions. The results of the factor analyses are reported in Tables 1 and 2. The factor solutions passed both Bartlett's test of sphericity (a χ^2 test) and the Kaiser–Myer–Olkin measure of sampling adequacy. In all cases, two or three factors can be identified and these factors explain more than 50% of the variance of the original variables, i.e. the item in the questionnaire. In Tables 1 and 2, factor loadings greater than 0.50 are displayed in italic.

4.1.1. Capital Budgeting Methods

Panel A of Table 1 shows the factor loadings of the capital budgeting methods used by the firms. Capital budgeting methods that are based on the present values of future cash flows, i.e. net present value, net present index and internal rate of return have high loadings with the first factor. On the other hand, payback method and return on investment, which are not based on discounting future cash flows, have high loading with the second factor. Therefore, the first factor can be interpreted as a factor of those capital budgeting methods that discount the future cash flows generated by the investment project. In the same way, the second factor can be interpreted as a factor of those capital budgeting methods that do not discount the future cash flows. The factor structure observed is consistent with the capital budgeting literature, which divides capital budgeting methods into two categories. The first category includes sophisticated methods, which pay attention to the interest rate, such as the net present value method. The second category includes simple methods, such as the payback method, which do not discount the future cash flows generated by the investment project.

4.1.2. Types of Investments

Panel B of Table 1 reports factor loadings of the types of investments for which the firms use formal capital budgeting methods. We categorize investment types into three categories, i.e. operational, strategic and large investments. The factor solution is consistent with the capital budgeting

Table 1. Factor Loadings for the Varimax Rotated Factor Matrix.

		Factor Pattern (Loadings)	
		Factor 1	Factor 2
Panel A. Capital Budgeting Methods			
Net present value		*0.850*	0.010
Net present index		*0.785*	0.111
Internal rate of return		*0.694*	0.099
Payback method with interest rate		0.411	0.069
Payback method		−0.074	*0.862*
Return on investment		0.286	*0.666*
Kaiser–Myer–Olkin measure of sampling adequacy	0.628		
Bartlett's test of sphericity	0.021		
Variance explained by factors	0.548		

		Factor 1	Factor 2	Factor 3
Panel B. Types of Investments				
Reparation investment		*0.863*	0.145	−0.075
Necessary investment		*0.811*	−0.011	−0.156
New investment		*0.625*	0.495	0.286
Important project		*0.533*	−0.424	*0.516*
Nature of the investment		−0.098	*0.843*	−0.016
Strategic investment		0.158	*0.772*	0.449
IT investment		0.293	*0.609*	−0.255
Size of the investment		−0.180	0.076	*0.885*
Kaiser–Myer–Olkin measure of sampling adequacy	0.634			
Bartlett's test of sphericity	0.000			
Variance explained by factors	0.723			

		Factor 1	Factor 2
Panel C. Reasons to Use Formal Methods			
International		−0.001	*0.765*
Final decision-maker requires calculations		−0.067	*0.756*
Financier requires calculations		0.411	0.460
Lack of the time		*0.763*	0.239
Measuring responsibilities		*0.664*	0.285
Corporate culture		*0.754*	−0.203
Importance of the project		*0.637*	−0.153
Kaiser–Myer–Olkin measure of sampling adequacy	0.575		
Bartlett's test of sphericity	0.014		
Variance explained by factors	0.534		

Table 2. Factor Loadings for the Varimax Rotated Factor Matrix.

		Factor Pattern (Loadings)		
		Factor 1	Factor 2	
Panel A. Methods to Measure A Cost of Capital				
Experience		0.147	*−0.912*	
Cost of liabilities		0.394	*0.793*	
CAPM + beta		*0.900*	0.112	
CAPM + interest rate		*0.963*	0.011	
WACC		*0.812*	0.077	
Kaiser–Myer–Olkin measure of sampling adequacy	0.536			
Bartlett's test of sphericity	0.000			
Variance explained by factors	0.810			
		Factor 1	Factor 2	
Panel B. Reasons for Abandoning Capital Budgeting Decisions				
Budget constraint		*0.537*	0.450	
Lack of collateral		*0.726*	0.347	
Financing problems		*0.821*	0.320	
Weak capital structure		*0.743*	0.216	
Vision of the future		*0.667*	−0.210	
External financiers		0.152	*0.774*	
Lack of owner's perseverance		0.092	*0.762*	
Kaiser–Myer–Olkin measure of sampling adequacy	0.785			
Bartlett's test of sphericity	0.000			
Variance explained by factors	0.602			
		Factor 1	Factor 2	Factor 3
Panel C. Capital Structure				
Income financing is insufficient		*0.719*	0.140	−0.249
Projects define the amount of debt		*0.755*	−0.019	−0.158
Long-term debt		*0.786*	0.050	−0.339
Short-term debt		0.395	*0.506*	−0.090
Interest rate level		*0.776*	−0.062	0.175
Tax deductibility		*0.696*	0.250	0.386
Avoid running into debt		−0.289	0.221	*0.723*
Withdrawing profit funds		0.047	−0.170	*0.767*
Seeking co-owners		−0.083	*0.890*	0.042
Seeking main financier		0.068	*0.924*	0.013
Kaiser–Myer–Olkin measure of sampling adequacy	0.676			
Bartlett's test of sphericity	0.000			
Variance explained by factors	0.661			

literature, which often divides the types of investments into two categories, i.e. the operational and strategic investments. Our analysis, however, yields an additional factor, i.e. large investments. This may indicate that firms have limited time to evaluate every single small-sized investment project using the formal capital budgeting methods. Therefore, the size of the investment project is an important factor of using formal capital budgeting methods.

4.1.3. Reasons for Using Formal Methods

Panel C of Table 1 shows the factor loadings for the reasons for using formal methods when evaluating the investment proposals. Reasons inside the firm, i.e. lack of time, measuring responsibilities, corporate culture and importance of the project, have high loadings with the first factor. Therefore, the first factor can be interpreted as a factor of internal reasons for using formal capital budgeting methods. In the same way, the second factor can be interpreted as a factor of those reasons outside the firm, i.e. the internalization and the final decision-makers' needs. Internal reasons are caused by the firm itself and those reasons may be consequences of the rapid and uncontrolled growth. Small-sized firms probably want to ensure the profitability of the investment, because the future of the firm may be endangered if an erroneous decision is made. External reasons, by contrast, are caused by the external actors who require formal analyses of capital budgeting proposals. The result is consistent with the previous studies, which indicate that the external pressure caused by venture capitalists drives toward more reliable control and reporting systems in new technology-oriented firms (e.g. Granlund & Taipaleenmaki, 2005; Lerner et al., 2003). Our result indicates that capital budgeting methods are also used for external reasons.

4.1.4. Methods for Evaluating the Cost of Capital

Panel A of Table 2 shows the factor loadings of the methods for measuring the cost of capital. The methods that are based on the theory-driven measures of the cost of capital, i.e. CAPM and WACC models, have high loadings with the first factor. On the other hand, experience and the cost of liabilities, which are not based on theoretical models, have high loadings with the second factor. Therefore, the first factor can be interpreted as a factor of theoretical methods. In the same way, the second factor can be interpreted as a factor of practical methods to evaluate the cost of capital based on simple methods.

4.1.5. Reasons for Abandoning Capital Budgeting Decisions

Panel B of Table 2 reports the factor loadings of the reasons for abandoning capital budgeting decisions. Items that are based on the internal reasons, i.e. budget constraint, lack of collateral, financing problems, weak capital structure and the vision of the future have high loadings with the first factor. On the other hand, external financiers and a lack of owner's perseverance, i.e. the external reasons, have high loadings with the second factor. Therefore, the first factor can be interpreted as a factor of internal reasons for abandoning capital budgeting decisions, and the second factor can be interpreted as a factor of external reasons for abandoning investment proposals.

4.1.6. Characteristics of Capital Structure

Panel C of Table 2 shows the factor loadings of the reasons for the current capital structure of the firm. The reasons for the current capital structure that include the basic elements of business, such as insufficient income financing, long-term debt, interest rate level, tax deductibility and defining the amount of debt by projects, have high loadings with the first factor. On the other hand, firms that prefer to use short-term debt and try to find external financiers, have high loading with the second factor. Therefore, the second factor can be interpreted as a factor of the growth-oriented firms. Previous studies identify those firms as fast-growing entrepreneurial firms in the early life-cycle stage (e.g. Davila et al., 2003; Reid, 1996). In addition, the firms that avoid running into debt and withdraw profit funds have high loading with the third factor.

4.2. Regression Analyses

The contingency approach assumes that the use of management accounting practices depends on a wide variety of firm-specific elements. In order to identify the firm characteristics that affect the factors estimated in Section 4.1, we estimate the following linear regression model:

$$Y_i = a_1 + b_1\mathrm{R\&D}_i + b_2\mathrm{SOFTWARE}_i + b_3\mathrm{SALES}_i + b_4\mathrm{EXPORT}_i + \varepsilon_{1i} \tag{1}$$

where Y_i is a dependent variable obtaining the factor score of the ith firm, $\mathrm{R\&D}_i$ the ratio of research and development expenditures to net sales of the ith firm, $\mathrm{SOFTWARE}_i$ a dummy variable that has a value of one if the ith firm is a software firm and otherwise zero, SALES_i the net sales of the ith firm, EXPORT_i the ratio of export to net sales of the ith firm, a the estimated intercept, b's are the estimated slope coefficients of the variables that affect the factor scores and ε the error term. The factor scores are those obtained from the factor solutions reported in Tables 1 and 2.

4.2.1. Capital Budgeting Methods

The results of regressing the factor scores of different dimensions of capital budgeting methods on the dependent variables defined in Model (1) are reported in Table 3. A dummy variable for the software industry has a significantly negative slope coefficient when Factor 2 is regressed on the variables defined in Model (1). This indicates that software firms do not use simple capital budgeting methods to the same extent as the other firms. All in all, the results do not reveal significant differences in the capital budgeting methods between the high and low R&D-intensity firms. Therefore, the results do not support our first hypothesis that small high-tech firms prefer sophisticated capital budgeting methods because of the special characteristics of the industry.

4.2.2. Types of Investments

Table 3 also reports the results of estimating Model (1) to investigate whether the types of investments of high-tech firms are different from those in the other industries. In Column (4), the estimated slope coefficient of the dependent variable $\text{R\&D}_i$ is significantly positive, suggesting that high-tech firms use the formal capital budgeting methods only in the case of strategic investments. The results are consistent with previous studies, which indicate the importance of integrating R&D into strategic issues of the firm (Liao & Cheung, 2002; Berry, 1998; Chester, 1994). In addition, Ronsley and Rogers (1994) suggest that decision-making in R&D can be improved by asking whether the projects are strategically appropriate. The result therefore, extends the previous findings on the significance of the strategic investments in the R&D-intensive firms by revealing that the R&D-intensive firms use formal capital budgeting methods only in strategic investments.

4.2.3. Reasons for Using Formal Methods

The results of estimating Model (1) to investigate the reasons for using formal methods when evaluating the profitability of capital budgeting proposals are also reported in Table 3. The estimated slope coefficients of the dependent variables are insignificant, suggesting that high-tech firms have similar reasons for using formal capital budgeting methods than the firms in other industries.

Table 3. Result of Regressing Factor Loadings on the Measures of the Technology-Intensity of the Firm.

	Capital Budgeting Methods		Types of Investments			Reasons for using Formal Methods	
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
	Factor 1 (p-value)	Factor 2 (p-value)	Factor 1 (p-value)	Factor 2 (p-value)	Factor 3 (p-value)	Factor 1 (p-value)	Factor 2 (p-value)
Constant	0.014 (0.983)	−0.350 (0.580)	1.198 (0.078)	−1.336 (0.072)	0.230 (0.721)	0.448 (0.498)	0.008 (0.990)
R&D	0.190 (0.379)	0.212 (0.324)	−0.240 (0.210)	*0.415* *(0.053)*	0.058 (0.754)	−0.028 (0.890)	−0.281 (0.184)
SOFTWARE	−0.120 (0.825)	*−1.340* *(0.018)*	−0.285 (0.556)	−0.667 (0.213)	−0.763 (0.115)	0.196 (0.730)	0.820 (0.167)
SALES	0.195 (0.364)	0.196 (0.359)	−0.292 (0.160)	0.369 (0.107)	0.007 (0.973)	−0.406 (0.068)	−0.038 (0.862)
EXPORT	*−0.367* *(0.021)*	−0.109 (0.468)	0.057 (0.660)	−0.193 (0.182)	−0.043 (0.738)	0.180 (0.219)	0.219 (0.147)
N	32	32	30	30	30	32	32
R^2	0.188	0.255	0.180	0.186	0.120	0.139	0.114

Note: In order to find the firm characteristics that affect the factors estimated in Section 4.1, we estimate the following linear regression model:

$$Y_i = a_1 + b_1\mathrm{R\&D}_i + b_2\mathrm{SOFTWARE}_i + b_3\mathrm{SALES}_i + b_4\mathrm{EXPORT}_i + \varepsilon_{1i}$$

where Y_i is a dependent variable obtaining the factor score of the ith firm, R&D$_i$ the ratio of research and development expenditures to net sales of the ith firm, SOFTWARE$_i$ a dummy variable that has a value of one if the ith firm is software firm and otherwise zero, SALES$_i$ the net sales of the ith firm, EXPORT$_i$ the ratio of export to net sales of the ith firm, a the estimated intercept, b's are the estimated slope coefficients of the variables that affect the use of capital budgeting methods and ε is the error term. Factor scores are those obtained from the factor solutions reported in Tables 1 and 2.

4.2.4. Methods for Evaluating the Cost of Capital

The results of regressing the factor scores of different dimensions of methods to estimate the cost of capital on the dependent variables are reported in Table 4. The estimated slope coefficients of the dependent variables are insignificant, suggesting that high-tech firms use similar methods to measure the cost of capital than the other firms. The result does not give support to our second hypothesis that formal methods for estimating the cost of capital are used in small-sized high-tech firms.

Table 4. Result of Regressing Factor Loadings on the Measures of the Technology-Intensity of the Firm.

	Methods for Measuring a Cost of Capital		Reasons for Abandoning Capital Budgeting Decisions		Capital Structure		
	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
	Factor 1 (*p*-value)	Factor 2 (*p*-value)	Factor 1 (*p*-value)	Factor 2 (*p*-value)	Factor 1 (*p*-value)	Factor 2 (*p*-value)	Factor 3 (*p*-value)
Constant	0.388 (0.690)	0.056 (0.962)	0.337 (0.515)	0.251 (0.657)	0.079 (0.871)	−0.047 (0.910)	0.405 (0.374)
R&D	−0.662 (0.134)	−0.379 (0.453)	−0.244 (0.104)	−0.186 (0.258)	−0.069 (0.655)	−0.217 (0.103)	−0.007 (0.963)
SOFTWARE	1.880 (0.119)	1.296 (0.349)	*1.193* *(0.006)*	0.519 (0.266)	−0.362 (0.418)	*1.668* *(0.000)*	0.072 (0.862)
SALES	−0.212 (0.606)	−0.037 (0.941)	−0.194 (0.314)	−0.107 (0.613)	−0.070 (0.717)	−0.053 (0.747)	*−0.523* *(0.005)*
EXPORT	0.541 (0.173)	0.312 (0.497)	0.194 (0.150)	0.132 (0.243)	0.150 (0.223)	0.089 (0.389)	*0.268* *(0.022)*
N	12	12	54	54	53	53	53
R^2	0.328	0.122	0.203	0.048	0.089	0.368	0.191

See footnote in Table 3.

4.2.5. Reasons for Abandoning Capital Budgeting Decisions

Table 4 also reports the results of estimating Model (1) to investigate whether the reasons for abandoning the capital budgeting methods of high-tech firms are different from those in other industries. In Model (10), the estimated slope coefficient of the dependent variable $\mathrm{SOFTWARE}_i$ is significantly positive, suggesting that software firms have more internal reasons for abandoning investment projects.

4.2.6. Characteristics of Capital Structure

The results of regressing the factor scores of the different dimensions of capital structure on the dependent variables are reported in Table 4. A dummy variable for software industry has a significantly positive slope coefficient in Column (13). The results indicate that software firms use short-term debt and seek co-owners and main financiers. Previous studies indicate that financing of business start-ups is a problem in small firms despite the fact that finding external capital is one of the most important events in the early life cycle of any entrepreneurial firm (e.g. Cassar, 2004; Davila et al., 2003; Reid, 1996). These results give support to our hypothesis that small high-tech firms, especially software firms, have limited sources of capital and therefore external financiers are needed.

4.3. Robustness Checks

We begin our robustness checks of the results by estimating Model (1) such that the factors are replaced by the original questions as dependent variables. In other words, we regress each individual question in the questionnaire on the independent variables defined in Model (1). The results from these regressions are essentially similar to those reported in Tables 3 and 4. Small high-tech firms use similar capital budgeting methods and methods for evaluating the cost of capital as the other firms. Supporting the results reported in Tables 3 and 4, software firms as a special case of small high-tech firms are seeking for co-owners and external financing. We have replicated all the analyses by dividing the sample into two groups based on the software industry dummy instead of the R&D intensity of the firm. The results remain the same.

Finally, we analyze non-response bias for the two sets of data, because two sets of questionnaires were distributed. The first group of firms contains the small software firms and the second group of firms covers small firms in other industries. In order to get a measure of the potential non-response bias, the earliest 20% of responses were compared to the latest 20% of replies in both samples. The results remain the same.

5. CONCLUSIONS

This paper investigates the capital budgeting methods used in small high-tech firms. We define high-tech firms based on their R&D intensity and we also investigate the effect on the software industry as a special case of the R&D. We focus on the methods used by small high-tech firms when they estimate the profitability of investment projects, calculating the cost of capital and making decisions related to capital structure. Finnish data gathered by questionnaire in April 2002 are used in the study.

The planning horizon of capital budgeting decisions typically covers the next five-year period in all small firms. The systematic use of capital budgeting methods is as popular in the R&D-intensive firms as it is in the other firms. The results indicate that the return on investment and the payback period method are the most frequently used methods for assessing the profitability of investment in the R&D-intensive firms. The result extends the previous findings of the significance of strategic investments in R&D-intensive firms by revealing that the R&D-intensive firms use formal capital budgeting methods only within strategic investments.

The regression analyses of the factor scores indicate that the high-tech firms do not use simple capital budgeting methods to the same extent as other firms do. Therefore, the results do not indicate significant differences in the capital budgeting methods between the high and low R&D-intensity firms, although the financial accounting literature see R&D expenditures as an investment rather than as a cost (see e.g. Chan et al., 2001; Lev & Sougiannis, 1996). The results indicate that the specific characteristics of the software industry affect more the use than the size of the firm, but the R&D intensity itself does not affect to the use of formal capital budgeting methods.

The results of the regression analyses reveal that neither of the high-tech indicators, R&D intensity and the software industry affect the use of methods of evaluating the cost of capital. The result does not give support to our second hypothesis that formal methods for measuring the cost of capital are used in small-sized high-tech firms. The result is consistent with the corporate finance literature revealing that small firms are less likely to use sophisticated methods such as CAPM to estimate the cost of capital (e.g. Graham & Harvey, 2001).

The results indicate that internal reasons such as financing problems and budget constraints are typical problems in high-tech firms and reasons why small-sized software firms abandon their investment decisions. As previous studies indicate, the financing of business start-ups is a problem in small firms (e.g. Cassar, 2004). Consistent with our third hypothesis we find that the software firms are seeking a main financier and co-owners and try to avoid running into debt. Our results are consistent with previous studies that have found that equity financing is a significant source of growth for small firms (Cassar, 2004; Davila et al., 2003).

NOTES

1. In order to obtain more specific results for the length of planning horizon, we constructed a continuous variable as follows. We select the planning horizon with the highest score using the median point (for one to two years it gets a value of 1.5, for

two to five years it gets a value of 3.5, etc.) and construct a continuous variable describing the planning horizon. Next, we estimate a regression model similar to used later in Section 4.2. The results of estimating the model indicate that all dependent variables, including R&D intensity, have insignificant slope coefficients.

2. Generally, the capital budgeting methods get the following rates of the use among the users of formal methods: return on investment 82%, payback period method 81%, net present value 53%, payback period method with interest rate 44%, internal rate of return 35% and net present index 14%.

3. The following rates of use were reported for methods to calculate the cost of capital: cost of liabilities 85%, owners define the cost of capital 77%, based on experience 76%, CAMP + risk 29%, WACC 13% and CAPM + beta 7%.

4. Generally, the following reasons are behind the abandoning capital budgeting decisions: vision of the future 58%, budget constraints 43%, financing problems 41%, lack of collateral 28%, weak capital structure 22%, lack of owner's perseverance 13% and external financiers withdraw 5%.

5. Actually, the mean equity ratio for the R&D-intensive firms is 50.7 and 47.4% for the other firms. During the last five years the mean cost of current liabilities was 5.4% for the R&D intensive firms and 5.3% for the other firms.

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APPENDIX

Main questions and preliminary data analysis: Mean values and *t*-tests *p*-values among three groups of firms and the results of the Kruskal–Wallis test between the groups. A five-point Likert scale ranging from (1) 'never/not important' to (5) 'always/very important' is used in the survey.

	High R&D Firms (Mean Value) (*p*-Value)	Medium R&D Firms (Mean Value) (*p*-Value)	Low R&D Firms (Mean Value) (*p*-Value)	Difference (χ^2) (*p*-value)
Question 1: How long is the planning horizon of capital budgeting in your firm?				
1–2 years	*4.73*	*4.67*	*4.65*	0.342
	(0.000)	*(0.000)*	*(0.000)*	(0.843)
2–5 years	*3.76*	*4.30*	*3.74*	*5.780*
	(0.000)	*(0.000)*	*(0.000)*	*(0.056)*
5–10 years	*2.12*	3.39	*2.00*	*17.435*
	(0.000)	(0.130)	*(0.001)*	*(0.000)*
Over 10 years	*1.28*	*1.71*	*1.38*	3.342
	(0.000)	*(0.000)*	*(0.000)*	(0.188)
Question 2: To what extent does your firm use the following capital budgeting methods?				
NPV	3.14	3.24	3.07	0.170
	(0.720)	(0.496)	(0.844)	(0.919)
IRR	2.77	2.60	3.09	0.898
	(0.553)	(0.233)	(0.821)	(0.638)
Net present index	*2.00*	*2.08*	*2.20*	0.389
	(0.020)	*(0.008)*	*(0.037)*	(0.823)
ROI	*4.00*	*4.18*	*4.07*	1.023
	(0.003)	*(0.000)*	*(0.000)*	(0.600)
Payback period	*4.00*	*4.19*	*4.47*	1.939
	(0.002)	*(0.000)*	*(0.000)*	(0.379)
Payback + interest	2.87	3.06	*3.69*	3.858
	(0.670)	(0.854)	*(0.022)*	(0.145)

Question 3: For what kind of investments are the formal capital budgeting methods used?				
Repairs	*2.29*	3.05	3.20	*6.801*
	(0.019)	(0.789)	(0.486)	*(0.033)*
Necessary investment	*2.00*	3.05	3.25	*9.732*
	(0.000)	(0.853)	(0.491)	*(0.008)*
New investment	*3.71*	*4.19*	*3.94*	2.395
	(0.019)	*(0.000)*	*(0.001)*	(0.302)
Important investment	*2.17*	2.69	2.50	1.305
	(0.034)	(0.370)	(0.139)	(0.521)
Nature of investment	*4.20*	*4.13*	*4.10*	0.673
	(0.000)	*(0.000)*	*(0.000)*	(0.714)
Strategic investment	*4.50*	*4.00*	*4.25*	2.653
	(0.000)	*(0.001)*	*(0.000)*	(0.265)
IT-investment	3.14	2.94	3.07	0.137
	(0.635)	(0.816)	(0.844)	(0.934)
Size of investment	*4.40*	*4.42*	*3.60*	2.917
	(0.000)	*(0.000)*	*(0.000)*	(0.233)
Question 4: To what extent are the following reasons to use formal capital budgeting methods?				
International project	3.13	2.82	*2.14*	4.318
	(0.709)	(0.605)	*(0.003)*	(0.115)
Decision-maker requirement	3.20	3.40	3.43	0.423
	(0.550)	(0.176)	(0.234)	(0.810)
Financier requirement	2.43	2.76	3.35	3.622
	(0.120)	(0.448)	(0.303)	(0.163)
Lack of time	2.92	*2.47*	2.92	1.516
	(0.819)	*(0.095)*	(0.809)	(0.468)
Measuring responsibilities	*2.42*	*1.73*	*2.36*	*4.837*
	(0.012)	*(0.000)*	*(0.089)*	*(0.089)*
Business culture	3.25	3.33	3.14	0.490
	(0.389)	(0.331)	(0.635)	(0.783)
Significance of the project	*2.17*	2.69	2.50	1.305
	(0.034)	(0.370)	(0.139)	(0.521)
Question 5: To what extent are the following methods used to measure the cost of capital?				
Experience	*4.00*	*3.75*	*4.29*	1.174
	(0.041)	*(0.080)*	*(0.000)*	(0.556)

Owner's return requirement	3.71 (0.220)	*4.07* *(0.008)*	*4.00* *(0.018)*	0.523 (0.770)
Cost of liabilities	3.20 (0.799)	*3.89* *(0.052)*	*4.33* *(0.001)*	1.648 (0.439)
CAPM + beta	*1.80* *(0.033)*	2.00 (0.111)	2.67 (0.423)	1.744 (0.418)
CAPM + risk premium	*1.80* *(0.033)*	*1.67* *(0.010)*	2.67 (0.423)	3.077 (0.215)
WACC	2.40 (0.468)	*1.50* *(0.001)*	3.20 (0.704)	5.843 (0.054)
Question 6: To what extent are the following reasons for abandoning capital budgeting decisions?				
Budget constraint	3.27 (0.337)	2.74 (0.461)	2.67 (0.339)	2.028 (0.363)
Lack of collateral	*2.35* *(0.029)*	*2.37* *(0.083)*	*2.24* *(0.032)*	0.172 (0.918)
Financing problems	3.27 (0.355)	2.76 (0.489)	*2.36* *(0.090)*	4.031 (0.133)
External financiers	*1.42* *(0.000)*	*1.42* *(0.000)*	*1.60* *(0.000)*	0.765 (0.682)
Weak capital structure	2.70 (0.328)	*1.95* *(0.001)*	*2.41* *(0.061)*	2.957 (0.228)
Vision of the future	3.19 (0.457)	*3.73* *(0.010)*	*3.44* *(0.053)*	2.584 (0.275)
Lack of owner's perseverance	*1.80* *(0.000)*	*1.94* *(0.002)*	*1.89* *(0.001)*	0.122 (0.941)
Question 7: To what extent do the following describe the capital structure of your firm?				
Income financing is insufficient	*1.87* *(0.000)*	2.83 (0.592)	2.58 (0.094)	*6.835* *(0.033)*
Projects define the amount of debt	*2.33* *(0.017)*	*3.74* *(0.005)*	3.22 (0.449)	*12.421* *(0.002)*
Long-term debt	2.81 (0.533)	*4.14* *(0.000)*	3.26 (0.354)	*8.919* *(0.012)*
Short-term debt	*2.04* *(0.002)*	*2.28* *(0.044)*	2.60 (0.187)	2.479 (0.290)
Interest rate level	*2.25* *(0.013)*	3.38 (0.268)	2.64 (0.273)	*6.531* *(0.038)*

Tax deductibility	*1.91*	2.39	*2.26*	2.025
	(0.000)	(0.061)	*(0.008)*	(0.363)
Avoid running into debt	*3.88*	3.48	3.54	1.680
	(0.004)	(0.103)	(0.045)	(0.432)
Seeking co-owners	2.72	*1.65*	*1.61*	*8.559*
	(0.396)	*(0.000)*	*(0.000)*	*(0.014)*
Seeking main financier	2.96	*1.61*	*1.70*	*9.976*
	(0.912)	*(0.000)*	*(0.000)*	*(0.007)*
Withdrawing profit funds	*1.72*	*1.67*	*1.65*	0.037
	(0.000)	*(0.000)*	*(0.000)*	(0.982)

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BUDGETING, PERFORMANCE EVALUATION, AND COMPENSATION: A PERFORMANCE MANAGEMENT MODEL

Al Bento and Lourdes Ferreira White

ABSTRACT

Performance management involves budgeting, performance evaluation, and incentive compensation. This study describes a model that encompasses these three elements of performance management. To illustrate the model, survey data were examined using path analysis. The empirical evidence supports the model, and suggests several intervening variables that mediate the direct and indirect effects of budgeting, performance evaluation, and incentives on gaming behaviors and individual performance.

INTRODUCTION

Firms continue to deploy significant resources to improve their performance measurement systems (American Institute of Certified Public Accountants (AICPA) & Maisel, 2001; Lawson, Stratton, & Hatch, 2004). For example,

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in the past two decades, firms have struggled to either improve or replace their budgeting systems (Hansen, Otley, & Van der Stede, 2003), introduce strategy-driven non-financial performance metrics (Kaplan & Norton, 1996), and link various performance indicators to generous pay-for-performance plans for their key managers (Ittner & Larcker, 1998a). All these innovations rely on the assumption that such performance measurement systems will help firms not only measure performance, but also manage it. Yet, practitioners in charge of designing and implementing performance management systems have received only limited guidance from research on this topic. Despite streams of literature on different steps of the performance management cycle (set targets, monitor performance, and reward), conflicting empirical results have left practitioners with inconclusive explanations, especially in regard to how the different steps of the performance management cycle relate to each other.

Since the pioneering studies on budgeting by Argyris (1952) and the original framework on control systems by Anthony (1965), management accounting research on performance management has focused mainly on budgeting related variables. Researchers have typically selected two or three budgeting practices (e.g., budget participation, budget tightness, or reliance on accounting performance measures) and examined the impact of those practices on job satisfaction, stress, or performance at the individual or firm level. The empirical tests first investigated the simple, direct linear additive effects of budgeting practices on motivation, behaviors, or performance, addressing questions such as "does participation in budgeting influence budgetary performance of managers?" (Kennis, 1979). Those tests often produced conflicting results that led researchers to change focus to examine the interactive effects of budgeting and non-budgeting variables on specific dependent variables (see, for example, the literature review on participative budgeting by Shields & Shields, 1998; and the review of research on reliance on accounting performance measures by Hartmann, 2000). Researchers testing for interactive effects posed questions such as "does the effect of high-budget emphasis and high participation on performance depend on the level of task uncertainty?" (see Brownell & Hirst, 1986). Despite significant theoretical progress, these interactive studies also reached some inconsistent results, in part because of the methodological limitations of testing for numerous potential interactive effects among budgeting and non-budgeting variables, and in part because of the lack of robust theory to guide researchers in their predictions (Covaleski, Evans, Luft, & Shields, 2003).

Recently, several studies have attempted to reconcile inconsistent results from the additive and interactive model studies using an intervening model approach. Instead of testing for the direct effect of budgeting practices on each dependent variable separately (such as job-related stress or gaming behaviors), these studies explicitly recognize the relationships among the intervening variables. For example, Shields, Deng, and Kato (2000) asked the question "do control systems (budget participation, tightness, and budget-based compensation) affect performance directly, or do they affect stress, which in turn affects performance?" Empirical evidence to support such intervening models has been building up, with the discovery of each new intervening variable to explain the effects of budgeting on performance (e.g., budget adequacy as reported in Nouri & Parker, 1998; and budget goal commitment as reported in Chong & Chong, 2002).

Covaleski et al. (2003), describing this line of psychology-based budgeting research, emphasized the need for further research that does not simply focus on the direct linear effects of budgeting practices on performance, but argued in favor of a research strategy that examines the effects of budgeting on other intervening variables and then tests for the mediating effects of those variables on behavior (e.g., gaming) and performance. Following this strategy, our study proposes a comprehensive performance management model.

The next section describes the performance management model, and explains the variables included in each step of the model. The third section presents the research questions, and discusses 11 hypotheses derived from the performance management model. The fourth section shows results of an empirical illustration of the proposed model using path analysis, followed by the last section on conclusions and relevance of the findings.

THE PERFORMANCE MANAGEMENT MODEL

Our study proposes an integrative model that includes the various elements of performance management (budgeting, evaluating performance, and assigning rewards). Instead of selecting a few budgeting and non-budgeting variables to examine their impact on performance, this model attempts to illustrate the relationships among key variables along each step of the performance management cycle. We selected those variables based on a review of the literature, and organized them according to where they occur in the performance management cycle. This approach addresses the call from Hansen et al. (2003) for more research that does not simply study budgeting in isolation from other organizational practices, but considers budgeting "as part of an organizational package" (Hansen et al., 2003, p. 110).

In particular, the empirical tests we employed to illustrate this model include both actual and individual preferences for each performance management practice, to examine their impact on managerial performance (see section on the empirical illustration of this model). The inclusion of actual and preferred levels of each performance management practice is motivated by the growing literature on managerial preferences for control systems, and the effects of such preferences on the effectiveness of controls (Chow, Shields, & Wu, 1999; Clinton & Hunton, 2001; Shields & White, 2004).

Fig. 1 illustrates the proposed model. This model builds upon three streams of research: budgeting, performance evaluation, and compensation. We hypothesize that variables in each step have a direct influence on the variables in the following step, and an indirect effect on variables further along in the performance management cycle. While not intending to be exhaustive, the lists of variables included under each step are representative of key factors, documented in the literature, that help explain organizational choices related to the next step. The main purpose of this model is to demonstrate that each step does not exist in isolation; rather, each contribute direct and or indirect effects on managerial performance.

Antecedent Variables

Performance management depends on characteristics of the work itself, and of the manager. Four antecedents of budgetary behavior identified in the budgeting literature are included in the first step of the model. Task difficulty and task variability are used to describe task characteristics (Hirst, 1983; Brownell & Hirst, 1986; Brownell & Dunk, 1991). Task difficulty relates to the ability to specify the procedures to be followed to perform the task, that is, the input/output relations (Perrow, 1970; Van de Ven & Delbecq, 1974). Task variability represents the lack of routine or the number of situations that call for different methods or procedures for performing the task (Van de Ven & Delbecq, 1974; Brownell & Dunk, 1991). Responsibility accounting refers to the type of responsibility center (cost, revenue, profit, or investment center), and reflects the level of decentralization and independence of the responsibility center manager, a suitable setting for budget participation (Hopwood, 1972; Bruns & Waterhouse, 1975; Otley, 1978). Experience (years on the job) relates to the level of specific knowledge the manager has accumulated about his or her organizational unit, and contributes to information asymmetry between the responsibility center manager and his or her superior. Information asymmetry has been found to be a

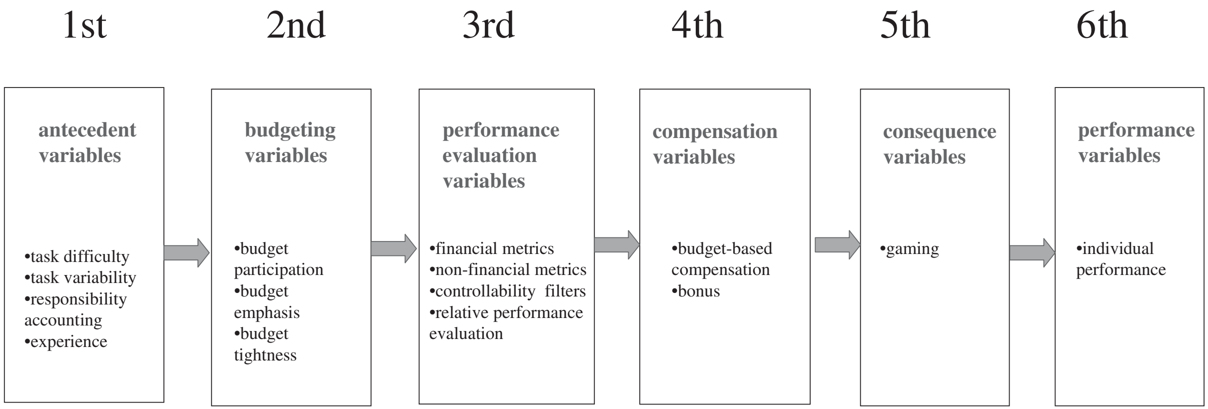

Fig. 1. The Performance Management Model (with selected variables).

major reason for budget participation (Shields & Young, 1993; Shields & Shields, 1998).

Budgeting Variables

Budgeting (step 2 in Fig. 1) is a key step in performance management, as it influences practically all other steps. The process of preparing and negotiating budgets, and establishing targets influences directly how individual performance is evaluated at the end of the budgeting period, and it influences motivation through compensation contracts that promise rewards based on budgetary performance; it also guides behaviors and ultimately impacts performance. Three of the most researched budgeting variables are included in our model. Budget participation, also known as participative budgeting, describes the extent to which an individual manager "is involved with, and has influence on, the determination of his or her budget" (Shields & Shields, 1998, p. 49). Budget emphasis reflects the extent to which a comparison of budgeted and actual results is emphasized as the basis of performance evaluation and allocation of organizational rewards (Hartmann, 2000). Budget tightness, the opposite of budgetary slack, refers to "predetermined budget targets that are perceived to be accurate, important to achieve, and which require serious effort and a high degree of efficiency in accomplishment" (Simons, 1988, p. 268).

Performance Evaluation Variables

Next, in the performance management cycle is the performance evaluation step (see step 3 in Fig. 1). Once budget targets are in place, decisions are made about which financial and non-financial performance metrics are emphasized for evaluation and compensation purposes, and which methods to employ to adjust for uncertainty in the evaluation process. This step has a direct impact on how much incentive compensation will be paid out to the manager, and, if properly implemented, will indirectly reduce the likelihood of gaming behaviors and improve individual performance. Our review of the literature on performance evaluation yielded four variables that play a major role in managing individual performance: the use of financial and non-financial metrics, controllability filters, and relative performance evaluation. Financial metrics (e.g., costs, revenues, or profits) are measures of performance that are expressed in monetary terms, usually tied to reports routinely provided by the organization's accounting and control systems. Non-financial metrics are not expressed in monetary terms, but may be quantified in operating terms (e.g., market share, percent of on-time deliveries). Considerable attention has been devoted in the performance management literature about how best to combine use of both types of metrics (Ittner & Larcker, 1998a, 1998b); and empirical evidence supports the premise that both are necessary to capture relevant performance dimensions and predict future performance (Hemmer, 1996; Epstein, Kumar, & Westbrook, 2000; Said, HassabElnaby, & Wier, 2003).

Controllability filters are ex-post adjustments made by a superior when evaluating performance of a subordinate against a pre-set standard. These adjustments are based on the controllability principle that managers should be held accountable only for factors that they can control. Even though it is a long-standing principle advocated by early management accounting researchers (e.g., Solomons, 1965; Demski, 1976), it has been disregarded to some degree by practitioners (Merchant, 1987). Questions regarding which factors determine the use of controllability filters, and which consequences ensue when organizations disregard them, thus continue to attract research interest (e.g., Shields, Chow, & Whittington, 1989; Bento & White, 1998; Chow et al., 1999; El-Shishini, 2001).

Relative performance evaluation (RPE) is another commonly used mechanism for removing uncontrollable factors facing a peer group of managers (Antle & Smith, 1986; Gibbons & Murphy, 1990). Under conditions of uncertainty, information about the performance of a peer group (inside or outside the organization) improves the quality of the evaluation because it allows superiors to filter factors such as industry-related risk or economy-wide factors (e.g., regulatory changes, inflation), and helps superiors focus on the outcomes of the subordinate's efforts compared to the outcomes of others facing similar constraints (Maher, 1987). Empirical studies have found evidence that firms do use RPE (e.g., Bannister & Newman, 2003), especially to insulate managers from adverse performance-related events. For example, the performance of managers operating in the airline industry was significantly affected in the aftermath of September 11 terrorist attacks in the US, creating the need for RPE to assign fair rewards to those managers who responded most effectively when compared to their peer group.

Compensation Variables

In the fourth step of the model, performance incentives are expected to be influenced by budgeting and performance evaluation variables (Jensen, 2003). Budget-based compensation refers to the extent to which monetary rewards are contingent upon performance compared to budget (Waller & Chow, 1985; Merchant, 1989; Chow et al., 1999). Bonus, the other compensation variable in our model, reflects the extent to which performance-contingent rewards represent a significant portion of total pay. As compensation becomes more dependent on budgetary performance, and the proportion of compensation that is performance-based increases, managers have greater incentives to meet the performance goals (Merchant & Van der Stede, 2003).

Consequence Variables

Gaming is a dysfunctional response to the pressures to meet performance goals. In the fifth step of our model, gaming is expected to be influenced by compensation, evaluation, budgeting, and antecedent variables. Gaming, also known as earnings management or earnings manipulation, refers to "any action … which affects reported income and which provides no true economic advantage to the organization and may in fact, in the long-term, be detrimental" (Merchant & Rockness, 1994, p. 79).

Performance Variables

In the sixth and last step of our model, performance of an individual manager is expected to be influenced by gaming, compensation, evaluation, budgeting, and antecedent variables. Given the arguments mentioned above for the previous steps in our model, we expect these variables to have both direct and indirect effects on performance.

RESEARCH QUESTIONS AND HYPOTHESES

This study explores the following research questions:

(1) Does the proposed performance management model depict the effects of budget participation and intervening variables on individual performance?
(2) To what extent do budgeting, performance evaluation, and compensation variables affect individual performance?
(3) Does the proposed performance management model capture the relationships among the variables in the performance management cycle?
(4) Do antecedent variables influence the performance management model? To what extent do antecedent variables affect individual performance?

These research questions led to the formulation of 11 hypotheses described below.

Hypothesis 1. Budget participation is positively related to task difficulty and variability, responsibility accounting, and experience.

In situations where managers face highly challenging and varied tasks, participation in the budgeting process provides managers with access to additional resources that would otherwise be unavailable, had budget targets been simply imposed. As the type of responsibility center increases in complexity with greater decentralization, and the manager accumulates more job-related knowledge through longer experience on the job, budget participation may increase.

Hypothesis 2. Budget emphasis is positively related to budget participation and other antecedent variables.

When budget participation increases, we expect reliance on budgets to increase also. Budget emphasis has been found to interact positively with budget participation in determining motivational outcomes such as job-related tension (Hopwood, 1972; Otley, 1978; Brownell & Hirst, 1986), social withdrawal and subordinate tension (Hirst, 1983), and budgetary performance (Kennis, 1979). Compatible combinations of budget participation and budget emphasis are more effective in producing positive organizational outcomes when certain antecedent conditions (i.e., low-task difficulty) are also present (Brownell & Dunk, 1991).

Hypothesis 3. Budget tightness is positively related to budget emphasis, budget participation, and other antecedent variables.

Budget tightness refers to the manager's perception of the probability that he or she will achieve the budget targets. Budget emphasis is positively associated with budget tightness because as the importance of meeting budget targets increases, so does the effort required to meet such targets. Onsi (1973), Merchant (1985), and Lal, Dunk, and Smith (1996) have found some empirical support for a negative relationship between budget emphasis and tightness, suggesting that budget emphasis generates a need for subordinate managers to create slack. Results from other studies (e.g., Collins, 1978) contradicted this explanation. Dunk and Nouri (1998), after an extensive review of the literature on antecedents of budgetary slack, concluded that these conflicting empirical results about the effects of budget emphasis on tightness can be explained by information asymmetry. When information asymmetry is low, budget emphasis will lead to budget tightness because managers will not be able to negotiate slack, even though they will have an incentive to do so. In our model, we hypothesize that budget emphasis (after controlling for budget participation) is positively related to budget tightness.

High budget participation may be associated with more realistic budget targets, that is, budget tightness. Participation increases perceived fairness and justice in the budgeting process (Wentzel, 2002), leading to increased motivation, goal commitment (Chong & Chong, 2002), and agreement on tougher budget targets (Fisher, Frederickson, & Peffer, 2000). Similarly to the previous argument regarding information asymmetry, budget emphasis and budget tightness, as participation reduces information asymmetry through information exchanges during the budget negotiation process, managers have less opportunity and less need to build in slack (Onsi, 1973; Cammann, 1976; Young, 1985).

Hypothesis 4. The use of financial performance metrics is positively related to budget tightness, budget emphasis, budget participation, and other antecedent variables.

An increase in the use of financial metrics is expected to follow an increase in the pressure to meet tighter budget targets. The extent to which financial metrics are used for evaluating and rewarding managers is also closely related to budget emphasis. In the supervisory style literature, concerns with costs, efficiency, and meeting budgets are commonly used to describe budget emphasis (as in the budget-constrained, budget-profit, and profit conscious styles reported by Hopwood, 1972; Otley, 1978; and other studies on the reliance on accounting performance measures reviewed by Hartmann, 2000). Participation in decision making has been found to increase satisfaction with the performance management system and the perceived usefulness of feedback about outcomes (Kleingeld, Tuijl, & Algera, 2004). In our model, budget participation may increase satisfaction with and perceived usefulness of financial and non-financial metrics, which in turn may influence their actual use for performance evaluation.

Hypothesis 5. The use of non-financial performance metrics is positively related to the use of financial performance metrics, budget tightness, budget emphasis, budget participation, and other antecedent variables.

The use of non-financial performance metrics may follow the use of financial metrics because of the current concern with adjusting for the limitations of financial, historic-based performance metrics by giving greater importance to key non-financial metrics (Hemmer, 1996). Shields and White (2004) found, in fact, a strong correlation between the uses of those two types of performance metrics for incentive compensation purposes. Similar to the arguments offered in support of Hypothesis 4, we expect budget tightness, budget emphasis, and budget participation to positively influence the use of non-financial metrics. Increases in both budget tightness and budget emphasis may create a stronger need for non-financial metrics that capture dimensions of performance not confined to monetary terms so as to help offset the dysfunctional effects of management myopia (Hemmer, 1996; see value drivers in Merchant & Van der Stede, 2003). Participation in budgeting may be followed by participation in other forms of decision making, including the choice of financial and non-financial metrics.

Hypothesis 6. The use of controllability filters is positively related to the use of non-financial and financial performance metrics, budget tightness, budget emphasis, budget participation, and other antecedent variables.

When managers have less control over a performance metric, financial or non-financial, there is a greater need for controllability filters because the performance outcome is less informative about which desirable actions the manager has taken (Merchant, 1987). To the extent that participation in the budgeting process is high, budget emphasis and budget tightness may increase, and this may result in a greater need for controllability filters that will avoid the dysfunctional consequences of holding managers accountable for uncontrollable events. As Shields, Chow, and Whittington (1989) concluded, the use of controllability filters is positively associated with an increased individual effort to perform.

Hypothesis 7. The use of relative performance evaluation is positively related to the use of controllability filters, non-financial and financial metrics, budget tightness, budget emphasis, budget participation, and other antecedent variables.

We applied the theoretical developments by Maher (1987) to examine the factors along the performance management cycle that influence the use of RPE. We expect that the same conditions of uncertainty and pressure to meet budget targets described above for controllability filters also hold true for RPE. Thus, controllability filters should be positively associated with RPE. Similarly, more emphasis placed on the use of outcome-based financial and non-financial metrics may result in a greater need for RPE to remove environmental factors that affect those metrics, and yet are outside the managers' control (because of situations where managers could not mitigate the impact of adverse factors on his or her performance by any degree of managerial effort). When participation in the budget process increases with budget emphasis, we also expect superiors to employ more relative performance evaluations. Greater monitoring is a significant factor in explaining RPE usage. Budget tightness has been found to be positively correlated with greater use of monitoring and reporting controls (Simons, 1988), and here we extend this result to argue that tightness also requires more use of RPE to preserve fairness and procedural justice.

Hypothesis 8. Budget-based compensation is positively related to the use of relative performance evaluation and controllability filters, financial metrics, budget tightness, budget emphasis, budget participation, and other antecedent variables; it is negatively related to the use of non-financial metrics.

A stronger link between budget targets and compensation is consistent with increased use of RPE and controllability filters to sort out relevant from irrelevant indicators of performance. The choice of performance metrics, both financial and non-financial, may also influence the way incentives are designed. The extant research on performance measurement suggests that the choice of financial and non-financial performance metrics has a significant impact on gaming behaviors and performance (see discussion in Shields & White, 2004). In this study we hypothesize that this direct effect of performance metrics on gaming and performance is supplemented by indirect effects through intervening motivational variables. Performance metrics influence motivation through the way in which they are used in performance-contingent compensation contracts. However, increased use of non-financial metrics may lead to fewer rewards being paid out on the basis of meeting budget targets (Hemmer, 1996), hence the negative relationship between non-financial metrics and budget-based compensation.

Budget-based compensation is expected to be a function of the three budgeting variables from step 2 of this model as well. Shields et al. (2000) have demonstrated that budget participation and budget-based incentives have a negative effect on job-related stress, and reduced stress improves individual performance. They also found that budget difficulty is positively associated with stress. Prior to that study, Shields and Young (1993) had found that budget participation had a strong correlation with budget-based incentives. Therefore budget-based compensation should have a positive relationship with both budget participation and budget emphasis. Organizations that emphasize budgets for performance evaluation and compensation purposes are also likely to adopt compensation contracts that explicitly link rewards to how performance compares with budgets. Drawing from the hypotheses in Simons (1988) and Shields et al. (2000), we expect budget tightness to be positively related to budget-based compensation. Even though monetary incentives associated with budgets induce managers to negotiate slack into their budgets, their superiors will likely attempt to ensure that budget targets are reasonably tight and accurate before paying compensation based on achievement of those targets (Simons, 1988).

Hypothesis 9. Bonuses are positively related to budget-based compensation, the use of relative performance evaluation and controllability filters, financial and non-financial metrics, budget tightness, budget emphasis, budget participation, and other antecedent variables.

Since organizations that make compensation contingent on budget achievement are also likely to designate a significant portion of total pay as bonuses, many of the same arguments offered above regarding factors that influence budget-based compensation will apply to bonuses too. An extensive use of bonuses as rewards (as compared to base salaries) is consistent with the use of RPE and controllability filters, as well as financial and non-financial performance metrics. To the extent that budget tightness increases performance-related risk, managers who bear those risks will require a proportionate compensation-related risk, with a high payout in the form of bonuses if they are successful in meeting those difficult targets (Chow, 1983; Merchant, 1989; Merchant & Manzoni, 1989). When budget participation is high, and there is a strong emphasis on meeting budgets, organizations may increase the amount of performance-contingent rewards compared to total pay to motivate managers to use resources in the best way possible to improve performance in accordance with organizational goals (Shields & Young, 1993).

Hypothesis 10. Gaming is positively related to bonuses, budget-based compensation, the use of relative performance evaluation and controllability filters, financial and non-financial metrics, budget emphasis, and other antecedent variables; it is negatively related to budget tightness and budget participation.

Firms use budget-based compensation and bonuses to create incentives for managers to improve performance (Chow, 1983; Waller & Chow, 1985; Shields & Young, 1993). However, these incentives may create additional pressure for managers to engage in dysfunctional behaviors such as gaming to meet budget targets (Jensen, 2003). If RPE and controllability filters effectively removed uncontrollable factors from the evaluation process, managers would likely have fewer reasons to engage in gaming behaviors. On the other hand, a high use of controllability filters and RPE may introduce more subjectivity in performance evaluation and contribute to an "excuse culture" (Merchant & Van der Stede, 2003), thus offering more opportunities for gaming. Previous studies have found significant correlations between financial and non-financial metrics and gaming (e.g., Shields & White, 2004). In particular, that study found that the use of non-financial metrics has a positive influence on the likelihood that managers will engage in gaming behaviors. In our study, we argue that increased reliance on a summary financial metric (given all the limitations of historic, short-term financial metrics pointed out by Kaplan & Norton, 1996) may result in more gaming.

With regard to budgeting variables and gaming, budget participation and tightness are expected to have a negative association with gaming, while budget emphasis has a positive one. Increased participation in the budgeting process leads to more information exchange (Shields & Young, 1993), goal commitment, and perceptions of fairness and justice in the evaluation process (Little, Magner, & Welker, 2002). Therefore managers who have a greater influence in setting their own budget targets should have less incentive to resort to gaming to manipulate results (Fisher et al., 2000). Tight budget targets are often accompanied by increased monitoring and reporting controls (Simons, 1988), so that, even though managers under tight budgets may feel tempted to use gaming to manipulate results, they will not have much opportunity to get away with gaming and go undetected. Budget emphasis, on the other hand, is expected to influence gaming positively, as managers who realize that their bosses rely more on budgets for performance evaluation may decide to alter the timing of revenues, costs, or investments to meet the budget targets (Merchant, 1985; Jensen, 2003; Hansen et al., 2003).

Hypothesis 11. Performance is positively related to gaming, bonuses, budget-based compensation, the use of relative performance evaluation and controllability filters, financial and non-financial metrics, budget tightness, budget emphasis, budget participation, and other antecedent variables.

Gaming is associated with performance because the earnings manipulation practices involved in gaming are specifically intended to alter reported performance. Budget-based compensation and bonuses are also designed to have positive effects on performance (Merchant, 1989). To the extent that RPE and controllability filters reduce uncertainty by shielding managers from uncontrollable factors, they may also affect performance positively. The use of financial and non-financial performance metrics, as they clarify the objectives of an organizational unit, may influence performance positively (Shields & White, 2004). By setting targets at challenging levels, budget tightness may lead to improved performance. After controlling for other factors, budget emphasis has been found to be associated with performance (see review in Hartmann, 2000). Finally, budget participation, as it improves goal commitment and motivation, and leads to attainable targets, enhances the chances of higher performance directly and indirectly, through the effects of budget participation on other controls (see review in Covaleski et al., 2003).

AN EMPIRICAL ILLUSTRATION OF THE MODEL

The Survey

A survey questionnaire was developed based primarily on instruments tested in previous studies, and distributed to 100 managers in the mid-Atlantic area who had direct budget responsibility. After preliminary interviews to describe the purposes of the project, and to guarantee strict confidentiality, participants were asked to complete the questionnaires and mail them to the researchers. The pre-stamped return envelopes enclosed with the questionnaires contained no means of identifying individual respondents, to encourage the managers to be most candid about their responses. This was necessary due to the sensitive nature of parts of the questionnaire that dealt with issues such as compensation variables and gaming behaviors. Sixty-four completed questionnaires were received. This 64% response rate is impressive, given that pilot tests of the questionnaire revealed that it would take approximately 25 min to complete. The managers were asked to rate, for each performance management practice, the extent to which it was actually used in their organizations, and to which they would prefer it to be used, in order to increase performance, job satisfaction, and morale.

The respondents reported average experience of five years in their positions and average budgeted revenues of $40,000,000 for their responsibility centers. The fact that the respondents were responsibility center managers, and not students or financial specialists, was an intentional aspect of the research design, to increase the relevance of the empirical tests of the performance management model.

Measurement of Variables

To promote comparability with previous studies, the questionnaire included measures from prior research whenever they were available.

Antecedent Variables

Task difficulty and variability measures were taken from the 14-item instrument originally developed by Van de Ven and Delbecq (1974), using a seven-point scale anchored by 1 = Strongly Disagree and 7 = Strongly Agree. Responsibility accounting was measured by one questionnaire item asking the respondent whether he or she was primarily responsible for costs (= 1), revenues (= 2), profits (= 3), or investments (= 4). Experience was measured by one questionnaire item asking how many years the respondent had held the current job in the company.

Budgeting Variables

The three budgeting variables were measured using a seven-point scale anchored by 1 = Very Little and 7 = Very Much, which respondents were asked to use for rating both their current and preferred levels. Budget participation was measured with the four-item instrument used by Chow et al. (1999), which was adapted from the one developed by Milani (1975), and later used in several studies (e.g., Kennis, 1979, Brownell, 1982, Shields & Young, 1993). The budget tightness measure consisted of a three-item instrument from Chow et al. (1999), based on Kennis (1979), Simons (1988), and Merchant and Manzoni (1989). Budget emphasis was measured with a six-item instrument adapted from Merchant (1981) and Chow, Shields, and Wu (1993), which was developed based on the original work from Hackman and Porter (1968) and later used in Dermer (1975).

Performance Evaluation Variables

Similarly to the instruments on budgeting practices described above, the four performance evaluation variables used a seven-point scale ranging from 1 = Very Little and 7 = Very Much, applied to ratings of both current and preferred levels.

Given that the purpose of our model is to relate budgeting, performance evaluation, and incentives to gaming behaviors and performance, we reviewed the literature on the choice of performance metrics to find out which metrics should be included in this test of the model because they most closely relate to the two dependent variables of interest (gaming and performance). Our search of the literature was guided by three main criteria: (1) we wanted to choose one financial metric, and one non-financial metric to recognize the growing trend of organizations that weigh both types of metrics when evaluating and rewarding managers (American Institute of Certified Public Accountants (AICPA) & Maisel, 2001); (2) we needed performance metrics that would apply to a wide range of responsibility center managers (as opposed to stock-based metrics, for example, that apply at the enterprise level but not at the responsibility center or individual manager's level); and (3) we gave priority to metrics most popular in current practice. This search resulted in two performance metrics selected for this study: efficiency gains (financial) and market share (non-financial). These metrics are among the most frequently used in practice and have been found to relate significantly to both gaming behaviors and performance (Shields & White, 2004).

Efficiency gains capture the financial results of a manager's effort to control costs in order to achieve higher profit margins. Empirical evidence from Shields and White (2004) suggests that efficiency gains were the financial metric most preferred by the surveyed managers. Market share has been suggested as a key non-financial performance metric because it measures what percentage of a target market the business unit is able to control. It is one of the three most popular non-financial metrics in current practice (American Institute of Certified Public Accountants (AICPA) & Maisel, 2001). Kaplan and Norton (1996) have recommended market share as a core measure to assess strategic performance from the customer perspective for organizations interested in adopting a balanced scorecard of performance metrics. Therefore in the empirical tests presented in this section, we used efficiency gains and market share as surrogates for the use of financial and non-financial metrics, respectively.

The two questions on efficiency gains and market share were the same as in Shields and White (2004). Controllability filters related to five situations in which performance is adjusted for factors beyond control of the manager, using the instrument developed by Chow et al. (1999) based on the original framework by Merchant (1987). RPE was measured by one question based on the findings of Maher (1987) regarding the extent to which compensation is influenced by the performance of similar units inside or outside the organization.

Compensation Variables

The question about budget-based compensation, which was based on Simons (1988), Shields and Young (1993), and Chow et al. (1999), asked for the extent to which the compensation contract clearly specified how compensation is related to budget performance. This question used a seven-point scale ranging from 1 = Very Little and 7 = Very Much, and the participant had to rate both current and preferred levels. The question regarding bonus was used in the same studies cited for budget-based compensation, but it was slightly adapted for the purposes of this study. Instead of using the seven-point scale, this item in the questionnaire asked for the actual percentage of total pay that typically came from performance-based bonuses, as opposed to salary; the participant was asked to give the percentage as it "currently is" and the percentage it "should be."

Consequent Variables: Gaming Scenarios

The four scenarios were selected from the gaming practices questionnaire originally developed by Bruns and Merchant (1989, 1990) and later used by Merchant and Rockness (1994) and other studies addressing earnings management (e.g., Shields & White, 2004). These scenarios were selected because they were closely related to the performance metrics used in this study: two games influenced the efficiency gain metric (outsourcing work to postpone reporting the costs; deferring discretionary items to another period); and the other two games influenced the market share metric (shipping earlier to avoid missing a budgeted sales target; offering liberal payment terms to boost sales in the short term). The managers were asked to rate the probability that they would take that action using a seven-point scale anchored by 1 = Highly Improbable and 7 = Highly Probable.

Performance Variables: Individual Performance

Nine questions were included in the questionnaire to measure individual performance, using the instrument originally developed by Mahoney, Jerdee, and Carroll (1963) and frequently used in accounting research (e.g., Brownell & Hirst, 1986; Kren, 1992; Nouri, Blau, & Shahid, 1995; Wentzel, 2002; Chong & Chong, 2002). Each question had a nine-item scale anchored by 1 = Below Average and 9 = Above Average (Table 1).

Descriptive Statistics

Table 1 shows descriptive statistics for the 15 variables used in this study. Some questionnaires were returned with missing values, so the number of observations varies slightly. We performed reliability analysis to adjust the

Table 1. Descriptive Statistics.

Scale	N	$\bar{X}$	s	Cronbach's Alpha
Panel A: Scales and reliability				
Individual performance	63	38.75	5.91	0.80
Gaming	63	16.97	5.50	0.69
Controllability filters	63	17.33	5.12	0.89
Budget tightness	64	11.67	1.82	0.62
Budget emphasis	64	26.14	7.95	0.88
Budget participation	62	20.82	5.11	0.85
Task variability	61	36.64	5.57	0.71
Task difficulty	64	26.39	5.75	0.67

Variable	N	$\bar{X}$	s
Panel B: Other variables			
Bonus	58	18.40	20.67
Budget-based compensation	64	26.14	7.95
Relative performance evaluation	64	3.80	1.85
Non-financial metrics	64	2.45	1.70
Financial metrics	64	3.56	1.80
Experience	64	4.95	4.53
Responsibility accounting	63	2.17	1.02

scales from other studies for this particular sample and considered only the items that the reliability analysis indicated that they formed an internally consistent scale. All of the Cronbach alphas were at or above 62%, which suggests a relatively high reliability.

Path Analysis Results

We performed path analysis to construct the relationships among the variables described in Fig. 1. We tested whether the variables in each step along the performance management cycle that were influenced by variables in the previous step and whether the relationships among variables within each step were significant. This technique helped us to determine which variables along the path had direct and indirect effects on performance (either positive or negative) and the relative magnitude of the relationships within each set of variables.

Regression analyses were performed to determine the path coefficients for the relationships among the variables proposed in the model for this study. The main quantitative regression results are reported in Table 2, and Fig. 2

Table 2. Regression Results.

Dependent Variable	Independent Variables	Beta	$\bar{R}^2$	Significance
Performance			0.14	0.01
	Financial metrics	0.27		
	Budget participation (*p*)	0.27		
	Bonus	0.20		
Gaming			0.18	0.007
	Controllability filters	0.27		
	Budget participation	−0.26		
	Experience	0.26		
	Non-financial metrics	0.23		
Bonus			0.35	0.0001
	Budget-based compensation	0.48		
	Financial metrics (*p*)	−0.30		
	Non-financial metrics (*p*)	0.29		
	Task difficulty	−0.24		
Budget-based			0.35	0.001
compensation	Budget emphasis	0.34		
	Responsibility accounting	0.33		
	Non-financial metrics (*p*)	−0.32		
	Relative performance evaluation	0.31		
	Task variability	0.24		
Relative			0.14	0.01
performance	Financial metrics	0.25		
evaluation	Responsibility accounting	0.23		
	Budget tightness (*p*)	0.23		
Controllability			0.07	0.05
filters	Financial metrics	0.25		
	Budget participation (*p*)	0.20		
Non-financial			0.36	0.0001
metrics	Financial metrics (*p*)	0.53		
	Responsibility accounting	0.36		
	Budget participation	0.23		
	Experience	0.18		
Financial metrics			0.06	0.03
	Budget emphasis	0.28		
Budget tightness			0.25	0.0003
	Budget participation (*p*)	0.42		
	Budget emphasis	0.25		
	Task variability	0.20		
Budget emphasis			0.13	0.007
	Budget participation	0.36		
	Task variability	0.18		

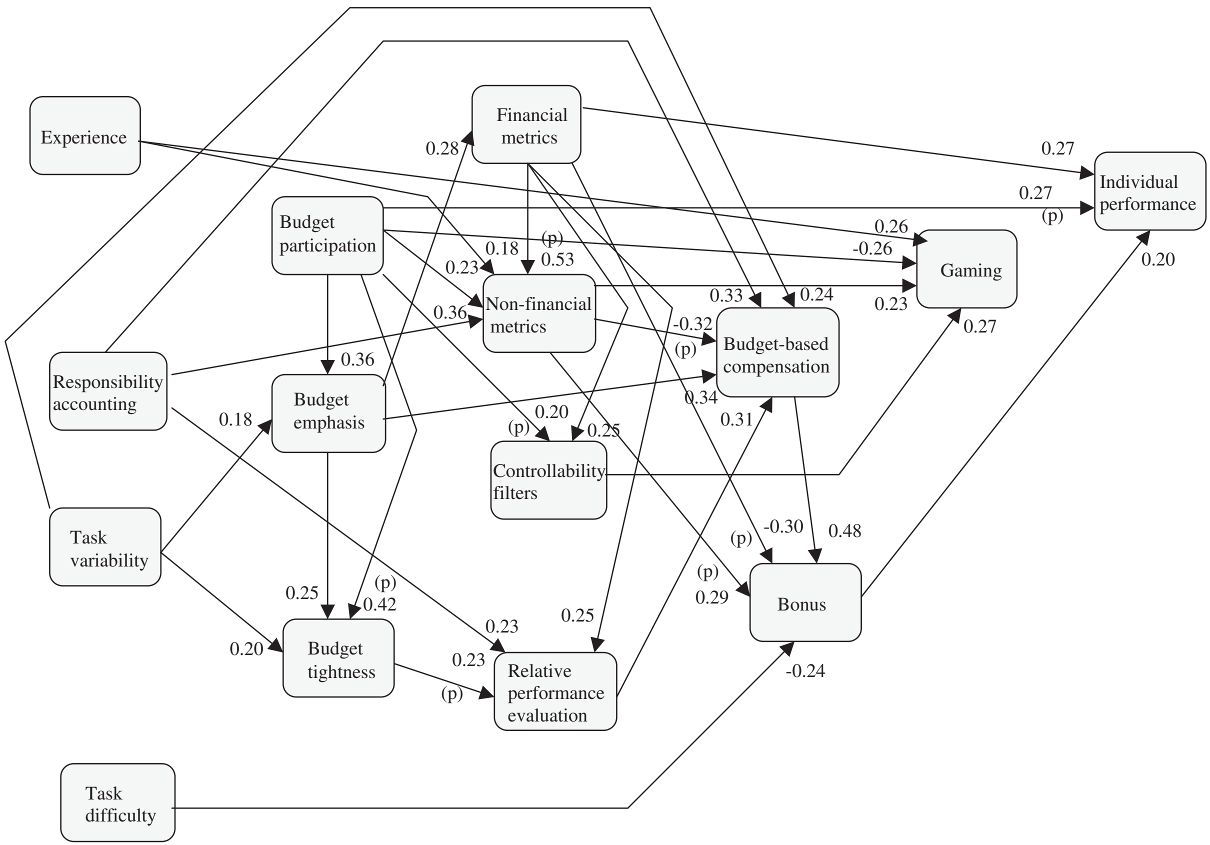

Fig. 2. Significant Path Relationships.

illustrates the main results from our path analysis graphically. Beta weights or path coefficients are reported instead of partial correlations (regression coefficients) because the beta weights indicate the extent to which change in the dependent variable is produced by a standardized change in one of the independent variables, after controlling for the other independent variables (Blalock, 1979). For the purposes of preparing Table 2 and Fig. 2, all relationships included are statistically significant and positive, with four exceptions in which the relationship is negative (see discussion below). To facilitate reading, variables marked with (*p*) reflect preferred levels (instead of actual levels).

The overall results provide preliminary empirical evidence in support of our performance management model. In step 1, we find only non-significant direct relationships between the antecedent variables in step 1 and budget participation in step 2, leading us to reject Hypothesis 1. However, we find direct and indirect effects of these antecedent variables on other variables in steps 2–6. Task variability is the only antecedent variable found to directly influence budgeting. In step 2, budget emphasis has significant and positive relationships with both task variability and budget participation, consistent with Hypothesis 2. Budget tightness has a strong association with budget participation (preferred), and significant relationships with budget emphasis and task variability, as predicted in Hypothesis 3. Considering the relationships among budgeting variables, managers who have a greater input in setting budgets report that their organizations place more emphasis on achieving budget targets, even when holding them accountable for harder targets. This result and the inclusion of preferred levels of budget participation in the analysis help explain the conflicting findings of Merchant (1985) and Lal, Dunk, and Smith (1996) in support of positive relationships among budget participation, emphasis, and tightness.

In step 3, the use of financial metrics is positively related to budget emphasis but not significantly related to any other budgeting or antecedent variable, providing weak support of Hypothesis 4. The use of non-financial metrics is positively related to the use of financial metrics (preferred levels), producing the strongest relationship among all tested for the 15 variables in this model. Non-financial metrics are also related to budget participation, responsibility accounting, and experience, consistent with Hypothesis 5. It is interesting to note that budget participation has a direct effect on the use of non-financial metrics, but contributes to the use of financial metrics indirectly through its influence on budget emphasis.

The use of controllability filters and RPE are both influenced by financial metrics. Furthermore, controllability filters are positively related to budget participation (preferred), in support of Hypothesis 6. Increased use of RPE is associated with responsibility accounting (more complex responsibility centers such as profit and investment centers tend to employ RPE) and higher budget tightness (preferred), as expected from Hypothesis 7.

In step 4, budget-based compensation is positively affected by RPE and budget emphasis, and it is negatively affected by non-financial metrics (preferred). Managers who would prefer not to have non-financial metrics tend to have compensation contracts that clearly specify that compensation will be calculated based on budget-related performance. Budget-based compensation is also more prevalent in responsibility centers with greater complexity and decentralization levels, and under conditions of higher task variability. These results generally support Hypothesis 8; however, the lack of a significant relationship between budget participation and budget-based compensation seems to contradict Shields and Young (1993), who found a significant and positive association between these two variables. In our study, budget participation is found to influence budget emphasis and the use of non-financial metrics, and those two performance evaluation variables in turn significantly impact budget-based compensation. It seems that participation does not directly influence compensation, but once we controlled for the intervening effects of performance evaluation variables, we realized that budget participation does have an indirect effect on budget-based compensation.

Bonuses (percent of pay at risk) are positively related to budget-based compensation and the use of non-financial metrics (preferred), as expected from Hypothesis 9, but hold a negative relationship with financial metrics (preferred) and task difficulty in our sample. The strong relationship between budget-based compensation and bonuses is consistent with a situation in which managers who have compensation contracts that objectively link compensation to budget-related performance tend to have more of their total pay at risk. The unexpected negative relationships of task difficulty and financial metrics with bonus may be explained by the agency theory argument of risk aversion: when difficulty increases and reliance on financial results also increases, so does performance risk. Managers are shielded from that risk by reducing compensation risk via lower percentages of pay at risk.

In step 5, gaming is positively related to the use of controllability filters, non-financial metrics, and experience, and negatively related to budget participation, as indicated in Hypothesis 10. More experienced managers responded that they are more likely to engage in gaming behaviors, while managers who participate more in their budgeting processes report a lower likelihood that they will adopt gaming practices. Contrary to the incentive literature, there were no significant, direct relationships between compensation variables and gaming for this sample once we controlled for the effects of performance evaluation, budgeting, and antecedent variables on gaming.

In step 6, individual performance is positively associated with bonuses, budget participation (preferred), and the use of financial metrics, consistent with Hypothesis 11. Managers who have more pay at risk, whose performance is measured by financial results, and who prefer higher levels of participation in budgeting tend to be evaluated as top performers. We found no significant association between gaming and performance, perhaps due to the performance scale used, which is not confined to items typically subject to gaming manipulations.

CONCLUSION AND RELEVANCE OF THE FINDINGS

The objective of this study was to propose a comprehensive performance management model and illustrate the model with empirical results. The empirical illustration of the model was based on a non-random sample of 64 responsibility center managers, and this relatively small sample size may limit the interpretation of the model effects. Overall, the empirical results, albeit preliminary, corroborate the proposed model, and suggest that it can be useful in future research on intervening variables that mediate the relationship between budgeting and performance. Notwithstanding these results, the variables used to test our model only explain 14% of the variation in individual performance. Therefore other relevant variables are missing from the set of variables used to test the model, suggesting a possible omitted variable bias.

The results show that each variable along steps 2–6 of the proposed performance management model can be significantly explained by other variables included in the model, except for antecedents of budget participation. The results are particularly strong to explain compensation variables (budget-based compensation and bonus), non-financial metrics, and budget tightness. Budget participation has two beneficial effects: it reduces gaming (directly and through its association with the use of controllability filters) and it increases performance, directly and indirectly, through intervening variables such as budget emphasis, budget tightness, and the use of non-financial performance metrics. These intervening variables, in turn, influence other performance evaluation and compensation variables that have a direct impact on performance. Antecedent variables seem to play a significant role in explaining budgeting, performance evaluation, and compensation practices, but they seem not to affect individual performance directly.

This study integrates the previous literature on performance management practices by offering a comprehensive model of how variables along each step of the performance management cycle have direct and indirect effects on performance. In particular, this study introduces the preference for budget participation as a relevant factor in explaining managerial performance.

The preferred levels of budget participation, tightness and financial and non-financial metrics showed significant relationships with other variables along the performance management cycle. This result suggests that actual performance management practices are not sufficient to explain differences in managerial performance, as managerial preferences for those practices also influence performance.

Future research could benefit from adding individual-level variables such as leadership style, cognitive style, and personality traits (including tolerance for ambiguity and locus of control) to help explain the remaining variations in individual performance. Variables at the business unit or firm level, such as strategic mission, or cultural values, should also increase the explanatory power of the model.

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ANALYZING THE INVESTMENT DECISION IN MODULAR MANUFACTURING SYSTEMS WITHIN A CRITICAL-THINKING FRAMEWORK

Mohamed E. Bayou and Thomas Jeffries

ABSTRACT

The absence of the reasoning stage in the analysis of long-term investment decision creates a serious gap in this classic topic in management accounting literature. The purpose of this paper is to fill this gap. The traditional analysis focuses on the evaluation stage using capital budgeting tools to rank alternative investment proposals. It tacitly assumes that the decision is to be made, thereby bypassing the reasoning stage. However, the reasoning stage may reveal that there is no sufficient justification (reasoning) to consider searching for and evaluating alternative proposals for this decision. Focusing on the reasoning component, the paper combines Fritz's (1989, 1990) "creative tension" and Janis and Mann's (1977) "challenges" as the driving forces for the problem-finding step. To demonstrate the significance of filling the reasoning gap in the long-term investment decision, the paper selects the modular manufacturing system and the complex investment decision required for its adoption. Using hypothetical data, the paper employs the Dempster-Shafer

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Theory of Evidence and Omer, et al's (1995) algorithm to compute the belief and plausibility values of the three reasoned actions: (1) maintain the status quo, (2) adopt Level 2 (assembly) modularity or (3) adopt Level 2 (design) modularity.

The contributions of the paper include (1) highlighting a critical gap currently existing in one of the classical decisions in the management accounting literature; (2) developing a framework for filling this gap and (3) applying this framework to the intricate nature of the modular manufacturing system and its complex investment decision.

The traditional analysis of long-term investment decisions often begins with the evaluation stage, using financial criteria such as return on investment (ROI), net present value (NPV), internal rate of return (IRR) and payback period (in addition to some non-financial benefits) in ranking alternative investment proposals. This analysis bypasses a fundamental step, the reasoning stage of the decision-making process. Reasoning as a prelude to the evaluation stage is essential for developing the relevant framework for this decision; more importantly, this step ratifies the evaluation stage itself as it may prove that there is no need (i.e., no sufficient reason exists) to consider making the decision in the first place. The absence of the reasoning step in this classic topic in the management accounting literature creates a serious gap that needs to be filled.

To fill this gap, we construct the investment decision as a critical-thinking model. Finocchiaro's (1989, 1990) critical-thinking triad of reasoning, evaluating and self-reflecting is appropriate for this purpose. In addition, we employ Fritz's (1989, 1990) "creative tension" and Janis and Mann's (1977) "challenges" in order to develop the formal reasoning stage of the decision-making process. Thus, the major argument of this paper proceeds as follows: before an investor begins evaluating a set of alternative proposals, there is often a critical stage of "creative tension" and "challenges," driven by threats, uncertainty or substantial losses; upon the occurrence of a trigger event (e.g., a massive public recall of a defective product), the investor begins the process of problem finding (the reasoning stage) to justify the task of problem solving (the evaluation stage).

We demonstrate the importance of the reasoning stage as a prelude to the stage of evaluating alternative investment proposals by analyzing the decision of adopting a modular manufacturing system. This adoption entails a complex investment decision (Van Cauwenbergh, Durinck, Martens, Laveren, & Bogart, 1996; Abdel-Kader & Dugdale, 1998, 2001). The substantial investments needed to restructure the firm's operations around an intricate network of product platforms, product families, assembly processes and logistics can revolutionize the entire value chain (Meyer & Lehnerd, 1997); as Sanchez and Mahoney (1996) assert that modularity in the design of products should lead to modularity in the design of the organization itself that produces these products. Indeed, the platform approach has revolutionized the way products are designed, manufactured and marketed. Developing successful new lines of modular products hinges upon developing product-platform flexibility,[1] which requires a close examination of the firm's national and international supplier network at all tiers in order to establish a reliable source of modules, systems and interfaces at the prescribed quality on time and which are sufficiently flexible to cooperate rather than compete with other suppliers to serve the manufacturer. The first step in this complex decision is not to list and evaluate the alternative proposals regarding the type of plant and equipment for building the modular manufacturing system; rather, it is the development of sufficient reasoning to consider whether such a decision should be made.

This study, as we said above, analyzes the modularity investment decision using Finocchiaro's (1989, 1990) critical-thinking triad of reasoning, evaluating and self-reflecting.[2] Focusing on the reasoning part of the investment decision, this study applies Dempster-Shafer's Theory of Evidence to show how the investor justifies the importance of making this decision before it proceeds to the evaluating stage of the decision. We use hypothetical data to illustrate the mechanism of this application. The first section of the paper reviews the literature on long-term investment decisions to show its predominant emphasis on the evaluation stage. The second section introduces the critical-thinking triad in which the reasoning stage is an integral element of the decision-making process. The third section explains the complex decision of adopting a modular manufacturing system and the significance of the reasoning stage for analyzing this decision. The fourth section applies Dempster-Shafer's Theory of Evidence to justify the importance or urgency of considering this investment decision. Limitations of the study appear in the fifth section, and is followed by summary and conclusions section.

A LITERATURE REVIEW OF THE LONG-TERM INVESTMENT DECISION

The literature on long-term investment decision is vast and varied. We classify most of the studies on this topic into three groups. The *financial* *performance or capital budgeting group* usually includes surveys of practice studies (Van Cauwenbergh et al., 1996; Abdel-Kader & Dugdale, 1998). This group also includes field studies of practice that emphasize steps other than economic appraisal of this decision, e.g., creating investment proposals and investigating the interplay of financial and strategic information in the decision-making process (Nixon, 1995; Abdel-Kader & Dugdale, 1998). The *financial risk group* focuses on the relationship between risk and return. For example, Kaplan and Atkinson (1989) point to the deficiencies of the capital budgeting models, e.g., using excessively high discount rates and incorrect base-case forecasts as well as failing to recognize all of the benefits of the investment proposals under study. Several studies include risk analysis explicitly as a prime factor in making the investment decision (Kaplan, 1986; Slagmulder, Bruggeman, & Wassenhove, 1995). Finally, the *non-financial factors group* criticizes the studies in the first two groups for their over-emphasis on the financial aspect of the long-term investment decision, and surveys managers' perceived importance of intangible factors in making this decision (Slagmulder et al., 1995; Abdel-Kader & Dugdale, 1998, 2001). The arguments in these studies pivot primarily around the evaluation stage of the decision-making process. Therefore, we classify these three groups of studies under the evaluation component of the following critical-thinking model.

A CYCLICAL CRITICAL-THINKING MODEL OF LONG-TERM INVESTMENT DECISIONS

While currently there is no generally acceptable definition of critical thinking (Whitaker, 2002/2003, p. 51), many analysts would agree that important long-term investment decisions in modularity require critical thinking. The word "critical" is the key term necessary to understand the concept of critical thinking, which can be explained by a debate in philosophy between Siegel and Finocchiaro regarding the nature of critical thinking. Finocchiaro (1989) objects to Siegel's (1988) equation, critical thinking = good reasoning = rationality, in that "good" reasoning and rationality need not be critical, i.e., they need not involve negative criticism (Siegel, 1990, p. 453). Finocchiaro (1990, p. 462) argues that Siegel's equivocation ultimately is "reduced to questionable appeal to authority and to question begging." Instead, he defines critical thinking as "the special case of reasoning when explicit reasoned assessment is present." It suffices for this paper's purpose to mention that the debate may settle on the view that "critical thinking is thinking which is reasoned, evaluative and self-reflective" (Finocchiaro, 1990, p. 465). Johnson-Laird (1991, p. 454) explains self-reflection as a meta-cognition of a higher-order type of thinking that depends on having access to a model of a thought process that gives rise to self-awareness. As to the question "must thinking be critical to be critical thinking?" Finocchiaro (1990, p. 465) replies:

> I believe that it is probably true that all thinking which is reasoned *and* evaluative *and* self-reflective is critical thinking. Then insofar as reasoned, evaluative, and self-reflective are three senses of "critical," we may also say that critical thinking is, indeed, thinking which is critical.

We employ this triad of critical thinking (reasoning, evaluating and self-reflecting) as the key stages of the long-term investment decision cycle (Fig. 1). Reasoning represents the problem-framing stage, which is set into motion by threats, challenges and creative tension. The problem finding is a function of the intensity in Fritz's (1989, 1990) principle of creative tension, explained in the following section. The stronger the tension, the more urgent the search for problem finding. The problem-solving stage requires evaluating a set of alternatives, and then self-reflecting upon the completion of the decision process. Once the cycle is completed, experience learned from going through this process enriches organizational learning (Senge, 1995; Zebda, 1995), and in turn, this helps the reasoning, evaluating and self-reflecting stages, and so on ad infinitum (Bayou & Reinstein, 1999, 2000). Let us closely examine the reasoning stage since this is the focus of this paper and the Dempster-Shafer theory application.

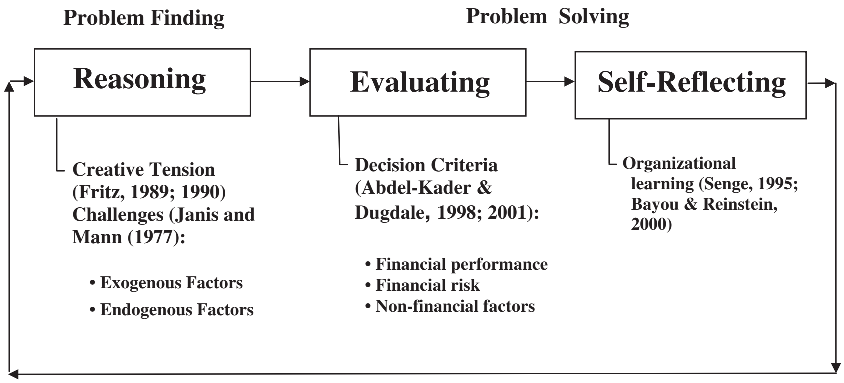

Fig. 1. The Cyclical Critical-Thinking-Based Investment Decision. *Source:* Adapted from Finocchiaro (1989, 1990).

Reasoning: Motivation (Cause) to Problem Finding (Effect)

Companies must be motivated before seeking to find and solve problems, a necessity that can be defined by Fritz's (1989, 1990) principle of "creative tension," which emanates from the distance (tension) between where one wants to be (vision) and is currently (current reality). Senge (1995, p. 79) recognizes this principle and stresses that "an accurate picture of current reality is just as important as a compelling picture of a desired future." Two sources can help form these "accurate pictures" of the present and the future: the employees and the organization.

Janis and Mann (1977) also explain the motivation needed for problem finding and solving by describing five stages in arriving at a lasting decision: appraising the challenge, surveying alternatives, weighing alternatives, deliberating about commitment and adhering despite negative feedback. We focus on the first stage, appraising the challenge, since it forms the basis for the reasoning stage of the modular investment decision. Janis and Mann's (1977, p. 172) challenge resembles Fritz's creative tension when they explain:

> Until a person is challenged by some disturbing information or event that calls his attention to a real loss soon to be expected, he will retain an attitude of complacency about whatever course of action (or inaction) he has been pursuing.

They (p. 172) classify the challenging information into two kinds. The first kind is a *trigger event*, as when a competitor has just suddenly designed its products using new modules and systems that threaten to disturb the industry's market share; this threat may escalate to a trigger point to begin serious consideration of investing in modularity. The second kind is new, impressive *communications*, e.g., a homebuilder announces to its suppliers that it will buy only whole modular sections of homes rather than individual components in building condominiums.

Modularity is currently a key production strategy that requires substantial investments. Therefore, the modularity investment decision is appropriate for explaining the importance of the reasoning stage, as presented in the next section.

THE NATURE OF THE MODULAR MANUFACTURING INVESTMENT DECISION

The management accounting literature often compares the mass production system (or Fordism, named after Henry Ford and his mass production of the Model T) and the Toyota Production System (Porter, 1985; Monden, 1993).[3] In mass production, a manufacturer seeks cost leadership through economies of scale by continuously producing and selling highly standardized products in large volumes. A cost leader can significantly reduce the sale price to strengthen its competitive position. But complex product markets of today demand the ability to quickly and globally deliver a high variety of customized products. In a mass-customization manufacturing system, the manufacturer seeks product differentiation to accomplish two objectives: to gain the perception of uniqueness that may ultimately lead to a monopolistic advantage, especially when the demand for the product is inelastic, and to increase product variety to respond to heterogeneous customer tastes and preferences. Product differentiation is costly to implement because as product variety increases, the risk of lower performance of a firm's internal operations increases due to higher direct manufacturing costs, manufacturing overhead, delivery times and inventory levels (Flynn & Flynn, 1999; Salvador, Forza, & Rungtusanatham, 2002). For example, component variety often increases when product variety increases, especially when vertical integration is low (Fisher, Ramdas, & Ulrich, 1999; Salvador et al., 2002) and suppliers experience dis-economics in responding to these developments (Krishnan & Gupta, 2001; McCutcheon, Raturi, & Meredith, 1994).

Accordingly, a manufacturer faces a difficult tradeoff decision: how to increase product variety to satisfy customers' heterogeneous needs while minimizing the cost of complexity arising from this product-variety strategy. The discussion of this tradeoff decision is not new. For decades, both research and practice have suggested modularity as a means for producing low-cost high-variety product architectures that provide final product configurations by mixing and matching sets of standard components with standard interfaces (Evans, 1963; Starr, 1965; Pine, 1993; Meyer & Lehnerd, 1997; Salvador et al., 2002). Langlois (2002) argues that the principles of modularity have an even longer pedigree that goes back to Adam Smith's proposal of "obvious and simple system of natural liberty" that shows how a complex modern society can become more productive through a modular design and economic institutions.

What is modularity? Modularity is an approach to design, develop and produce parts that can be combined in the maximum number of ways (Starr, 1965, p. 38). Evans (1963) treats modularity as a means to increase commonality across product varieties within a product family by incorporating the same components into these product variants. Kodama (2004, p. 634) elevates modularity to the level of strategy for "organizing complex products and processes efficiently. A modular system is composed of units (or modules) that are designed independently but still function as an integrated whole."

There are two kinds of modularity. The first kind, assembly based modularity, focuses on manufacturing techniques and assembly operations associated with a product. It emphasizes geographical partitioning to optimize assembly interface, as in the production of a cockpit. The second kind, the function-based (design) modularity, focuses on the intrinsic functionality of the product and how these functions are distributed. It seeks functional partitioning to optimize functional interface. Examples of this kind for the design of an automobile include brakes, power supply, climate-control and entertainment system. Currently, many manufacturing entities use modularity as an approach to mass produce (or purchase) common modules that can be combined in different configurations to produce product variety.

Challenges facing the Modularity Investment Decision: Several exogenous and endogenous factors may drive a manufacturer to seriously consider implementing a modular manufacturing strategy or escalate an existing one. Exogenous factors include uncertainties of market acceptance of the new modular products, competitors' reaction to the manufacturer's switch to modularity, availability and reliability of suppliers who can supply the necessary modules and systems, and labor union's and other personnel's acceptance or resistance to the new mode of manufacturing. These factors are beyond the firm's control. Endogenous factors, developed internally, which can form serious challenges and dilemmas, include design risks, uncertainty of testing outcomes during modular developments, skills to use new technologies and the ability and speed of restructuring the organization to implement the modularity strategy.

Reasoned Actions for the Modularity Investment Decision

When intensified, the exogenous and endogenous challenges may move the manufacturer to take actions on the modularity issue. We consider three reasoned actions.

(1) *Maintain the status quo*. Although the challenges are severe, a manufacturer may opt to maintain the status quo if the exogenous and endogenous factors carry high degrees of uncertainty so that any change may endanger the very existence of the firm.
(2) *Adopt Level-1 (assembly) modularity strategy*. In this alternative, the suppliers' facilities produce and deliver the modules to the manufacturer's

plant, which then performs the necessary subassemblies. That is, the suppliers' facilities are separated from the manufacturer's plant (McAlinden, Smith, & Swiecki, 1999, p. 2).

(3) *Adopt Level-2 (design) modularity strategy*. In this strategy, modules are optimized at the final assembly level by independent suppliers. Design modularity is function based, which seeks functional partitioning to optimize functional interface (McAlinden et al., 1999, p. 2).

Level-1 modularity is one step beyond the status quo alternative. According to McAlinden et al. (1999, p. 2), Level-1 modularity merely represents another form of outsourcing as a means to reduce such costs as labor. Level-2 modularity has more aggressive purposes including "a far greater range of system-wide improvements in design, material use, rates of product innovation, delivery time to market, and cost" (McAlinden et al., 1999, p. 2). Accordingly, Level-2 modularity involves a high degree of exogenous and endogenous uncertainties. We assume that the selection of action 1 (maintain the status quo) implies that the decision maker's "creative tension" has not yet reached a trigger point. By selecting Level-1 modularity, the decision maker's creative tension has reached a trigger point, but the decision maker is cautious and willing to accept only some risk regarding market acceptance, design and test uncertainty. Selecting action 3 implies that the decision maker is willing to accept more risks than those of action 2. This attitude may result from the belief that a drastic change in manufacturing is long overdue, or that such a full-scale modularity as Level 2 with all of its risks is the best way to face competition, current and future.

These three alternative strategies form the basis for the application of the Dempster-Shafer Theory of Evidence, explained as follows.

APPLICATION OF THE DEMPSTER-SHAFER THEORY OF EVIDENCE

The Dempster-Shafer Theory of Evidence, introduced by Dempster (1967, 1968) and Shafer, 1976), has received wide attention from many researchers in several disciplines for decades (Omer, Shipley, & Korvin, 1995). It provides useful measures for evaluation of subjective uncertainties in a multi-attribute decision problem where the decision maker must consider a number of strategies. The decision is constrained by uncertainties inherent in the determination of the relative importance of each attribute and the classification of alternative strategies according to the level of each attribute of each strategy. Uncertainties also affect the decision maker's selection of the optimum strategy according to the perceived "ideal" levels of the specified attributes (Omer et al., 1995, p. 256). The "ideal" levels stem from the metrics provided by the decision maker that represent its preferred values for the given attributes of the alternative actions.

This theory is considered an alternative to the traditional Bayesian theory, that focuses on probabilities (Shafer, 1990; Beynon, 2004). However, some researchers argue that this theory alone is inadequate to address problems of ambiguity inherent in the subjective judgment of the three modularity strategies outlined above. As Shipley, de Korvin, and Omer (2001, p. 210) argue, methods that utilize classic logic or statistics are not equipped to account for uncertainty in these judgments where only limited information is available. In many instances, these uncertainties give rise to ambiguity, fuzzy notions and imprecision rather than randomness and probability of occurrence. For example, the very concept of "variety" in the term "product variety" is fuzzy because it ranges from very different to slightly different. Ford Motor Company's Crown Victoria and Grand Marquis models are only slightly different; Taurus and Mercury Sable models are different; and Taurus and Lincoln LS models are very different. These models may share many common, uncommon and modified modules. In brief, implementing modularity entails several problems of measurement, uncertainty and ambiguity which the Dempster-Shafer theory alone is ill-equipped to solve. But when fuzzy-set theory is combined with the Dempster-Shafer Theory of Evidence, a powerful methodology emerges to account for these uncertainties and ambiguities. Yager (1990), Yen (1990) and Zadeh (1986) have generalized this theory to fuzzy sets.

Data Source

We envision interviewing a group of managers of a manufacturing plant. The managers are seriously considering an improvement in their modularity production system. In particular, they are pondering whether the plant should switch from using individual components to build a transmission for a vehicle to buying a system composed of a few modules. They realize that the time, effort and funds needed for making this decision are substantial. After we explain the general characteristics of the fuzzy-Dempster-Shafer theory, they agree to cooperate with us to apply this theory to their plant. The data we use in this application are hypothetical.

Applying a Fuzzy-Dempster-Shafer Theory of Evidence Algorithm

Omer et al.'s (1995) algorithm is designed to address the uncertainty inherent in decision-making situations. By integrating the fuzzy-set theory and the Dempster-Shafer Theory of Evidence, the algorithm rank orders the given alternatives from the highest to the lowest value based on the decision maker's ideal levels of selected critical attributes. More specifically, the algorithm seeks to (Omer et al., 1995, p. 265)

- simplify complex systems;
- systematically incorporate subjective factors;
- combine evidence from independent sources of information; and
- recognize the uncertainties inherent in the complex decision-making process.

The algorithm has the following characteristics:

1. It ranks the given alternatives in the multi-attribute case.
2. The ranking results from measuring the belief and plausibility values of each alternative and its functions.

To apply this algorithm, we first define the following set of t alternative reasoned actions, h_i where $1 \leq i \leq t$ with a F_i ($i = 1, 2, 3$) set of attributes based on a hypothetical interview of the key personnel of a manufacturing plant:

$$\begin{aligned} h_1 = {} & (.1/K1 + .8/K2 + .9/K3) + (.9/R1 + .5/R2 + .1/R3) \\ & + (.8/T1 + .1/T2 + .1/T3) \end{aligned}$$

$$\begin{aligned} h_2 = {} & (.1/K1 + .6/K2 + .8/K3) + (.1/R1 + .7/R2 + .2/R3) \\ & + (.3/T1 + .3/T2 + .2/T3) \end{aligned}$$

$$\begin{aligned} h_3 = {} & (.1/K1 + .6/K2 + .7/K3) + (.1/R1 + .8/R2 + .3/R3) \\ & + (.3/T1 + .4/T2 + .5/T3) \end{aligned}$$

where

K = market acceptance = {Low, Average, High} = {$K1$, $K2$, $K3$}
R = design risk = {Low, Medium, High} = {$R1$, $R2$, $R3$}
T = testing uncertainty = {Low, Moderate, High} = {$T1$, $T2$, $T3$}
$K1$ = low-market acceptance of the modular products
$K2$ = average market acceptance of the modular products
$K3$ = high-market acceptance of the modular products

$R1$ = low-design risk of the modular products
$R2$ = medium design risk of the modular products
$R3$ = high-design risk of the modular products
$T1$ = low uncertainty of testing outcomes during development of the modular products
$T2$ = moderate uncertainty of testing outcomes during development of the modular products
$T3$ = high uncertainty of testing outcomes during development of the modular products.

The reasoned actions, h_1, h_2 and h_3, correspond to the three alternative strategies of maintaining the status quo, adopting Level-1 (assembly) modularity and adopting Level-2 (design) modularity, respectively. The first strategy, h_1, is the most conservative since it promotes no change. Management's preference of this strategy indicates weak or lack of Fritz's creative tension or the absence of a trigger event, as explained above. The second action, h_2, is a medium stand between h_1 and h_3, where h_3 is the most aggressive action because the Level-2 strategy represents a greater degree of modularity than that of Level 1.

The variables (market acceptance, design risk and testing uncertainty) are the set of attributes, F_i ($i = 1, 2, 3$), and the variables K_i's, R_i's and T_i's are the elements, $f_i^{k_i}$, of the attributes where $k_i = 1, 2, 3$. The focal elements, $F_i^{k_i}$, result from the reasoned actions, h_i's:

$$F_{Market}^{Low} = .1/h_1 + .1/h_2 + .1/h_3$$
$$F_{Market}^{Average} = .8/h_1 + .6/h_2 + .6/h_3$$
$$F_{Market}^{High} = .9/h_1 + .8/h_2 + .7/h_3$$
$$F_{Design}^{Low} = .9/h_1 + .1/h_2 + .1/h_3$$
$$F_{Design}^{Medium} = .5/h_1 + .7/h_2 + .8/h_3$$
$$F_{Design}^{High} = .1/h_1 + .2/h_2 + .3/h_3$$
$$F_{Test}^{Low} = .8/h_1 + .3/h_2 + .3/h_3$$
$$F_{Test}^{Moderate} = .1/h_1 + .3/h_2 + .4/h_3$$
$$F_{Test}^{High} = .1/h_1 + .2/h_2 + .5/h_3$$

To compute the mass functions for these attributes, we need to develop the "ideal" weights, which are defined as follows for n fuzzy sets. Associated with each alternative h_j, we have n fuzzy sets corresponding to the n different attributes:

$$\sum_{k_i=1}^{n_i} \alpha_{i_j}^{k_i} \Big/ f_i^{k_i} \qquad \text{where } 1 \leq i \leq n \quad \text{and} \quad 1 \leq j \leq t$$

where $\alpha_{i_j}^{k_i}$ represents the $f_i^{k_i}$ value present in action h_j.

We extract the α_{iji}^{a} amounts from pairwise comparisons of the attribute elements of market acceptance, design risk and testing uncertainty:

$$\text{Market acceptance} = \{\text{Low}, \text{Average}, \text{High}\} = \{K1, K2, K3\}$$
$$\text{Design risk} = \{\text{Low}, \text{Medium}, \text{High}\} = \{R1, R2, R3\}$$
$$\text{Testing uncertainity} = \{\text{Low}, \text{Moderate}, \text{High}\} = \{T1, T2, T3\}$$

To conduct the pairwise comparison, we asked the group of plant managers in our hypothetical scenario to allocate 100 ‘‘relative preference points’’ for one element over another, which resulted in the following data set for the market acceptance attribute:

Low	20	Average	30	High	90
Average	80	High	70	Low	10
	100		100		100

These assignments of points reveal that the average market acceptance is four times as important as the low-market acceptance; the high-market acceptance is 233% as important as the average market acceptance; and the high-market acceptance is nine times as important as the low-market acceptance. It is important to check the consistency of these relative preferences, which we calculate in Matrices A and B below following Omer et al. (1995) and Guilford’s constant-sum method (Guilford, 1954; Cleland & Kocaogla, 1981).

Matrix A

	K1: *Low*	*K2*: *Average*	*K*3: High
K1: *Low*		80	*90*
K2: *Average*	20		*70*
*K*3: High	*10*	*30*	

We create Matrix B from the elements $a_{ij}$of Matrix A. Matrix B’s elements are determined by $b_{ij} = a_{ij}/a_{ji}$.

Matrix B

	K1: *Low*	*K2: Average*	*K*3: High
K1: *Low*		4.00	*9.00*
K2: *Average*	0.25		*2.33*
*K*3: High	*0.11*	*0.43*	

Next, the elements of Matrix C are determined from elements of Matrix B as $c_{ij} = b_{ij}/b_{i(j+1)}$

Matrix C

	Low/Average	Average/High
K1: Low	*.25*	.44
K2: Average	*.25*	.43
K3: High	*.26*	.43
Mean	*.25*	.43
SD	.005	.009

We note that while some ratios in Matrix C's columns are equal, the underlying preferences need not be identical (Omer et al., 1995). These occurrences simply result from inconsistencies of human judgment. Bell (1980) explains that a standard deviation greater than 0.05 indicates a significant inconsistency of judgment. He suggests that a researcher should ask management to reevaluate its 100 point allocation among the attribute elements until consistency (i.e., $\sigma \leq 0.05$) is obtained.

The relative weights, d_{ii}^{a}, are computed from Matrix C by assigning first 1.00 to the ''high'' element, then normalizing the results and rounding to yield the relative preferences of .07, .28 and .65 for *K*1, *K*2 and *K*3, respectively, shown as follows:

	*K*1: Low	*K*2: Average	*K*3: High
Weighting	.11	.44	1.00
Relative preference	.07	.28	.65

Similarly, the relative weights for *R*1, *R*2 and *R*3 are .72, .25 and .03, respectively, and .78, .13 and .09, for *T*1, *T*2 and *T*3, respectively.

The decision maker's set of "most preferred" relative weights is called the "ideal." The ideal indicates the highest attainable degree of satisfaction of the decision maker after comparing and compromising between the elements of the critical attributes.

$$Ideal = Market\ acceptance \oplus Design\ risk \oplus Testing\ uncertainity$$

Where

$$\begin{aligned} \text{Market acceptance} &= (.07/K1, .28/K2, .65/K3) \\ \text{Design risk} &= (.72/R1, .25/R2, .03/R3) \\ \text{Testing uncertainity} &= (.78/T1, .13/T2, .09/T3) \end{aligned}$$

Based on the ideal, the mass functions for each focal element are determined as follows:

$$\begin{array}{lll} m_1(K1) = .071, & m_4(R1) = .718, & m_7(T1) = .779 \\ m_2(K2) = .248, & m_5(R2) = .254, & m_8(T2) = .133 \\ m_3(K3) = .645, & m_6(R3) = .029, & m_9(T3) = .088 \end{array}$$

Next, for the three attributes, we determine the mass function for each focal element, A_i. In this application, which has three attributes each with three elements, we have $3 \times 3 \times 3 = 27$ focal elements to account for. The first element is determined as follows:

$$S_\alpha = m(A_\alpha) = \sum_{B \wedge C \wedge D = A_\alpha} m_1(B)m_2(C)m_3(D) \Big/ \sum_{B \wedge C \wedge D \neq 0} m_1(B)m_2(C)m_3(D)$$

where B, C and D represent focal elements of m_1, m_2 and m_3, and A_i is the ith focal element of m. Therefore, A_1 is computed as follows:

$$\begin{aligned} A_1 &= K1 \Lambda R1 \Lambda T1 \\ S_1 &= m(A_1) = m_1(F^{Low}_{Market})m_2(F^{Low}_{Design})m_3(F^{Low}_{Test}) \\ &= (.071)(.718)(.779) = .0398 \end{aligned}$$

The Theory of Evidence allows easy combination of independent sources of evidence (de Korvin, 1995). In this theory, "evidence" consists of two functions called *belief* and *plausibility*, i.e., lower and upper probability, respectively. For example, if X is the set of all potential answers of which A is a subset, the belief function, Bel (A), is the degree of support for the answer to be in A. Plausibility, Pls (A), is the degree to which the answer is in A cannot be refuted. Similarly, Pls (not A) is the degree to which the decision maker can refute that the answer is not in A (de Korvin, 1995). As Zadeh (1986) explains, the belief and plausibility measures in the Dempster-Shafer theory are the certainty (or necessity) and possibility, respectively, and both are probability distributions.

We use the following functions to compute the belief functions for the three alternative reasoned actions, h_1, h_2 and h_3:

$$\mathrm{Bel}(h_j) = \sum_{\alpha x} \inf \neq h_j[1 - \mu_{A\alpha}(X)m(A_\alpha)]$$

Applying this function produces the following results:

$$\mathrm{Bel}(h_1) = .23$$

$$\mathrm{Bel}(h_2) = .19$$

$$\mathrm{Bel}(h_3) = .18$$

These results show that action h_1 is better than the other alternatives since it is closest to management's ideal. The other two beliefs of h_2 and h_3, .19 and .18, respectively, are lower than that of alternative h_1 whose belief is .23. That is, management holds a strong belief in maintaining the status quo rather than switching to Level-1 or Level-2 modularity and take their market, design and testing risks. However, the ultimate ranking must also include the plausibility values of the three alternatives, which are measured by the following equation:

$$\mathrm{Pls}(h_j) = \sum_{\alpha} A_\alpha(h_j)m(A_\alpha)$$

Application of this equation provides the following results:

$$\mathrm{Pls}(h_1) = .54$$

$$\mathrm{Pls}(h_2) = .22$$

$$\mathrm{Pls}(h_3) = .23$$

Combining the belief and plausibility values provides the support for each alternative action as follows:

$$\begin{aligned}
\mathrm{Evidence}(h_j) &= \mathrm{Bel}(h_j) \oplus \mathrm{Pls}(h_j) \\
\mathrm{Evidence}(h_1) &= .23 \oplus .54 = .77 \\
\mathrm{Evidence}(h_2) &= .19 \oplus .22 = .41 \\
\mathrm{Evidence}(h_3) &= .18 \oplus .23 = .41
\end{aligned}$$

Combining the belief and plausibility functions provides results closer to management's ideal: h_1, h_2 and h_3. That is, currently management prefers to maintain the status quo rather than switch to a modularity strategy and take the market, design and testing risks that accompany the modularity actions. Management's belief in the status quo alternative of .23 is stronger than its belief in Level-1 (assembly) modularity of .19 and in Level-2 (design) modularity of .18. Although management's belief in adopting Level 1 (.19) is slightly stronger than in Level-2 (.18), these two strategies have equal evidence (.41). The status quo alternative has a much stronger evidence of .77. When management does not accept the switch to modularity, the investment decision does not proceed to the second stage, evaluation, in the cyclical critical-thinking decision model (Fig. 1). Our process has shown that *evidently* an investment decision is not worth making.

LIMITATIONS OF THE STUDY

This study has some limitations, summarized as follows:

(1) Finocchiaro's (1990) concept of critical thinking adapted in this paper is not universally accepted. Moreover, some authors argue that the term "critical thinking" is an empty concept, devoid of any substance (Whitaker, 2002/03).
(2) The application of the Dempster-Shafer Theory of Evidence accounts for only three alternative actions and three attributes, each with only three elements. There are several other actions, attributes and elements that may play critical roles in the investment decision. However, incorporating more alternative actions and attributes and elements into the algorithm increases the complexity of the methodology and calculations, which runs counter to the algorithm's primary goal of simplifying complex systems, as mentioned above.
(3) Managers' perceptions are subjective, reducing the reliability of results. However, repeating the process with more and different personnel may increase the credibility of the algorithm's results.
(4) The theories of Dempster-Shafer and fuzzy sets have many critics. This paper inherits the weaknesses of these theories.

SUMMARY AND CONCLUSIONS

The traditional long-term investment decision, as presented in the management accounting literature, often begins with listing and evaluating a number of alternative investment proposals, using such criteria as NPV, IRR, and payback period in addition to non-financial measures. This approach tacitly assumes that the decision is to be made; therefore, it bypasses an essential step, the reasoning stage that precedes the evaluation stage. Finding sufficient reasons for such strategic decisions as the adoption of a modular manufacturing system is one of the important functions of the controller (Lee, 1999, p. 4). The absence of the reasoning step as a prelude to the evaluation step in the traditional long-term investment decision creates a gap in this approach. Filling this gap is necessary in order to (1) provide sufficient reasoning for considering this decision or dropping it from consideration, and (2) help the decision maker frame the decision according to its compelling reasons revealed by the reasoning step.

The purpose of this paper is to fill this gap by presenting the long-term investment decision as a critical thinking structure. Using Finocchiaro's (1989, 1990) critical-thinking triad, namely reasoning, evaluating and self-reflecting, and Fritz's (1989, 1990) "creative tension" model, the paper focuses on a combination of the first element of the triad, reasoning, and Fritz's model. Thus, the main argument of the paper states that *without a compelling reason and a trigger event, a decision maker would not seriously consider making the long-term investment decision and begin collecting and evaluating alternative courses of action for making this decision.*

To demonstrate the application of this reasoning stage, the paper explains the intricate nature of the investment decision in a modular manufacturing system. This decision is critical to many manufacturers because it revolutionizes the entire value chain (Sanchez & Mahoney, 1996). A manufacturer may consider applying (1) Level-1 (assembly) modularity strategy, (2) Level-2 (design) modularity strategy or (3) refrain from making the decision by maintaining the status quo. The Dempster-Shafer Theory of Evidence is instrumental for this reasoning stage. Using hypothetical data and Omer et al.'s (1995) algorithm, which operationalizes the evidence theory, the paper shows how a decision maker can justify with sufficient reason his or her consideration of the long-term investment decision.

The contribution of the paper includes (1) highlighting a critical gap currently existing in one of the classical decisions in the management accounting literature; (2) developing a framework for filling this gap and (3) applying this framework to the intricate nature of the modular manufacturing system and its complex investment decision.

NOTES

1. A platform is a set of elements and interfaces that are common to a family of products. Within a product family, the set of common elements, interfaces and/or processes is generally called the "product platform," while the individual product instances derived from the platform are called the "variants." That is, product-family designs share platform architecture, i.e., common elements and structures.

2. The investment decision triad of reasoning, evaluating, and self-reflecting is Finocchiaro's (1990) definition of critical thinking. This definition results from a long debate between Siegel (1988; 1990) and Finocchiaro (1989, 1990) as explained in this paper.

3. It is important to note that the Toyota Production System (TPS) and lean manufacturing are not synonymous. As Hall (2004) explains: "Differences between the Toyota Production System, as practiced by Toyota, and lean manufacturing are significant. Two of those are that TPS emphasizes worker development for problem solving and spends much more time creating standardized work, which lean seldom incorporates."

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CEO COMPENSATION AND FIRM PERFORMANCE: NON-LINEARITY AND ASYMMETRY

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ABSTRACT

The relationship between CEO compensation and firm performance is a field of intense theoretical and empirical research. The purpose of this study is to gain additional insights into the nature of this relationship by examining empirically the relatively unexplored areas of its non-linearity. The findings of this study show strong evidence that supports the view that the relationship between executive compensation and firm performance is non-linear and asymmetric. Additionally, the structure of asymmetry is found to be dependent upon the measure of performance. Convexity characterizes the asymmetry of the relationship between executive compensation and market returns, while concavity distinguishes the asymmetry of the relationship between executive compensation and accounting returns.

1. INTRODUCTION

The classic principal–agent problem is the consequence of separation of control from the firm's ownership associated with authorization of the

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managerial choice process. Expected to pursue the owner's goals, the manager enjoys know-how and information advantages, while the owner does not. The owner, as the principal, is thus confronted with the probability that the manager, as the agent, may not pursue the owner's goals, and designs ex ante mechanisms to solve the problem of efficient contracting in the presence of incomplete information. If incomplete information is about pre-contract agent's behavior, the principal faces a problem of adverse selection, which can be solved by self-selection mechanisms like signaling or screening. If, on the other hand, incomplete information is about post-contract agent's behavior, the principal encounters a moral hazard dilemma, which can be solved by designing specific incentives schemes to foster the agent's effort (Lambert, 2001; Bebchuk & Fried, 2003).

The relationship between executive incentives and firm performance has been the subject of intensive theoretical and empirical scrutiny by researchers from a variety of disciplines.[1] Despite the vast amount of research a number of issues still remain unresolved. The concern about the existence of asymmetries and non-linearities in the relationship between executive compensation and firm performance, in particular, appear to have been left relatively unexplored.

Conceptually, the existence of asymmetries in the relationship between compensation and performance measures does not invalidate the theoretical underpinning of the agency model. As a matter of fact, it is conceivable that symmetry may not be optimal, as no theoretical reason exists to justify the presence of symmetric responses in compensation contracts. On the contrary, asymmetric responses may be built into compensation contracts as a means to strengthen the incentive structure of compensation contracts. From this perspective, asymmetry may be consistent with agency theory and optimal contracting arrangements to the extent that encouraging a risk-taking behavior, while shielding the executive from downside risks aligns the incentives of the executive with those of the shareholders. In fact, symmetric responses do not necessarily induce efforts in an agency context.

The purpose of this study is to gain further insights into the nature of the relationship between chief executive officer (CEO) compensation and firm performance by empirically examining this relatively unexplored area of asymmetry, using a panel of 455 U.S. firms spanning a period of seven years, from 1996 to 2002.

The remainder of the study proceeds as follows. Section 2 briefly reviews the literature on the relationship between firm size, firm performance, and executive compensation. Section 3 specifies a non-linear and asymmetric relationship between executive compensation and firm performance. The data and their sources are described in Section 4, with Section 5 detailing the main empirical results. A brief conclusion and a summary of the empirical results appears in Section 6.

2. OVERVIEW OF THE LITERATURE

Early studies of executive compensation, such as Ciscel and Carroll (1980), Healy (1985), and Lewellen and Huntsman (1970), focused primarily on the linkages between executive compensation, firm size and profits. The relationship between executive compensation and firm size is one of the most consistent empirical results in the compensation literature, with most studies reporting a compensation elasticity with respect to size of about 0.30 (Rosen, 1992), implying that executive compensation increases by about a third as firm size doubles. Subsequent research has confirmed the positive relation between firm size and executive compensation (Conyon, Peck, & Sadler, 2000; Carpenter & Sanders, 2002; Cordeiro & Veliyath, 2003; Indjejikian & Nanda, 2002; Yermack, 1995).

Executive compensation increases with the size of the firm because of the higher level of skills and managerial talent required by the higher degree of complexity and diversity of activities within such organizations. In the more recent past, stimulated in part by theoretical developments in agency theory (Holmström, 1979), the emphasis has shifted to the investigation of direct linkages between executive compensation and firm performance. Agency theory suggests that CEO incentives can be aligned with the preferences of the shareholders through compensation arrangements that reward the CEO in accordance with firm performance. Although the empirical order of magnitude of the relationship between compensation and performance still remains highly controversial, most of the research conducted in the past two decades has produced a significant amount of evidence in support of the hypothesis that firm performance positively affects executive compensation, for example, Murphy (1985, 1986), Jensen and Murphy (1990), Abowd (1990), Ely (1991), Boschen and Smith (1995), and Kaplan (1994).

A related issue concerns the nature of firm performance measures. Researchers have examined the relationship between executive compensation and firm performance using accounting-based measures, such as profit, return on equity, and return on assets, as well as market-based performance measures, such as stock price and total shareholder return. At the same time, they have also recognized that each of these measures has drawbacks of its own. From the shareholder's perspective, return is generated from stock price changes and is not defined in accounting terms. In theory, market-based measures are ex ante, forward-looking measures of performance, as they reflect managerial decisions that induce future profitability. Conversely, accounting-based measures are ex-post, historical measures of performance, and are thus conceptually less relevant from the shareholder's perspective.

In practice, however, stock prices are a very noisy signal as they are frequently subject to significant market-wide fluctuations that mirror the determinants of the business cycle and the conditions of fiscal and monetary policy, and hence do not exclusively reflect executive performance (Bertrand & Mullainathan, 2000). In contrast, accounting-based measures shield executive performance from much of the noise and the accountability associated with stock market fluctuations. Nevertheless, several studies have found evidence that executive compensation responds more to the market-based than the accounting-based performance measures. Coughlan and Schmidt (1985), Rich and Larson (1984), Murphy (1985), and Conyon et al. (2000), among others, find significant empirical evidence that connects executive compensation to market-based returns. Baber, Janakiraman, and Kang (1996), on the other hand, report that such linkages are primarily associated with non-cash compensation. Additionally, Boschen, Duru, Gordon, and Smith (2003) present evidence that indicates that firms give less emphasis to accounting-based measures and increasingly rely on market-based measures. On the other hand, Lewellen and Huntsman (1970), Sloan (1993), and Carpenter and Sanders (2002), among others, find strong linkages between accounting-based measures of performance and executive compensation.

For the most part, executive compensation research has been confined to cash compensation as a proxy for total compensation, for example, Abowd (1990), Jensen and Murphy (1990), Lambert and Larker (1987), Mishra, Gobeli, and May (2000), Murphy (1985), and Sloan (1993), among others. Cash compensation comprises salary and bonuses, but does not include other forms of compensation, such as long-term incentives payouts and stock option grants. In earlier studies the use of cash compensation was for the most part justified on the basis of data availability and the relative magnitude of the cash component in total compensation. However, the changes that occurred in the last decade in the composition of compensation contracts, such as the enormous expansion of non-cash compensation, and the significant proliferation in the number of firms offering stock options to their executives and employees, together with the Securities and Exchange Commission (SEC) mandated disclosure regarding stock option grants issued to executives,[2] have resulted an increased attention to the relevance of non-cash compensation in pay-performance studies, notably Bertrand and

Mullainathan (2000), Core, Guay, and Verrecchia (2003), Cordeiro and Veliyath (2003), and Main, Bruce, and Buck (1996), among others.

Asymmetry of performance effects entails a non-linearity in the relationship between executive compensation and firm performance. As a result, failure to account for such non-linearity may result in model misspecifications and empirical analyses, which preclude a full assessment of the effects of performance on executive compensation. Yet, a striking feature of the most empirical work to date is that few systematic attempts have been made to evaluate the presence of asymmetric effects of firm performance measures on executive compensation. There is not much empirical evidence to date for the popular view (Crystal, 1991) that good performance is rewarded, while poor performance is ignored, or that compensation contracts are disproportionately more sensitive to positive than negative performance realizations (Joskow & Rose, 1994).

There is some evidence, however, that firms shield executive compensation from current charges against accounting performance that are not necessarily within the CEO's control (Gaver & Gaver, 1998), and from the contemporaneous effect on accounting performance of restructuring charges (Dechow, Huson, & Sloan, 1994). Gaver and Gaver (1998) use a sample of firms that reported 'Extraordinary Items' and/or 'Discontinued Operations' to demonstrate that nonrecurring losses on the income statement are not associated with CEO cash compensation, which suggests that compensation committees filter such losses from the determination of compensation. This action serves to reduce the riskiness of the CEO's compensation, since nonrecurring losses (e.g., those due to the adoption of new accounting standards) are often beyond the control of the CEO.

As noted above, such actions do not undermine the predictions of agency theory. Dechow et al. (1994) argue that since restructuring charges are typically associated with permanent reductions in costs (e.g., layoffs) and/or increased operational synergy, such charges tend to increase firm value and it is in the firm's best interest to encourage the CEO to take such actions. Eliminating the restructuring charge, which decreases current accounting measures, from the determination of compensation removes a disincentive for the CEO to take the steps necessary to maximize firm value.

3. MODEL SPECIFICATION AND RELEVANT HYPOTHESES

In this section, I outline a model of executive compensation that postulates a non-linear, asymmetric relationship between performance and executive compensation, where positive and negative performance realizations of equal magnitude elicit an unequal compensation response.

Specifically, it is assumed that executive compensation is a semi-log-linear function of performance and a log-linear function of size:

$$\ln COMP_{it} = \alpha + \beta \ \ln z_{it} + \delta\pi_{it} + \varepsilon_{it} \tag{i}$$

where $COMP_{it}$ is the executive compensation in firm i at time t, z_{it} represents the firm size and π_{it} denotes the performance measure. The term ε_{it} is a stochastic error, which is assumed to be serially uncorrelated with zero mean and constant variance, and independently distributed across firms. In Eq. (i), the parameters β and δ represent the short-run elasticity of executive compensation with respect to the firm size, z_{it}, and the short-run semi-elasticity with respect to performance, π_{it}, respectively.[3]

Eq. (i) is derived on the stylized assumption that the relationship between (the logarithm of) executive compensation and firm performance is linear. The effects of performance on executive compensation are assumed symmetric, i.e., whether $\pi_{it} > 0$ or $\pi_{it} < 0$, they are equal in magnitude and opposite in sign. On the other hand, asymmetry in performance effects requires that when $\pi_{it} > 0$ or $\pi_{it} < 0$, the effects on executive compensation are not just opposite in sign, but also different in magnitude. Eq. (ii) removes the symmetry assumption, and models the asymmetric effects in the compensation equation using, as an approximation, specification of the performance measure with threshold at $\pi_{it} = 0$:

$$\ln COMP_{it} = \alpha + \beta \ \ln z_{it} + \delta_1 \, pos(\pi_{it}) + \delta_2 \, neg(\pi_{it}) + \varepsilon_{it} \tag{ii}$$

where $pos(\pi_{it})$ and $neg(\pi_{it})$ denote the positive and negative values of performance measure, π_{it}.

Eq. (ii) implies that the effect of performance on executive compensation depends upon whether π_{it} is positive or negative. When $\pi_{it} > 0$ is true, the short-run effect of performance on executive compensation is captured by the point estimate of δ_1. Conversely, when $\pi_{it} < 0$ is true the short-run effect is δ_2. This asymmetric pattern of performance effects indicates that an improvement or a worsening of a positive performance is not necessarily equivalent to an improvement or a worsening of a negative performance. Thus, for example, the effect on executive compensation of an increase of 10 percentage points in π_{it}, when π_{it} is positive (say, from 20 to 30) is not the same as that of an increase of 10 percentage points in π_{it} when π_{it} is negative (say, from -30 to -20).

Eq. (ii) incorporates the relevant empirical hypotheses underlying this study, which can be summarized as follows. First, the effects of firm performance measures on executive compensation are asymmetric. This hypothesis is rejected if the coefficient on the positive and negative values of the performance variable, δ_1 and δ_2, in Eq. (ii) are not significantly different from each other, i.e., $\delta_1 - \delta_2 = 0$. Second, alternative performance measures display different patterns of asymmetry. This hypothesis is rejected if, given two alternative measures of performance, say, π_{1it} and π_{2it}, the differences $\delta_{11it} - \delta_{12it}$ and $\delta_{21it} - \delta_{22it}$ are jointly not significantly different from zero, where δ_{11it} and δ_{21it} are the coefficient estimates of $pos(\pi_{1it})$ and $pos(\pi_{2it})$, δ_{12it} and δ_{22it} are the coefficient estimates of $neg(\pi_{1it})$ and $neg(\pi_{2it})$, respectively. Noticeably, the rejection of the asymmetry hypotheses provides evidence that supports the conventional representation of the executive compensation model.

4. SAMPLE SELECTION, VARIABLE MEASUREMENTS, AND DESCRIPTIVE STATISTICS

This section describes the sample, data sources and variable measurement. All data for this study are drawn from Standard and Poor's (2004) *ExecuComp* database. The sample consists of panel data from 455 U.S. firms covering the period 1996–2002. This sample is obtained from an initial sample of 2,394 U.S. firms after imposing the condition that CEO tenure extend over the entire period 1996 to 2002, with full years of tenure during 1997–2002, and at least 6 months tenure in 1996. This condition is imposed to guarantee homogeneity in the pay-performance relationship and to control to some degree for human capital heterogeneity within firms. Panel A of Table 1 presents the sample selection process.

Detailed information about industry composition of the sample is presented in Panel B of Table 1. The sample encompasses 25 industries, with 2-digit SIC ranging from 01 to 99. The largest sample representation is the electrical equipment industry, with 42 firms or about 9.2 percent of the sample, followed by insurance and other financial services, and services, each with 32 firms or about 7 percent of the sample, and the chemical industry with 31 firms or about 6.8 percent of the sample. The industries with the smallest sample representation are mining with 4 firms, about 0.9 percent, and toy manufacturing and construction, each with 5 firms, accounting for approximately 1.1 percent of the sample.

This sample has at least two advantages over other samples. First, it is random and utilizes the most recent available information. Not only does it include newer firms, but also large firms are not overly represented[4] as in the studies that use common data sources such as *Forbes* or *Fortune*. The sample

Table 1. Sample Selection & Industry Composition.

	Number of Firms	CEO-Year
Panel A: Sample selection		
Initial sample 1996–2002	2,394	11,766
Less: no starting date as CEO	163	769
Less: CEO left position prior to 1996	82	256
Less: CEO did not serve during the 7-year study period	1,140	5,636
Less: lack data for study period	542	1,836
Less: omitted due to missing data	12	84
Final sample	455	3,185

Industries	2-Digit SIC	Number of Firms	Percentage
Panel B: Industry composition			
Mining	10, 12, 14	4	0.9
Gas & oil and petroleum refining	13, 29	21	4.6
Construction	15–17,19	5	1.1
Food	1, 20–21, 54, 58	28	6.2
Clothing & footwear	22–23, 31, 56	19	4.2
Forest product, paper	24, 26	11	2.4
Furniture	25, 57	7	1.5
Printing & publishing	27	13	2.9
Chemicals	28	31	6.8
Rubber, plastic, stone, clay, & glass	30, 32	10	2.2
Primary & fabricated metal	33–34	18	4.0
Industrial machinery	35	22	4.8
Electrical equipment	36	42	9.2
Transportation equipment	37	11	2.4
Instruments	38	16	3.5
Toy manufacturing	39	5	1.1
Transportation	40, 42–47	19	4.2
Telecommunication	48	8	1.8
Utilities	49	26	5.7
Wholesale trade	50–51, 99	14	3.1
Retail trade	52–53, 55, 59	17	3.7
Banks	60	29	6.4
Insurance, other financial services	61–64, 67,69	32	7.0
Services	70–79	32	7.0
Healthcare & professional services	80, 82, 83, 87	15	3.3

contains data from a wide variety of firms: those in the Standard and Poor's 500, Standard and Poor's Mid-Cap 400, and Standard and Poor's Small-Cap 600, which provide considerable variation in firm size.[5] The sample is taken over a period of time and follows SEC regulations on disclosure requirements, as well as the FASB debate on accounting for stock options, which ultimately produced SFAS 123 "Accounting for Stock-based Compensation." Thus, the sample corresponds to a period during which firms made compensation decisions in accord with current disclosure requirements, and this adds to the generalizability of the findings.

Two measures of executive compensation are used in this study: cash compensation and total (cash and non-cash) compensation. Cash compensation (*CASHCOMP*) is defined as the sum of salary and bonus. Total compensation (*TOTALCOMP*), includes both cash and non-cash compensation. Non-cash compensation is composed of long-term incentive payouts, the value of restricted stock grants, the value of stock option grants, and any other compensation item for the year. Stock options are valued at the grant-date using *ExecuComp*'s modified Black and Scholes (1973) methodology.[6] Firm performance is modeled using both accounting-based and market-based measures. Market-based performance is measured as total one-year shareholder return on common stock (*TRS*), defined as the closing price at fiscal year-end plus dividends divided by the closing price of the prior fiscal year-end. Accounting-based performance is measured by return on assets (*ROA*), defined as income before tax, extraordinary items, and discontinued operations divided by average total assets. Finally, firm size is proxied by net annual sales (*SALES*).

Table 2 (Panel A) presents descriptive statistics of the relevant variables in the sample panels. The average cash compensation and total compensation over the seven-year period are \$1.2788 and \$4.453 million, respectively, and are much higher than the corresponding median values of \$0.929 and \$2.031 million. The mean of accounting returns is 3.66%, while the mean of stock market returns is 20.12%, and the average amount of sales is \$3.537 billion. Consistent with prior literature, accounting returns have lower volatility, as measured by the overall standard deviation, than stock market returns. This is generally consistent with the smoothing effects of accruals.

The pair-wise correlation matrix of the variables is reported in Panel B of Table 2. The highest correlation, as expected, is between *CASHCOMP* and *TOTALCOMP* (0.50). The correlation between *SALES* and *CASHCOMP* (0.41) is also strong and significant, as is that between *SALES* and *TOTALCOMP* (0.28). Both measures of performance, *TRS* and *ROA*, also have a small significant positive univariate association with both measures

Table 2. Descriptive Statistics, and Correlations.

Variables	Mean	S D.	25th Percentile	Median	75th Percentile	Skewness	Kurtosis
Panel A: Descriptive statistics							
CASHCOMP	1.27877	1.26352	0.56300	0.92900	1.52500	3.93	27.11
TOTALCOMP	4.45280	8.68068	1.04129	2.03050	4.58405	9.32	148.43
SALES	3536.78	9777.32	419.61	1020.99	2719.78	10.71	172.02
TRS	20.12	66.52	−15.28	9.07	38.84	4.04	38.14
ROA	3.66	17.00	1.49	4.73	8.81	−11.01	188.82
SALARY%	32.85	23.97	15.23	27.12	44.04	1.11	3.76
BONUS%	19.55	17.37	5.42	16.83	28.67	1.12	4.37
OTHER%	1.18	4.35	0.00	0.00	0.22	6.60	57.94
STOCK%	46.41	28.61	23.83	49.50	69.72	−0.20	1.92

Variables	*CASHCOMP*	*TOTALCOMP*	*SALES*	*TRS*	*ROA*
Panel B: Pair-wise correlations					
CASHCOMP	1.0000				
TOTALCOMP	0.4951	1.0000			
	(0.0000)				
SALES	0.4074	0.2779	1.0000		
	(0.0000)	(0.0000)			
TRS	0.0322	0.0796	−0.0403	1.0000	
	(0.0695)	(0.0000)	(0.0230)		
ROA	0.0841	0.0514	0.0334	0.1161	1.0000
	(0.0000)	(0.0037)	(0.0595)	(0.0000)	

Note: All data are from Standard and Poor's *ExecuComp* database. *CASHCOMP* is cash compensation, in millions of dollars, defined as the sum of salary and bonus. *TOTALCOMP* is cash and non-cash compensation, in millions of dollars. Non-cash compensation includes composed of long-term incentive payouts, the value of restricted stock grants, the value of stock option grants and any other compensation item for the year. *TOTALCOMP* pay includes stock grants (valued at the grant-date market price) and stock options (valued using *ExecuComp*'s modified Black–Scholes formula–*ExecuComp* values options using an ''expected life'' equal to 70% of the actual term. In addition, *ExecuComp* sets volatilities below the 5th percentile or above the 95th percentile to the 5th and 95th percentile volatilities, respectively; similarly, dividend yields above the 95th percentile are reduced to the 95th percentile.) *SALES* is net annual sales, in millions of dollars. *ROA* is return on assets, defined as income before tax, extraordinary items and discontinued operations divided by average total assets. *TRS* is total one-year shareholder return on common stock, defined as the closing price at fiscal year-end plus dividends divided by the closing price of the prior fiscal year-end. *ROA* and *TRS* are deciles. *SALARY%*, *BONUS%*, *OTHER%* and *STOCK%* are the salary, bonus, other, and stock-based compensations as a percentage of total compensation. In a normal distribution, skewness is zero, and excess kurtosis is 3. Correlation coefficients' *p*-values are in parenthesis beneath the estimated correlation coefficients.

of compensation, *CASHCOMP* and *TOTALCOMP*. The pair-wise correlations between *SALES*, *ROA*, and *TRS* are below 0.10, which does not raise multicollinearity concerns. Consistent with previous studies, there is also a positive and significant correlation between stock market returns, *TRS*, and accounting returns, *ROA*, as well as an inconclusive association between *SALES* and both measures of performance.

5. EMPIRICAL RESULTS

This section summarizes the main empirical results of the study. I examined the pay-performance relationship using four alternative models. Two models employ the stock market measure of performance (*TRS*) and the other model use the accounting measure (*ROA*). I also included firm net sales as the proxy for size in all models.

As a starting point, and for comparison purposes, I performed a fixed-effects estimation of cross-section time-series regressions based on *symmetric* specifications of the relationship. Time-specific effects, in the form of yearly dummy variables are included in all the estimated models.

The estimates were obtained using the Within-Group (WG) estimator with cash compensation (*CASHCOMP*) or total compensation (*TOTALCOMP*) as the dependent variable as shown below in models 1–4:[7]

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{1}$$

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{2}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{3}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{4}$$

The results in Table 3 suggest that the statistical performance of the symmetric model is quite satisfactory. The WG estimator yields significant estimated coefficients with correct signs in all cases. The results with respect to size indicate that the relationship between executive compensation (both cash and total) and size is positive and significant, regardless of the measure of performance used.

Table 3. Within-Group Estimates of the Symmetric Model.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (1)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (2)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (3)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (4)

Dependent /Variable Independent Variables	ln $CASHCOMP_{it}$		ln $TOTALCOMP_{it}$	
	Model 1	Model 2	Model 3	Model 4
Constant	5.52170	5.69784	5.52162	5.82190
	(44.11)	(43.60)	(25.97)	(26.60)
ln $SALES_{it}$	0.21012	0.17174	0.33374	0.29092
	(12.25)	(9.58)	(11.46)	(9.69)
TRS_{it}	0.11645		0.11285	
	(11.91)		(6.80)	
ROA_{it}		0.35609		0.42706
		(3.80)		(4.22)
R^2				
within	0.242	0.212	0.226	0.218
overall	0.410	0.387	0.344	0.314
between	0.367	0.339	0.308	0.285
F test (1)	108.27	91.50	99.35	94.84
p-value	0.0000	0.0000	0.0000	0.0000
F test (2)	14.70	14.15	10.16	10.18
p-value	0.0000	0.0000	0.0000	0.0000
Number of observations	3183	3183	3183	3183

Note: Variables are defined as in Table 2, except that the values of *ROA* and *TRS* are in decimals and not percentages. Year effects (in the form of yearly dummy variables) and a constant are included in all regressions. *t*-statistics are in parenthesis beneath the estimated coefficients. *F* test (1) is a test of the null hypothesis that all explanatory variables including the year effects (except the constant) are jointly not significantly different from zero. *F* test (2) is a test of the null hypothesis that the fixed effects are jointly not significantly different from zero.

Table 3 reports two *F* tests. The first concerns the null hypothesis that all coefficients except the constant are zero; the second refers to the null hypothesis that the fixed effects are not significantly different from zero. In both cases, and for all the four estimated models, the null hypothesis is soundly rejected. The elasticity of cash compensation with respect to size is approximately 0.21 in Model 1, 0.17 in Model 2, and about 0.29 or higher in the case of total compensation. These estimates are generally in accord with the findings of previous studies. Similarly, the results with respect to performance indicate that the relationship between executive compensation (both cash and total) and performance is also positive and statistically strong. The estimated coefficients of *TRS* and *ROA* are significantly different from zero at any conventional level. The coefficient estimate of *ROA*, however, is more than three times the magnitude of the coefficient estimate of *TRS*. This outcome suggests that in the determination of executive compensation a greater weight is placed on accounting returns than market performance. This result is not uncommon to the literature, and is consistent with risk-sharing concerns, since stock returns are more volatile in the short-run than return on assets. Stock returns vary owing to factors outside the control of the CEO, and hence their use in the compensation contract increases the risk imposed on the executive. Lambert and Larker (1987) demonstrate that firms with less volatile stock returns place greater weight on stock returns when determining compensation.

To avoid potential biases inherent in using either measure alone, I included both measures as explanatory variable. Models 5 and 6 represent such formulation:

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta_1 TRS_{it} + \delta_2 ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{5}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta_1 TRS_{it} + \delta_2 ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{6}$$

The estimation results of Models 5 and 6 are reported in Table 4. The estimated coefficients of *TRS* and *ROA* are, again, significantly different from zero at any conventional level, regardless of the fact that the performance measures enter the compensation equation together. As in the earlier results, the coefficient estimate of *ROA* is much larger in magnitude than the coefficient estimate of *TRS*.

Overall, then, the estimation results in Tables 3 and 4 suggest that the symmetric version of the model performs relatively well. What is arguable, however, is whether the estimated coefficients are significant and relevant from the economic viewpoint. In particular, based on the estimates of Models 5 and 6, a one percentage point change in *TRS* results in a change of \$6,985 and \$16,177, respectively, while a similar change in *ROA* shifts the cash and total compensation of the median CEO by \$16,583 and \$52,407, respectively. Sloan (1993) provides evidence consistent with the prediction that firms whose stock prices respond more strongly to non-firm-specific factors place greater weight on accounting earnings in order to shield executives from undue compensation risk.

Table 4. Within-Group Estimates of the Symmetric Model.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1\ TRS_{it} + \delta_2\ ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (5)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1\ TRS_{it} + \delta_2\ ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (6)

Dependent Variable (Model)/ Independent Variables	ln $CASHCOMP_{it}$ (Model 5)	ln $TOTALCOMP_{it}$ (Model 6)
Constant	5.65268	5.52162
	(44.04)	(26.07)
ln $SALES_{it}$	0.19156	0.30976
	(10.87)	(10.34)
TRS_{it}	0.11026	0.10485
	(11.20)	(6.26)
ROA_{it}	0.25954	0.33524
	(4.35)	(3.30)
R^2		
within	0.247	0.229
between	0.394	0.328
overall	0.355	0.298
F test (1)	98.98	89.84
p-value	0.0000	0.0000
F test (2)	14.83	10.19
p-value	0.0000	0.0000
Number of observations	3183	3183

Note: Variables are defined as in Table 2, except that the values of *ROA* and *TRS* are in decimals and not percentages. Year effects (in the form of yearly dummy variables) and a constant are included in all regressions. t-statistics are in parentheses beneath the estimated coefficients. F test (1) is a test of the null hypothesis that all explanatory variables including the year effects (except the constant) are jointly not significantly different from zero. F test (2) is a test of the null hypothesis that the fixed effects are jointly not significantly different from zero.

The validity of these results relies critically on the maintained hypotheses of symmetry and no adjustment costs. In order to test the symmetry hypothesis, I revised estimation models to include a variable equal to π_{it}, representing *positive* measure of performance, if 1 and zero otherwise. Similarly, I included another variable to represent *negative* measure of performance when $\pi_{it} < 0$. Models (1a)–(4a) represent the changes in specification discussed earlier.

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{1a}$$

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{2a}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{3a}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{4a}$$

Both measures of performance are included in Models 5 and 6 while testing the null hypothesis of symmetry. Models (5a) and (6a) are presented below:

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSTRS_{it} + \delta_{22} NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{5a}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSTRS_{it} + \delta_{22} NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{6a}$$

The results of WG estimates are presented in Table 5. The findings indicate the estimation results of the asymmetric specifications are highly at variance with those presented in Tables 3 and 4.

As in earlier results, the F tests reported in Table 5 soundly reject the null hypotheses that all coefficients except the constant are zero and that the fixed effects are not significantly different from zero. Further, the three R^2 are also not too different from those reported in Tables 3 and 4, with the exception of the R^2 within, which are significantly higher in all the estimated models. This is particularly evident in Models (1a), (2a) and (5a). Since the WG estimator maximizes the R^2 within, this finding alone is an indication of the greater explanatory power of the asymmetric specification. The findings with respect to size are reasonably close, and in some cases almost identical, to those obtained under the symmetry assumption. The results with respect to performance, on the other hand, indicate that there is strong evidence of asymmetric effects.

The sample was modified to exclude new CEOs, i.e., those hired in 1996. The results were basically the same as those reported in Table 5. Furthermore, employing dummy variables for regulated firms and firms' capitalization level did not have any impact on the results reported in Table 5.

Consistent with the findings of a higher R^2 within, the estimated coefficients of *POSTRS*, *NEGTRS*, and *POSROA* are significantly different from

Table 5. Within-Group Estimates of the Asymmetric Model.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (1a)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (2a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (3a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (4a)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (5a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (6a)

Dependent Variable/Independent Variables:	ln $CASHCOMP_{it}$			ln $TOTALCOMP_{it}$		
	Model 1a	Model 2a	Model 5a	Model 3a	Model 4a	Model 6a
Constant	5.54783	5.59146	5.5482	5.53535	5.74301	5.62000
	(45.21)	(44.72)	(45.72)	(26.07)	(26.42)	(25.91)
ln $SALES_{it}$	0.21810	0.16759	0.19822	0.33793	0.28785	0.31090
	(12.96)	(9.78)	(11.87)	(11.61)	(9.67)	(10.42)
$POSTRS_{it}$	0.04510	—	0.03014	0.07293	—	0.06453
	(3.39)		(2.62)	(3.53)		(3.14)
$NEGTRS_{it}$	0.52871	—	0.45943	0.32952	—	0.25706
	(13.22)		(11.71)	(4.76)		(3.67)
$POSROA_{it}$	—	3.03790	2.59985	—	2.4140	2.07580
		(17.27)	(15.03)		(7.89)	(6.72)
$NEGROA_{it}$	—	−0.06829	−0.19482	—	0.11264	0.02658
		(−1.08)	(−3.14)		(1.02)	(0.24)

R^2:						
within	0.272	0.281	0.329	0.229	0.232	0.242
between	0.412	0.303	0.345	0.336	0.307	0.318
overall	0.377	0.294	0.341	0.304	0.283	0.295
F test (1)	112.72	118.02	120.95	89.77	91.00	78.77
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F test (2)	15.23	15.90	16.86	10.20	10.44	10.42
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of observations	3183	3183	3183	3183	3183	3183

Note: *POSTRS* is the same as *TRS when* $TRS>0$ and zero otherwise and *POSROA* is the same as *ROA when* $ROA>0$ and zero otherwise. Likewise, *NEGTRS* is the same as *TRS when* $TRS<0$ and zero otherwise and *NEGROA* is the same as *ROA when* $ROA<0$ and zero otherwise. All other variables are defined as in Table 2, except that the values of are in decimals and not percentages. Year effects (in the form of yearly dummy variables) and a constant are included in all regressions. *t*-statistics are in parenthesis beneath the estimated coefficients. *F* test (1) is a test of the null hypothesis that all explanatory variables including the year effects (except the constant) are jointly not significantly different from zero. *F* test (2) is a test of the null hypothesis that the fixed effects are jointly not significantly different from zero.

zero at any conventional level and in all six estimated models. This provides substantial evidence that the effect of positive performance realization is significantly different from that of negative performance. Further, the Wald test of parameters, reported in Table 6, indicate strong non-linearity condition and the asymmetric influence of positive and negative performance measures. That is, a negative *TRS* is heavily penalized and a positive *TRS* is only mildly rewarded. In contrast, a positive *ROA* is heavily rewarded and a negative *ROA* does not appear to have any significant influence on CEO compensation. A formal test of the hypothesis that *TRS* and *ROA* share the same pattern of asymmetry is soundly rejected by the joint test of parameters as presented in Table 6. For Model (5a) (cash compensation model) the test statistic, with 2 and 2,717 degrees of freedom, yields an F value of 145.06, ($p<0.0000$), while for Model (6a) (total compensation model) the value of the F statistics, with 2 and 2,717 degrees of freedom, is 16.27 ($p<0.0000$).

This asymmetric structure is evident in both cash and total compensation regressions. Additionally, my results indicate that both performance measures have effects on executive compensation levels that are economically significant. In particular, based on the estimates of Models (5a) and (6a), for the median CEO the effect of a one percentage point change in positive *TRS* realizations on cash and total compensation is \$1,875 and \$9,902, respectively, while the effect of a similar change in negative *TRS* results in cash and total compensation declines of \$28,755 and \$39,464, respectively. Conversely, a one percentage point change in positive *ROA* realizations translates in a median change of cash and total compensation equal to \$180,584 and \$347,654, respectively, whereas a change in negative *ROA* realizations does not have any significant effects on either measure of compensation.

In short, by accounting for asymmetry, the economic significance of the relationship between executive compensation and performance is much greater than what is suggested by the analysis that ignores asymmetry. While theory is largely silent on the size of the incentives that would be optimal from the standpoint of the shareholders, these results indicate that American CEOs in the late 1990s and early 2000s had much more to gain from improving accounting returns than from improving market returns.

Alternatively, this evidence suggests that risk preferences may not be invariant to incentives. Executive compensation contracts may be constructed to encourage risk-taking behavior in accounting performance, as executive compensation is relatively shielded from negative *ROA* realizations, while at the same time compensation contracts may strengthen risk-averting behavior in market performance, as executive compensation is not insulated from negative *TRS* realizations. This incentive structure may also motivate

Table 6. Estimates of Asymmetric Performance Effects Wald Test.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (1a)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (2a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (3a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (4a)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (5a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (6a)

Dependent Variable:	ln $CASHCOMP_{it}$			ln $TOTALCOMP_{it}$		
	Model 1a	Model 2a	Model 5a	Model 3a	Model 4a	Model 6a
Panel A: $\delta\_1 - \delta\_2$						
TRS, F (1, 2717)	112.77	—	91.89	10.41	—	5.79
Prob > F	(0.0000)		(0.0000)	(0.0013)		(0.0162)
ROA, F (1, 2717)	—	260.40	222.15	—	47.31	37.41
Prob > F		(0.0000)	(0.0000)		(0.0000)	(0.0000)
Panel B: Joint Tests						
$\delta_{11} - \delta_{12}$ and $\delta_{21} - \delta_{22}$	—	—	145.06	—	—	22.34
F (2, 2717); Prob > F			(0.0000)			(0.0000)

Note: Variables are defined as in Table 2.

unintended and unanticipated effects. For instance, it may result in too much risk-taking or it may shorten the time horizon used to make decisions. Among other things, however, this asymmetric structure of incentives appears to be consistent with and may help explain the increased number of mergers and acquisitions that occurred in the late 1990s.

A comparison between these estimates and those presented earlier clearly indicates that imposing the assumption of symmetry results in substantial specification bias. Interestingly, the bias appears to operate in opposite directions. The estimates in Tables 3 and 4 underestimate the impact of a positive *ROA* and overestimate the impact of a negative *ROA*. Conversely, they overestimate the impact of a positive *TRS* realization and underestimate the impact of a negative *TRS* realization. It is thus quite evident that the structure of asymmetry present in *TRS* does not mirror the structure of asymmetry present in *ROA*, as asymmetry is concave in *ROA* and convex in *TRS*.

In summary, evidence provided by estimates of the asymmetric version of the executive compensation model lends strong support in favor of the main hypotheses: (a) performance has non-linear asymmetric effects on executive compensation; and (b) alternate measures of performance display different patterns of asymmetry and non-linearity. Further, it suggests that modeling executive compensation as a symmetric performance process leads to a statistically mis-specified model and fails to resolve the compensation anomalies first noticed by Jensen and Murphy (1990).

6. SUMMARY AND CONCLUDING REMARKS

In this study, an empirical model to assess the importance of asymmetries in executive compensation contracts was presented. This issue is for the most part an unexplored area of agency theory. However, the empirical results of this study provide a great deal of evidence suggesting that ignoring them leads to serious misspecifications. It was also shown that these issues are important because they offer an answer as to why in the current literature the estimates of the effects of performance on executive compensation appear to be too small to have any economic significance.

Consistent with previous studies, the response of executive compensation to accounting returns is much stronger than the response to shareholder returns. While theory offers little guidance to the size of the incentives that would be optimal from the standpoint of the shareholders, the strength of the relationship indicates that in the late 1990s and early 2000s American CEOs had much more to gain from improving accounting returns than from improving market returns. Second, strong evidence of asymmetry and nonlinearity in the relationship between executive compensation and firm performance is observed. Jensen and Murphy (1990) argue that the effects of performance on executive compensation are too low to be consistent with formal agency theory. The asymmetric specification of the executive compensation model offers a resolution about such concerns, as the results indicate that the performance measures have effects on executive compensation levels that are not only statistically significant but also economically meaningful. Thus, ignoring such asymmetries can lead to results that substantially understate the economic significance of the relationship between executive compensation and performance. Third, the results indicate that the structure of asymmetry is not invariant to the measures of performance. In fact, convexity appears to dominate the asymmetry of the relationship between executive compensation and market returns, while concavity is the main feature that characterizes the asymmetry of the relationship between executive compensation and accounting returns. Negative market returns are heavily penalized while positive market returns are only mildly rewarded. Conversely, positive accounting returns are heavily rewarded, while negative accounting returns are not penalized at all.

An apparently dualistic view of firm performance emerges from the results of this study. Performance is viewed as good, and rewarded as such, when positive realizations in accounting returns are obtained, whereas performance is deemed poor, and penalized as such, when negative realizations in stock market returns occur. Consequently, when performance is judged in terms of accounting returns, good performance is rewarded more than poor performance is penalized. Conversely, when performance is judged in terms of market returns, poor performance is penalized more than good performance is rewarded. This evidence, in turn, seems to suggest that risk preferences may not be invariant to incentives. Executive compensation contracts may be constructed to encourage a risk-taking behavior in accounting-based performance, as executive compensation is relatively shielded from negative accounting returns realizations, and, at the same time, to strengthen a risk-averting behavior in market-based performance, as executive compensation is not insulated from negative stock market realizations. This conjecture is consistent with agency theory, as executives are more likely to understand the drivers of accounting-based returns than to recognize the factors that can explain stock prices.

Inferences from this empirical study may be bounded by the temporal context in which it is embedded. The late 1990s have been a singular time in America's corporate history. The panel nature of the data makes the findings more robust; however, the economic outlook of the late 1990s may be fundamentally different from the one-facing firms now or in the future. Consequently, future research will be needed to determine to the extent to which these results can be generalized in periods of different economic prospects. On the whole, however, the findings in this study help provide a better understanding of the nature of the relationship between firm performance and executive compensation, and indicate that the relationship between executive compensation and performance is far more complex and multifaceted than the vast majority of previous studies have described.

NOTES

1. For a review of the theoretical and empirical research on the subject, see Murphy (1999) and Rosen (1992).
2. Beginning with fiscal year 1993, companies have been required by the SEC to annually report individual salary, bonus, other annual compensation, restricted stock grants, long-term incentives payouts, stock option grants, and all other compensation for the top five paid executives.
3. Elasticity compares the percentage change of one variable x with the percentage change of the other variable y ($\mathrm{d}\ln(y)/\mathrm{d}\ln(x)$). Semi-elasticity, on the other hand, compares the level change in one variable x with the percentage change of the second variable ($\mathrm{d}\ln(y)/\mathrm{d}x$).
4. The sample has a mean market capitalization of $5.53 billions, and a median of $1.25 billions. 48 firms have a market capitalization above $10 billion, 66 firms with capitalization of $4–$10 billion, 152 firms with capitalization of $1–$4 billion, and 189 firms have a market capitalization below $1 billion.
5. The sample consists of 149 S & P 500 firms, 118 Mid-Cap, and 133 Small-Cap firms. Fifty-five firms did not have S & P classification.
6. *ExecuComp*'s modified Black–Scholes formula – *ExecComp* values options using an ‘‘expected life’’ equal to 70% of the actual term. In addition, *ExecComp* sets volatilities below the 5th percentile or above the 95th percentile to the 5th and 95th percentile volatilities, respectively; similarly, dividend yields above the 95th percentile are reduced to the 95th percentile.
7. Each model was also estimated using ordinary least-squares (OLS) and random effects (RE) estimators. These estimates, however, are not reported because (a) the Lagrangian multiplier test (Greene, 2003) rejects the OLS model, and (b) the Hausman test (Baltagi, 2001) rejects the random effects model at any conventional level.

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EMPIRICAL ANALYSIS OF THE RELIABILITY AND VALIDITY OF BALANCED SCORECARD MEASURES AND DIMENSIONS☆

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ABSTRACT

For many years management accountants have been involved in the design of information systems for decision-making. To be effective in system design, accountants need pertinent and reliable performance measures within a valid framework. The Balanced Scorecard (BSC) has received a great deal of attention as a comprehensive model of performance that takes into account both financial and non-financial measures. This paper examines the empirical reliability and validity of the BSC framework and its associated measures. With reference to content validity, internal consistency reliability, and factorial validity, results show that BSC, with measures grouped into its four dimensions, is a valid performance model.

Previous studies have called for better reliability and validity of BSC measures. The present study may help in the design and implementation of BSCs in business units by adding robustness to the BSC framework, and by suggesting a set of valid measures associated with the four BSC

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dimensions. The results may lead to reduced costs of BSC design and implementation, and enhanced consistency of future studies of the BSC.

1. INTRODUCTION

A consensus has emerged among academics and practitioners that it is important to design and implement performance measurement systems that consider non-financial measures to obtain a better assessment of business performance (Chenhall & Langfield-Smith, 1998; Ullrich & Tuttle, 2004). The Balanced Scorecard (BSC), introduced by Kaplan and Norton (1992), has received a great deal of interest as a framework that takes into account both financial and non-financial measures to provide a comprehensive model of performance measurement. The BSC is one of the major topics examined in management accounting research during the past decade (Ittner & Larcker, 2001). The BSC proposes four dimensions to represent business-unit performance–Financial, Customer, Internal business processes, and Learning and Growth. Despite surveys reporting that a growing number of organizations use the BSC, little is known about the reliability and validity of the BSC's framework and its suggested measures (Ittner, Larcker, & Meyer, 2003; Chenhall, 2003). Surprisingly, little attention has been paid to the BSC as a valid performance measurement model as originally proposed by Kaplan and Norton.[1]

Kaplan and Norton (2001) report that a reason for delay in BSC implementation is that business units may not have developed reliable measures for the scorecards. Problems of valid and reliable measures also have an impact on the credibility and importance allocated to the BSC dimensions by managers (Lipe & Salterio, 2002). For example, Malina and Selto (2001) report that changes in importance are a function of how credible the BSC measures are. They report that for performance assessment of a particular unit, management initially allocated 20% weight to the Learning and Growth dimension, then the year after weighted it to just 4%, then finally eliminated the dimension because management felt the measures associated with this dimension were not reliable. Ittner et al. (1997) point out the importance of establishing the reliability and validity of measures before suggesting any business models. Surveys report that executives worry about the quality and reliability of non-financial performance measures in BSCs, which has an impact on BSC usage (Lingle & Schiemann, 1996; Ittner & Larcker, 2001; Reck, 2001). Moreover, the BSC is expensive to design and implement as it may mobilize management time for up to 2 years (Chow, Haddad, & Williamson, 1997; Lipe & Salterio, 2000).

The present study aims to help in the design and implementation of BSCs in business units by empirically examining the BSC dimensions and its suggested measures. To do this, we conducted a survey research among 90 Canadian business units. First, BSC common measures associated with each of the four BSC dimensions were selected. Measures can be unique to particular units or common to units, but as reported by Lipe and Salterio (2000) and Dilla and Steinbart (2005), it appears that only common measures count as evaluations of performance across units, as measures unique to individual units tend to be ignored. Second, we examined the reliability of these common measures. Finally, we examined the factorial validity of the four BSC dimensions; factorial validity refers to the degree of coherence between a theoretical expectation of dimensions and empirical results. The main question for the purpose of this research is: Does the BSC, with common measures along its four dimensions, represent a valid performance model?

The results show that the BSC represents a valid model; this is an important research contribution to the performance evaluation and management accounting literature. Because it is rather costly to develop, it is important for management to understand that BSC design can be enhanced and implementation issues mitigated by providing validity to the BSC framework.

To our knowledge, there has been no other study that has empirically investigated the BSC from a construct validity perspective, so the present study provides evidence in this area. Chenhall (2003) also points out the importance of spending more time to develop robust and reliable BSC measures to enhance consistency between studies on the BSC.

This paper is organized as follows: Section 2 presents a literature review and Section 3 describes the research methodology; Section 4 reports on the reliability of the BSC measures and the factorial validity of the BSC dimensions; and the last section discusses limitations and presents a conclusion.

2. LITERATURE REVIEW

Organizational psychology literature has pointed out the importance of reliable measures for performance measurement (Blum & Naylor, 1968). For example, subjective measures for performance assessments are often consider less accurate and reliable than objective measures because they may be influenced by the rater's biases (Heneman, 1986; Campbell, 1990). Reliability is also regarded as an important factor in the choice of performance measures (Ittner et al., 2003). According to Malina and Selto (2001) "to be effective as a management control device, the BSC should result in evaluations that are accurate" (p. 75). To examine the reliability of BSC common measures and the validity of its four dimensions, we start our analysis with the content validity step.

2.1. Content Validity: Selection of the BSC Common Measures

Content validity refers to the use of relevant dimensions and measures to represent a construct.

First, the literature on the BSC clearly proposes four dimensions–Financial, Customers, Internal business processes, and Learning and Growth. These dimensions are considered essential to almost all organizations (Malina & Selto, 2001).

Second, the literature proposes a list of measures associated with each of the dimensions. Kaplan and Norton (1996) reported that across business units, a core set of common measures is found among BSCs observed, regardless of those units' business objectives. This statement has been emphasized by Lipe and Salterio (2000), who report that experiment participants evaluated their divisions' performance based solely on common measures, unique performance measures having no effect on the evaluation judgments. The above observations support the viewpoint that the BSC should include only critical performance measures that are mainly reflected in the common measures. As we examine several business units in the present study, the use of a set of common measures is considered appropriate.

We selected the BSC measures based on Kaplan and Norton (1996, 2001) and Kaplan and Atkinson (1998), where several scorecards are presented. Table 1 shows the selected measures associated with the respective dimensions. These measures aim to be representative of a typical BSC having (1) short- and long-term objectives, (2) drivers and outcome measures, and (3) objective and subjective measures.

The selection of measures takes also account of the availability of non-financial data from business units.[2]

For the Financial dimension, *return on assets* and *net profit margin* reflect the financial performance, and *working capital ratio* reflects asset utilization. For the Customer dimension, *marketing expenses to revenues* reflects marketing efforts to solicit new customers, and *revenue growth* is a *proxy* for *market share*. For this dimension, we selected two measures, although previous research has often used a single measure to represent the Customer

Table 1. Balanced Scorecard Measures Considered for Reliability and Validity Examination.

Dimensions	Measures	Sources
Financial	Return on asset	K&N (2001), pp. 31, 82, and 172; K&N (1996), p. 49
	Net profit margin	K&N (2001), p. 31
	Working capital ratio	K&N (2001), pp. 100 and 172; K&N (1996), p. 52
Customer	Marketing expenses to revenues	K&A (1998), p. 552
	Revenue growth	K&N (2001), pp. 122 and 198; K&N (1996), p. 80
Internal business	Number of new products	K&N (2001), p. 37; K&N (1996), pp. 26, 52, 99, 101, and 112
	Number of products offers	K&A (1998), p. 553
	R&D expenses to revenues	K&N (1996), p. 52 and 99
Learning and growth	Employee absenteeism rate	K&N (2001), p. 19 and 248; K&N (1996), p. 137
	Employee turnover rate	K&A (1998), p. 568; K&N (2001), pp. 19, 99, 172, and 309; K&N (1996), p. 131
	Training expenses to revenues	K&N (2001), pp. 147, 248 and 309; K&N (1996), p. 29
	Revenue per employee	K&A (1998), p. 568; K&N (1996), pp. 52, 55, 131, and 154

Note: K&N stands for Kaplan and Norton, while *K&A* for Kaplan and Atkinson.

aspect (see Banker, Potter, & Srinivasan, 2000; Ittner et al., 1997). We have observed in some BSC studies that *revenue growth* appears in either the Financial dimension or in the Customer dimension, depending on the nature attributed to this measure. *Revenue growth* may be seen as an indicator of financial performance or as an indicator of competitiveness (with a customer focus) reflecting the relative market share and position. For example, growth in sales volume appears in the Customer dimension of Nova Scotia Power's scorecard (see Kaplan & Norton, 2001, p. 122). Other performance measurement models have a similar classification. In Lynch and Cross's (1991) Performance Pyramid Model, *revenue growth* is associated with the Market dimension instead of the Financial dimension, and in Fitzgerald, Johnston, Brignall, Silvestro, and Voss (1991) Determinants and Results Matrix, *revenue growth* is associated with the Competitiveness dimension instead of the Financial-performance dimension. For the Internal business-process dimension, *number of new products* introduced over the last 3 years, *number of product offers*, and *R&D expenses to revenues* reflect innovation initiatives. Finally, for the Learning and Growth dimension, *employee absenteeism rate* and *employee turnover rate* reflect employee satisfaction, *training expenses to revenue* reflects employees' training efforts, and *revenue per employee* reflects employee productivity.

To examine the reliability of the common measures selected and the validity of the BSC dimensions, we collected the above measures among business units. The next section describes how we collected the data.

3. RESEARCH METHODOLOGY

Survey research was employed to collect the required data. As managers are reluctant to permit disclosure of information on their units, we worked with a professional accounting organization to support the study and used their members' directory to pre-select a set of units from both manufacturing and service industries.[3]

Members were contacted by telephone and first asked whether they were organized as a business unit, since the BSC literature indicates that the performance measures chosen should be tailored to this unit of analysis. Moreover, only business units of 100 employees or more were targeted as units with less than 100 employees that are unlikely to have clearly attributed fields of responsibilities (Brownell & Dunk, 1991). For those units that fulfilled these criteria, we explained the nature of the study and elaborated upon the information they would be asked to provide. To encourage participation, respondents were promised summarized outcomes of the study. Questionnaires were reviewed for clarity and forwarded to the units that agreed to participate.[4]

Respondents were asked to provide financial and non-financial data to calculate the return on asset, net profit margin, working capital ratio, revenue growth, marketing expenses to revenues, number of new products, number of product offers, R&D expenses to revenues, training expenses to revenues, and revenue per employee measures. For the employee absenteeism rate and employee turnover rate measures, respondents were asked to classify their business unit's compared with peers' using a 7-point scale (1 meaning a high rate, 7 a low rate). Respondents were also asked to provide annual revenues for size classification and Standard Industrial Classification (SIC code) for industry classification (the appendix shows how these measures were collected).

Five hundred firms were contacted, and the 380 that agreed to participate received questionnaires. We conducted three telephone reminders at intervals of two weeks, four weeks, and six weeks. We received the questionnaires from 128 units, although responses from 38 units were eliminated because the questionnaires were incomplete. The sample consequently consists of 90 questionnaires, for a response rate of 24%. From these 90 business units, 85 are stand-alone firms, and 5 are business units of two large firms. The main reasons mentioned for non-participation in the study were confidentiality concerns.

The profile of the average respondent is a comptroller who holds a bachelor's degree in commerce with an accounting designation and has an average age of 42 years. At the business-unit level, the average number of employees is 156, with average revenues of 22 million Canadian dollars. The sample of business units consists of 48 manufacturing (53%) and 42 services (47%).[5] A t-test on industry, including all variables, shows no significant differences between manufacturing versus services groups. To estimate the non-response bias, we compared *late respondents* vs. *early respondents* and results indicate that we do not have the presence of non-respondents bias. Table 2 provides descriptive statistics of measures collected, while Table 3 provides a correlation matrix showing some anticipated relationships between the measures. For example, strong correlations are observed for the measures associated with the Financial and the Learning and Growth dimensions. The next section examines the reliability of BSC measures and the validity of BSC dimensions.

4. INTERNAL CONSISTENCY RELIABILITY OF MEASURES AND FACTORIAL VALIDITY ASSESSMENT OF THE BSC DIMENSIONS

Cronbach's α is the most recognized estimation of reliability in management accounting research (Brownell, 1995). We used the Cronbach's α coefficient to estimate the internal consistency reliability of measures. Coefficient α is therefore calculated first for each dimension (Churchill, 1979). Table 4 presents the BSC measures along with Cronbach's α coefficients for each dimension.

As shown in Table 4, we obtained a Cronbach's α coefficient of 0.64 for the three measures of the Financial dimension. This coefficient would be higher if we deleted the *working capital ratio*, but we kept it because of its sound content validity and because at early stage, a coefficient of around

Table 2. Descriptive Statistics of Measures Collected.

Data Obtained from Respondents					
Measures:	Mean	S.D.	Minimum	Maximum	Theoretical Range
Return on assets (ROA)	9.49	6.52	−4.70	31.40	Does not apply for these measures
Net profit margin (NPM)	5.05	5.36	−3.00	35.00	
Working capital ratio (WC)	1.73	1.25	0.19	10.90	
Marketing expenses to revenues (MRK)	0.02	0.04	0	0.32	
Revenue growth (REVGR)	6.81	18.04	−38.5	71.2	
Number of new products (NEWP)	15.29	19.64	0	50	
Number of products offers (POFF)	20.28	35.36	1	90	
R&D expenses to revenues (R&D)	0.0095	0.0158	0	0.12	
Training expenses to revenues (TRAI)	0.0026	0.0056	0	0.02	
Revenue per employee (RPE)	254,300	465,233	25,000	4,277,992	
Employee absenteeism rate (ABS)	5.41	1.25	2	7	1–7
Employee turnover rate (TURN)	5.24	1.63	1	7	1–7

Note: $n = 90$.

0.60 is considered reasonable (Nunnally, 1967, p. 226). For the Customer dimension the α coefficient is 0.51, which shows that the two measures are compatible enough for purposes of reliability. For the Internal business dimension, we have to delete the *R&D expenses to revenues* measure to obtain an α coefficient of 0.55. Finally, for the Learning and Growth dimension, two iterations are necessary; first, we must delete the *revenue per employee* measure to obtain an α of 0.43, then we must delete the *training expenses to revenue* measure to obtain an α coefficient of 0.58.

There are theoretical arguments to support this iterative process of Cronbach's α coefficient computation, deletion of items, and recomputation until an acceptable coefficient is achieved for each dimension (see Churchill, 1979, p. 69). Factor analysis can then be used to validate whether the four dimensions as proposed by Kaplan and Norton can be observed empirically, which would permit the examination of the factorial validity of the BSC.

Table 3. Correlation Matrix.

	ROA	NPM	WC	MRK	REVGR	NEWP	POFF	R&D	TRAI	RPE	ABS	TURN
ROA	*1.00*											
NPM	0.71**	*1.00*										
WC	0.07	0.26*	*1.00*									
MRK	−0.16	0.04	0.45**	*1.00*								
REVGR	0.11	0.04	−0.04	0.29*	*1.00*							
NEWP	0.01	0.08	−0.12	0.08	0.08	*1.00*						
POFF	0.06	−0.01	−0.15	−0.02	−0.11	0.39**	*1.00*					
R&D	−0.10	0.00	0.17	0.22	−0.12	0.11	0.03	*1.00*				
TRAI	0.01	−0.04	−0.17	−0.05	−0.24*	0.07	0.17	0.13	*1.00*			
RPE	−0.27**	−0.14	0.02	0.14	−0.04	0.06	0.02	0.01	−0.03	*1.00*		
ABS	0.06	0.12	0.04	0.02	0.10	−0.11	0.03	0.02	−0.13	0.21*	*1.00*	
TURN	0.04	0.13	0.27**	−0.01	−0.06	−0.07	−0.01	−0.04	−0.15	0.02	0.43**	*1.00*

**Pearson correlation is significant at the 0.01 level.
*Significant at the 0.05 level, (2-tailed), $n = 90$.

Factorial validity refers to the degree to which an empirical factor analysis is coherent with a priori theoretical expectations (Kerlinger, 1986). We therefore performed a principal components analysis, Varimax rotation, with the remaining measures (measures in italic in Table 4).

Table 5 presents the results that confirm the four BSC dimensions proposed by Kaplan and Norton, results that are also consistent with Hoque and James' (2000) study. Only one measure, *working capital ratio*, does not clearly fit the BSC dimensions, with a loading of 0.268 for the Financial dimension and a loading of 0.275 for the Learning and Growth dimension. Kerlinger (1986, p. 572) indicates that in some studies, low-factor loadings have already been retained. We therefore maintain for now the *working capital ratio* measure for the Financial dimension because of its sound content validity and weak association with the Learning and Growth dimension. As a reminder, the previous reliability analysis shows that Cronbach's α coefficient of the Financial dimension could be improved from 0.64. to 0.82 by deleting the *working capital ratio* measure; this will be kept in mind during analysis.

To increase robustness to the above results, we also ran a factor analysis with the BSC measures, but without reference to Kaplan and Norton's dimensions (see Table 6). The first rotation provided five factors, with two measures not loading on any factors–*training expenses to revenue* and *revenue per employee*. We deleted these two measures and the second rotation also provided five factors. We then calculated Cronbach's α coefficient for each factor (dimension). Results obtained are the same as in Table 5 for the

Table 4. Balanced Scorecard Measures with Cronbach's Alpha Coefficients per Dimension ($n = 90$).

Dimension	Measures	Cronbach Alpha Coefficient	Alpha if Item Deleted after First Iteration		Final Cronbach Alpha
Financial	*Return on asset*		0.21		
	Net profit margin	0.64	0.05		*0.64*
	Working capital ratio		0.82		
Customer	*Marketing expenses to Revenues*	0.51	0.23		*0.51*
	Revenue growth		0.03		
Internal business	*Number of new products*		0.00		
	Number of products offers	0.42	0.01		*0.55*
	R&D expenses to revenues		0.55		
			First Iteration	Second Iteration	
Learning and growth	*Employee absenteeism rate*		0.00	0.00	
	Employee turnover rate	0.00	0.00	0.00	*0.58*
	Training expenses to revenues		0.00	0.58	
	Revenue per employee		0.43	deleted	

Note: Descriptive statistics for the measures above are available in Table 2. Due to the high kurtosis index, Internal business measures have been transformed using the square foot for use in reliability analysis.
The nine measures in italics will be examined in further analysis.

Learning and Growth (F3), Internal business (F4), and Customer (F5) dimensions. The Financial dimension (F1) still includes *return on assets* and *net profit margin* measures, but not the *working capital ratio* measure, which loads highly (0.729) on another dimension (F2), leading to an increase of the α coefficient for the Financial dimension from 0.64 to 0.82. This analysis indicates again that the α coefficient could be improved by deleting the *working capital ratio*; this measure is therefore finally deleted from the Financial dimension. The F2 dimension includes the *working capital ratio* and *R&D expenses to revenues* measures; we calculated the α coefficient for these two measures but the α was only 0.34, which reveals reliability issues.

Table 5. Factor Analysis of BSC Measures with Reference to Kaplan and Norton's Dimensions.

Measures	Factor Loadings			
	F1 Financial	F2 Learning and Growth	F3 Internal Business	F4 Customer
Return on asset	0.914			
Net profit margin	0.917			
Working capital ratio	0.268	0.275	−0.349	−0.505
Marketing expenses to revenues				*0.487*
Revenue growth	0.127		−0.144	*0.850*
Number of new products			0.777	
Number of product offers			0.842	
Employee absenteeism rate		0.836		0.229
Employee turnover rate		0.823		−0.240
Eigenvalues	1.948	1.456	1.341	1.088

Note: Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser normalization.
Variance explained with the four factors: 72.912%.
Absolute values less than 0.10 have been suppressed.

The above results combined (Tables 4, 5, and 6) demonstrate internal consistency reliability of eight BSC common measures. These measures associated with the four BSC dimensions represent a valid core set of measures that may be used as a starting point for BSC design. Results also support the specific BSC structure of four dimensions as proposed by Kaplan and Norton as showing factorial validity (i.e., coherence between theoretical expectations and empirical results). These results support the Lipe and Salterio (2002) study, which demonstrates that the four BSC dimensions are important to managers for performance evaluation.

5. DISCUSSION, LIMITATIONS, AND CONCLUSION

The objective of this paper was to examine the reliability of BSC measures and the validity of its framework. Chenhall (2003) points out the importance of developing robust and reliable BSC measures to enhance consistency between BSC studies.

Referring to the concepts of content validity, internal consistency reliability, and factorial validity, results indicate that the BSC four dimensions with a set of common measures represent a valid performance model. The

Table 6. Factor Analysis of BSC Measures, with no Reference to Kaplan and Norton's Dimension, and Cronbach's alpha Coefficients.

Measures	Factor Loadings									
	First Rotation					Second Rotation				
	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
Return on asset	*0.899*	−0.113			0.102	*0.922*	−0.137			
Net profit margin	*0.863*	0.156	0.154			*0.914*	0.124			
Working capital ratio	0.193	*0.755*	0.218	−0.208		0.232	*0.729*	0.211	−0.240	
Revenue growth		−0.119			*0.796*					*0.964*
Marketing expenses to revenue	−0.127				*0.412*					*0.468*
Number of new products			−0.117	*0.835*				−0.102	*0.822*	0.126
Number of product offers		−0.116	0.116	*0.774*	−0.206		−0.113		*0.799*	−.175
R&D expenses to revenue		*0.556*		0.204	−0.291		*0.591*		0.260	−0.104
Employee absenteeism rate			*0.797*		0.124			*0.826*		0.183
Employee turnover rate			*0.836*					*0.841*		−0.156
Training expenses to revenue			−0.191	0.174	−0.693	measure deleted				
Revenue per employee	−0.472		0.186	0.150	0.208	measure deleted				
Eigenvalues	2.056	1.723	1.511	1.390	1.125	1.968	1.678	1.395	1.321	1.001
Final *Cronbach alpha*	n.a.	n.a.	n.a.	n.a.	n.a.	*0.82*	*0.34*	*0.58*	*0.55*	*0.51*

Note: Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization.
Absolute values less than 0.10 have been suppressed.

present study may therefore help the design and implementation of BSC in organizations by suggesting a set of measures associated with the specified BSC structure of four dimensions. Business units adapt their BSC measures to changes in strategy and/or the availability/development of reliable measures (Malina & Selto 2001). Simons (2000) reports that a well-designed BSC should permit a balance between short-term and long-term objectives, drivers and outcome measures, and objective and subjective measures; when examined the common measures reflect this.

In the future, researchers should examine the reliability of the BSC measures analyzed here with other units in different business settings. Churchill (1979) states that if a construct is more than a measurement artifact, it should be reproducible with a new sample when using reliable measures: reliable and valid measurement is the *sine qua non* of science. Doing this will enhance the robustness and reliability of BSC studies and offer a stronger base for BSC theory development. Lipe and Salterio (2000) report that accounting research should be conducted with relevant theories, but the theory is not yet developed for performance assessment. The present study is an initiative toward a theory-building perspective in examining the validity of the BSC as a performance model.

The present study has limitations and we note the most important. First, we agree that a larger sample would increase confidence in the results, but we had to deal with the difficulties of obtaining financial and non-financial data at the business–unit level, which also limited the number of BSC measures when examined. Second, although we carefully developed questionnaires to be concise and clear, some respondents may have misunderstood the instrument; this is a limit of this method. Third, we referred to and applied rigorous reliability and validity concepts, although these notions have limits. For example, reliability is rarely fully measured, but always estimated (Peter, 1979). Finally, as reported by Ittner and Larcker (1998), BSC measures developed for planning/management, compensation, or performance evaluation, are most likely not appropriated for the three contexts. The present results therefore apply to performance evaluation only.

For many years, management accountants have been involved in the design of information systems for decision-making. With the advent of integrated information systems such as the BSC, the "information producer" function of the accountant has become more challenging. To be effective in the design of BSCs, accountants need pertinent and reliable BSC measures within a valid framework–otherwise, measures used will not reflect business-unit performance.

Rigorous research on the BSC is only beginning to emerge. The present study aims to be one of them.

NOTES

1. Kaplan and Norton (2001) stated that "several years ago, we introduced the Balanced Scorecard. At that time, the Balanced Scorecard was about performance measurement, not about strategy" (p. 3). The reader should see the BSC as a construct aiming to assess business unit performance. This is the original aspect of this paper, since previous studies on the BSC took for granted the suggested measures and the four quadrants/dimensions.

2. Discussions with business unit managers, before we developed the questionnaires, provided us indications on the performance measures we could obtain from

them. As we were not interested in asking for measures not available from respondents, those discussions helped us to define information we could ask for.

3. This professional accounting organization is the Certified General Accountants (CGA). CGA-Canada is a Canadian professional accounting association representing 62,000 members and students. We worked with CGA–Quebec, an affiliate of CGA–Canada, which represents 10,000 members and students. The study follows an initiative by the author and CGA–Quebec on a project called Performance Indicators. Respondents were aware of the BSC approach.

4. Two academics and an adviser in linguistics reviewed the questionnaires.

5. The business units were in pulp and paper, textile, transformation, construction, industrial products, food products, retailer, wholesaler, leasing, and dealers. The percentage per industry is similar to the five hundred units contacted.

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APPENDIX

Based on the definitions provided, calculate the following measures:

Return on asset:

net profit + interest expense
___
total assets

For your unit, the **return on asset** is:

___

Net profit margin:

net profit
___
total revenue

For your unit, the **net profit margin** is:

___

Revenue growth:

sales current year (less)
sales previous year
___
sales previous year

For your unit, the **revenue growth** is:

___

Marketing expenses to revenues:

marketing expenses
___
total revenue

For your unit, **marketing expenses to revenues** is:

___

HAS THE EMERGENCE OF THE SPECIALIZED JOURNALS AFFECTED MANAGEMENT ACCOUNTING RESEARCH PARADIGMS?

Nen-Chen Richard Hwang and Donghui Wu

ABSTRACT

The purpose of this study is to investigate whether the emergence of specialized journals has affected management accounting research paradigms. Articles published in eight leading accounting journals from 1991 to 2000 are analyzed using Shields' (1997) classification schemes. The study reports two major findings. One is that the overall percentage of management accounting research published in five non-specialized accounting journals has remained relatively constant since the establishment of three specialized journals oriented to management accounting research. The other is that the editorial boards of specialized journals appear to have broader interests in research Topics, to be more flexible with regard to research Methods, and are more willing to accept manuscripts adopting various Theories. Overall, the results of this study support that the emergence of management accounting research journals impacted research paradigms gradually during the 1990s.

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1. INTRODUCTION

This paper is motivated by consistent interest within the academic community during the past two decades in revitalizing management accounting research. Among all the efforts directed at achieving this objective, the most significant is the establishment of management accounting-oriented academic journals, namely, *Advances in Management Accounting* (*AIMA*) in 1992, *Journal of Management Accounting Research* (*JMAR*) in 1989, and *Management Accounting Research* (*MAR*) in 1990. These journals provide a crucial link between academic research and business practices that allows researchers to propose and observe how management accounting techniques are implemented in organizations. These journals also render an interactive platform for academicians and practitioners to dissimilate findings and exchange experience on implementing management accounting tools and techniques in the business environment. As Professor Epstein (1992), the editor of *AIMA*, explicitly stated in the inauguration issue of *AIMA*:

> … *Advances in Management Accounting* is an attempt to bridge the gap between research and practice. It will include papers on any area of management accounting, as broadly defined. Acceptable research methods include survey research, field tests, corporate case studies and modeling along with many others. Papers may range from empirical to analytical, from practice-based to the development of new techniques …

To enhance our understanding of the impacts of these specialized journals on management accounting research, this paper attempts to address two research questions. One is to investigate whether the emergence of three management accounting-specialized journals has affected management accounting research paradigms. The other is to examine whether the establishment of management accounting-specialized journals did, indeed, enhance the diversity and quality of management accounting research from 1991 to 2000.

For the purpose of this study, we adopted the research framework developed by Shields (1997). In his study, Shields (1997) classified management accounting research articles by *Topics*, *Methods*, *Settings*, *Theories*, and *Results*. *Topics* refers to a broad classification of the subject matter, such as Cost and Management Accounting, Management Information Systems, and so forth. *Methods* refers to the research method used, such as whether the study used analytic, normative, laboratory experimental, and survey or case/field study. *Settings*, on the other hand, refers to the background of the study, specifically whether a single industry, such as Manufacturing, was the backdrop of the study. *Theories* refers to the underlying disciplines upon which the management accounting study was based. *Results* refers to the primary findings from the management accounting study.[1]

This study advances to the findings of Shields (1997) on several fronts. First, the study provides a more complete analysis by broadening the scopes of the Shields' (1997) study. In addition to the journals included in Shields (1997), we incorporate *AIMA, MAR*, and expand coverage of *Accounting, Organizations and Society* (*AOS*) in the data set.[2] Second, the study compares and contrasts the articles published in leading management accounting-specialized journals with leading non-management accounting-specialized journals to discern whether they reflect different interests. Finally, as stated in the editorial policies, *MAR* and *AOS* are identified as accounting journals with an international focus. The other six journals, on the other hand, appear to be more in line with research thoughts in North America. Therefore, we dichotomize the journals into international and North American categories in order to determine whether there are significant differences in what types of management accounting research have been published in these journals. Such a comparison provides useful insights as to whether the divergent foci of editorial policies would lead to significant differences in what types of management accounting research have been published in these journals.

Articles published in eight leading accounting journals, *The Accounting Review* (*TAR*), *Journal of Accounting Research* (*JAR*), *Journal of Accounting and Economics* (*JAE*), *Contemporary Accounting Research* (*CAR*), *AOS*, *AIMA*, *JMAR*, and *MAR*, from 1991 to 2000, are included in the data analyses. The selection of journals is based upon the following criteria. First, in order to generalize the results of this study to management accounting research field as a whole, we decide to broaden the scope of the data set by including all major journals that have published management accounting research. Second, in order to explore the effect of management accounting-specialized journals on management accounting research, this study compares and contrasts the articles published in specialized and non-specialized accounting journals. To accomplish this research objective, inclusion of eight journals in this study will yield meaningful insights to this inquiry. Finally, in order to probe whether the editorial foci of journals lead to different interests in publishing management accounting research, this study evaluates articles published in the data set to find out whether there are different research paradigms between North American and international journals. According to the editorial policies of all eight academic journals, we are able to classify these journals into two categories.

For the purpose of this study, *AIMA*, *JMAR*, and *MAR* are classified as management accounting-specialized journals, while the other five influential journals are non-management accounting-specialized journals. Moreover, *AOS* and *MAR* are classified as international journals,[3] while the other six are North American journals according to their editorial policies. Although possible arguments exist that our included journal list is somewhat incomplete and that the classifications of the journals/articles may not fully reflect the status of management accounting research, the inclusion of journals and the classification schemes used in this study do provide a workable framework for us to address our research questions.

To examine whether the emergence of specialized journals has affected management accounting research paradigms, we first divided the studied period (1991–2000) into two halves, 1991–1995 and 1996–2000. Moreover, we investigate articles published in the 1990s by separating them by (1) management accounting-specialized versus non-management accounting-specialized journals, and (2) North American focus or international focus. By applying statistical analyses to the publications in studied journals using the Shields' (1997) research framework, the results of the study provide insights as to whether (1) there is difference on the publication rate of management accounting research between the 1991–1995 and 1996–2000, (2) the establishment of *AIMA*, *JMAR*, and *MAR* affects, or offers a different, management accounting research paradigms from non-management accounting-specialized journals (*TAR*, *JAR*, *JAE*, *CAR*, and *AOS*), and (3) the different editorial foci between North American and international journals have led to divergent interests or preferences as to what studies are published in these leading academic publications.

There are several findings in this study. First, the overall quantity of publications of management accounting research in the five non-management accounting-specialized journals remains stable from 1991 to 2000. Second, there are significant differences in the research *Settings* and the *Theories* adopted among published articles between the two sub-periods. Third, in a comparison between specialized and non-specialized management accounting journals, we find that there are significant differences regarding research *Topics*, *Methods* and *Theories*. However, all journals published were conducted in similar research *Settings*, which are dominated by either a single industry/activity or a generic setting. Fourth, when the articles published in the North American journals are compared to those in the international journals, this study reveals that there are significant differences between the journals categories on research *Topics*, *Methods*, *Settings* and *Theories*. Overall, the results of this study appear to indicate that the emergence of management accounting research journals gradually impacted the research paradigms during the 1990s.

The remainder of this paper is organized as follows. Section 2 describes the data set and the collection processes of this study. Section 3 presents the overall trend of management accounting research for the selected accounting journals during the 1990s. Then, we compare and contrast the management accounting publications by dividing (1) the studied period into two sub-periods (1991–1995 and 1996–2000), and (2) the non-specialized journals (*TAR*, *JAR*, *JAE*, *CAR*, and *AOS*) from the specialized journals (*AIMA*, *MAR*, and *JMAR*), and (3) the North American (*TAR*, *JAR*, *JAE*, *CAR*, *AIMA*, and *JMAR*) versus the international journals (*AOS* and *MAR*). Finally, in Section 4, the study summarizes the research findings and discusses their implications to management accounting research.

2. DATA SET AND COLLECTION PROCESSES

Eight leading accounting journals have been included in this study. The following table presents information as to the nature (management accounting-specialized versus non-management accounting-specialized journals), the affiliation (professional organizations, higher education institutions, or independent), the origins (USA, Canada, or UK), and the editorial foci of the journals (North American or international).

Nature	Affiliation	Origins	Editorial Focus
Management accounting-specialized journals			
Advances in Management Accounting	Independent	USA	North America
Journal of Management Accounting Research	AAA	USA	North America
Management Accounting Research	CIMA	UK	International
Non-management accounting-specialized journals			
The Accounting Review	AAA	USA	North America
Journal of Accounting Research	University of Chicago	USA	North America
Journal of Accounting and Economics	University of Rochester	USA	North America
Contemporary Accounting Research	CAAA	Canada	North America
Accounting, Organization and Society	Oxford	UK	International

Management accounting articles published in the above journals from 1991 to 2000 are included in the data set. To facilitate data analyses, we have modified the Shields' classification scheme slightly.[4] Exhibit 1 illustrates and compares the Shields' (1997) original scheme to the modified schemes used in the study. Similar to the Shields' (1997) study, we exclude announcements,

Exhibit 1. Taxonomy of Management Accounting Research by Shields (1997) and its Adaptation for this Study.

Panel A: Shields (1997) taxonomy	Panel B: Taxonomy as modified for this study
Attribute 1: Topics of MAR Papers	
A. Management control systems	Management control systems
Incentives	Management control systems
Budgets or budgeting	Management control systems
Performance measurement	Management control systems
Transfer pricing	Management control systems
Responsibility accounting	Management control systems
Internal control	Management control systems
B. Cost accounting	Cost accounting
Cost accounting overall	Cost accounting
Cost allocation	Cost accounting
Activity-based costing (ABC)	Cost accounting
Product costing	Cost accounting
Cost variances	Cost accounting
C. Cost management	Cost management
Quality	Cost management
Just in time (JIT)	Cost management
Use of costs for decision making	Cost management
Benchmarking	Cost management
History	Cost management
D. Cost drivers	Cost drivers
E. Management accounting, information, and systems	Management accounting, information, and systems
F. Research methods and theories	Research methods and theories
G. Capital budgeting and investment decisions	Capital budgeting and investment decisions
	Cover more than one topic
Attribute 2: Methods used in MAR Papers	
A. Analytic	Analytic
B. Archival	Archival
C. Case/field study	Case/field study
D. Laboratory experimentation	Laboratory experiment
E. Behavioral simulation	Behavioral simulation
F. Literature review	Literature review
	Normative
G. Survey	Survey
H. Multiple research method	Multiple research methods
Attribute 3: Settings of MAR Papers	
A. Generic (abstract/stylized/simplified)	Generic
B. Government, not-for-profit, hospitals	Governmental or not-for-profit organizations
C. Single industry or activity	Single industry or activities
Manufacturing	Single industry or activities
Marketing and retailing	Single industry or activities
R&D	Single industry or activities
Transportation	Single industry or activities
Other	Single industry or activities
D. Multiple industries or activities	Multiple industries or activities
E. Service industry	Service industry
F. Inter-organizational	Inter-organizational
G. No or another setting	Other settings

Exhibit 1. (*Continued*)

Panel A: Shields (1997) taxonomy	Panel B: Taxonomy as modified for this study
Attribute 4: Theories Underlying MAR Papers	
A. Economics	Economics
B. Organizational behavior	Organization behavior
C. Production/operations management	Production/operations management
D. Psychology	Psychology
E. Sociology	Sociology
F. Strategic management	Strategic management
G. Mix of disciplines	Using multiple theories
	History
	No theory

Note: Shields' (1997) classification system does not include "Cover more than one topic" in the "Topic" attribute, "Normative" in the "Methods" attribute, or "History" and "No Theory" in the "Theories" attribute. A variety of combinations of methods (such as Analytic and Archival, Survey and Case/Field Study) or a variety of combinations of disciplines (such as Economics and Organizational Behavior, Economics and Psychology), as identified by Shields (1997), are not tabulated here.

commentaries or discussions, book reviews, and replies and corrigendum published in these seven journals from the data set.

There are three stages in the data collection process. In the first stage, management accounting articles published in five non-management accounting-specialized journals are identified. To limit the discrepancies in our classifications and that of Shields (*Topics*, *Methods*, *Settings* and *Theories*), one author of this study classified all management accounting articles covered by Shields (1997) and then compared our classifications with those reported in Shields' (1997) study. By reconciling the differences between Shields' and our classifications, the author gained a better understanding of how management accounting research articles were classified originally in Shields' (1997) study. In the second stage, management accounting publications not included in Shields (1997) study are identified and classified, using the same classification scheme developed in the first stage. Finally, the other author of this study independently repeated the exact same procedures described above for all the published management accounting articles in all eight journals from 1991 to 2000.

3. DATA ANALYSES

3.1. Overall Trend of Management Accounting Research

As discussed in the introduction section of this study, *TAR*, *JAR*, *JAE*, *CAR*, and *AOS* are treated as non-management accounting-specialized journals, while *AIMA*, *JMAR*, and *MAR* are categorized as management accounting-specialized journals. Since papers appearing in specialized journals all relate to management accounting, the analysis of overall trend in management accounting research is applicable only to the five non-specialized journals. In this section, we examine whether there is a temporal trend in the number of management accounting research articles published from 1991 to 2000, based on the results of regression analyses.

Referring to Table 1 and Panel A of Fig. 1, it appears that there is an increase in the number of management accounting articles published in the five non-specialized journals. The regression coefficient on the year variable is significant at a 10 percent level, which indicates that management accounting publication rates increased approximately 0.62 percent annually over the decade. However, when the journals are divided into two groups by the editorial focus of the journals (North American versus international); we find that the increasing trend may be driven by the *AOS* special issues devoted to management accounting research. Since the publication of management accounting research in *AOS* is volatile, neither the intercept nor the slope of the regression line is significantly different from zero, although there being an evident upward trend of publications by visual inspection (Panel B of Fig. 1). To discern this observation, we focus on non-specialized journals published in North America. Referring to Panel C of Fig. 1, it appears that the numbers of publications in management accounting research have been rather stable from 1991 to 2000. On average, 10.8 percent of the papers published in *TAR*, *JAR*, *JAE*, and *CAR* were about management accounting research. More importantly, there is no significant temporal change in the publication rates of management accounting papers in these four journals, as illustrated in the slope of regression line, which is close to zero (−0.10%). In conclusion, this finding does not yield supporting evidence that there was a significant increase in interest in publishing management accounting research in the 1990s despite the important evolution that occurred in management accounting during the studied period.[5]

In Table 2, the study presents the frequency distribution of published articles by *Topics*, *Methods*, *Settings* and *Theories*. Of the total 580 management accounting research papers published in the eight leading journals, 240 (41.4%) of the articles were on management control systems, followed by management accounting and information systems with 107 (18.4%) articles. While the management control system topic has been regarded as the mainstream management accounting issue after the 1980s (Anthony, 2003; Birnberg, 1999), the management accounting and information systems topic has gained popularity in recent years. In addition, the more traditional

Table 1. Publication of Management Accounting Papers in the Leading Accounting Journals.

	1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		ALL	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Panel A: Non-specialized journals																						
A1. International journals																						
AOS	12	29.3	6	14.6	5	13.2	9	24.3	9	28.1	8	23.5	8	20.0	4	10.0	21	63.6	16	43.2	98	26.3
A2. North American journals																						
CAR	0	0.0	3	13.0	3	11.5	1	2.7	0	0.0	3	12.0	1	4.3	2	10.5	1	4.2	1	4.3	15	6.0
JAE	0	0.0	1	5.3	2	16.7	2	6.7	4	15.4	3	8.3	7	25.9	4	28.6	2	5.0	0	0.0	25	10.5
JAR	2	6.7	2	8.3	2	10.0	0	0.0	9	34.6	0	0.0	3	12.5	3	11.1	3	10.0	2	10.5	26	10.5
TAR	4	8.9	9	20.5	10	18.9	7	19.4	3	10.3	4	19.0	3	11.1	2	8.3	2	9.1	4	21.1	48	15.0
Subtotal for A2	6	5.2	15	13.6	17	15.3	10	8.0	16	15.4	10	9.3	14	13.9	11	13.1	8	6.9	7	0.1	114	10.8
Subtotal for A1 & A2	18	11.5	21	13.9	22	14.8	19	11.7	25	18.4	18	12.7	22	15.6	15	12.1	29	19.5	23	19.3	212	14.8
Panel B: Specialized journals																						
AIMA	N.A.		12		13		11		11		11		N.A.		10		25		9		102	
JMAR	12		10		15		7		5		8		9		13		5		5		89	
MAR	13		13		12		17		21		20		21		20		18		22		177	
Subtotal for B	25		35		40		35		37		39		30		43		48		36		368	
Panel C: All the journals																						
	43		56		62		54		62		57		52		58		77		59		580	

Note: AOS = *Accounting, Organizations and Society*; *CAR* = *Contemporary Accounting Research*; *JAE* = *Journal of Accounting and Economics*; *JAR* = *Journal of Accounting Research*; *TAR* = *The Accounting Review*; *AIMA* = *Advances in Management Accounting*; *JMAR* = *Journal of Management Accounting Research*; *MAR* = *Management Accounting Research*. The numbers under the column "*N*" are the numbers of management accounting papers published, and those under the "%" column are the percentage of management accounting papers over total papers published in the non-specialized journals.

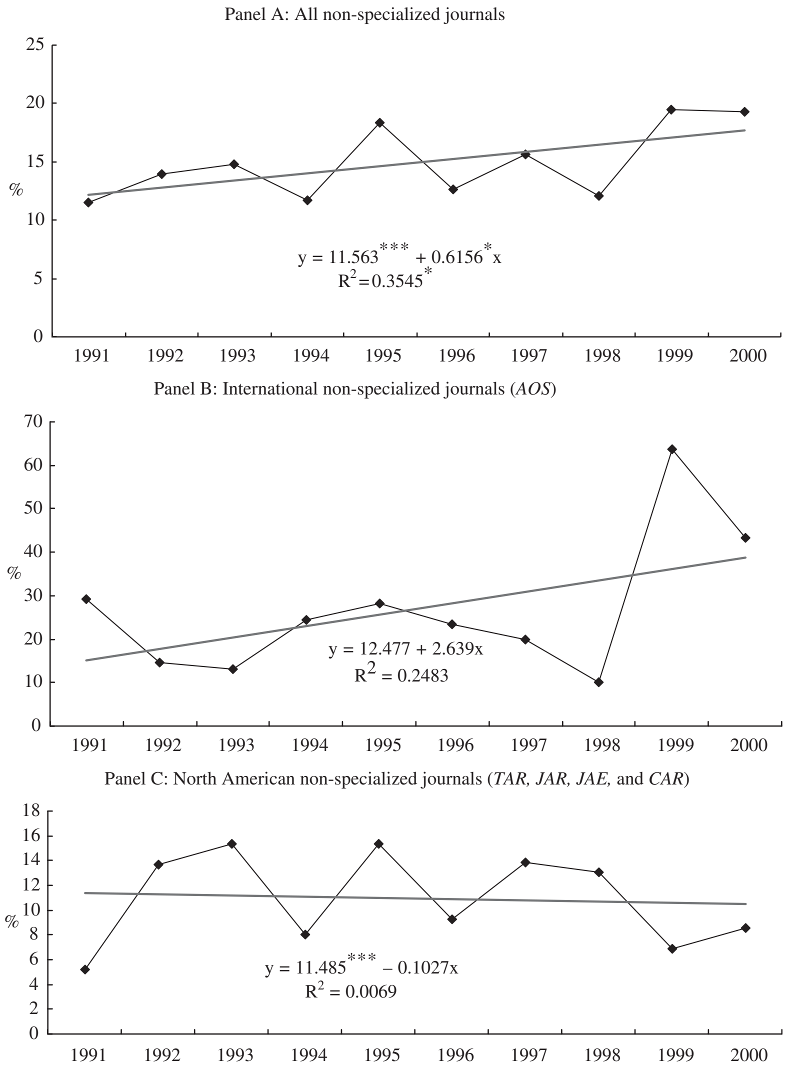

Fig. 1. Publication Rates for Management Accounting Papers in Non-specialized Journals. *Note:* The dependent variable for the regression is the percentage of management accounting papers published in the journals of interest, and independent variable is the year variable coded from 1 to 10. The*** and* for the coefficients indicate that the coefficients are significant at 1% and 10% level, respectively. Also,* for the R^2 indicates the model is significant at 10% level in the F-test.

Table 2. Distribution of Articles by Classifications.

	N	%
Panel A: Topics		
Management control systems	240	41.4
Cost accounting	82	14.1
Cost management	63	10.9
Cost drivers	19	3.3
Management accounting, information, and systems	107	18.4
Research methods and theories	33	5.7
Capital budgeting and investment decisions	24	4.1
Cover more than one topic	12	2.1
Total	580	100.0
Panel B: Methods		
Analytic	100	17.2
Survey	121	20.9
Archival	56	9.7
Laboratory experimentation	62	10.7
Literature review	54	9.3
Case/Field study	117	20.2
Behavioral simulation	4	0.7
Normative	46	7.9
Multiple research methods	20	3.4
Total	580	100.0
Panel C: Settings		
Single industry or activities	202	34.8
Multiple industries or activities	45	7.8
Governmental or not-for-profit organizations	45	7.8
Generic (abstract/stylized/simplified)	169	29.1
Service industry	22	3.8
Inter-organizational	9	25.7
Other settings	88	15.2
Total	580	100.0
Panel D: Theories		
Economics	232	40.0
Organizational behavior	51	8.8
Psychology	42	7.2
Production/operations management	39	6.7
Sociology	51	8.8
Strategic management	37	6.4
History	17	2.9
Using multiple theories	46	7.9
No theory	65	11.2
Total	580	100.0

Note: See Exhibit 1 for the taxonomy of management accounting research by Shields (1997) and its adaptation for this paper.

management accounting topics that address measurement issues, such as cost accounting and cost management, continue receiving significant attention by journal editors. These findings appear to support Shields' (1997) claim that there was an increase in the diversity of management accounting research published during the 1990s.

As to research *Methods*, surveys (121 articles, 20.9%) and case/field studies (117 articles, 20.2%) appear to be the most common research methods adopted by researchers. While it is not surprising that surveys are the most commonly used research method, case/field studies have become one of the primary methods employed in management accounting research since the late 1990s. The rising number of articles using this method and published in leading journals indicates that researchers who are in favor of this kind of research method are starting to generate positive outcomes after calls made by Kaplan (1984, 1986).

Regarding research *Settings*, accounting researchers seem to be in favor of conducting their studies in single-industry or single-activity settings. More than one-third of published articles (202 articles, 34.8%) investigate issues under this type of setting. Generic settings are also quite popular. From 1991 to 2000, more than one quarter of published articles (169 articles, 29.1%) were conducted in generic settings. While the service industry has become more important in recent years, there is no evidence indicating that researchers were paying more attention to the service industry in the 1990s. Only a limited number of management accounting studies were conducted in this setting (22 articles, 3.8%). Most management accounting researchers still focused on the manufacturing sector. Surprisingly, however, researchers have become more interested in management accounting research issues in government or not-for-profit organizations (45 articles, 7.8%).

Similar to academic research in other disciplines, accounting research is expected to be imbedded in solid theoretical frameworks. For example, financial accounting research is normally grounded in *Economics*. Relative to financial accounting, management accounting research tends to base its studies on a broader spectrum of theories developed in other disciplines, such as *Organizational Behavior*, *Psychology*, and *Production and Operations Management*. Interestingly, we find that *Economics* is the most dominant theory applied to management accounting research as well. Between 1991 and 2000, 232 articles (40.0%) published management accounting papers used *Economics* as the underlying theory. To a much lesser extent, the second major underlying disciplines used in management accounting are *Sociology* (51 articles, 8.8%) and *Organizational Behavior* (51 articles, 8.8%). The results of the study also show that 46 (7.9%) published articles used multiple theories to support their studies, while 65 (11.2%) papers did not appeal to any apparent theory to support their work. Examining the published management accounting research, the results of this study indicate that, gauged by research theories adopted, there is diversity and quality of management accounting research.

3.2. Management Accounting Research in 1991–1995 and 1996–2000

In this section, the study compares and contrasts the frequency of publication of management accounting research. If the emergence of the specialized journals does affect management accounting research paradigms, or present opportunities for a new paradigm to emerge, we should expect to find some indications of changes in research *Topics*, *Methods*, *Settings* and *Theories* among management accounting articles published over time. To discern this issue, we divide the studied period into two sub-periods, 1991–1995 and 1996–2000, as shown in the last two columns of Table 3. According to the framework developed by Shields (1997), we classified published articles by the attributes of *Topics*, *Methods*, *Settings* and *Theories*.

The null hypothesis indicates that, if the frequency of publication is independent of the categories formed by sub-periods and the attributes of research, there will be an equal proportion of cases in each category, and the expected frequency in category falling into the ith row and jth column can be calculated as

$$E_{ij} = \frac{R_i C_j}{N} \tag{1}$$

where R_i and C_j, are the totals in the ith row and jth column, respectively, and N the total number of all publications in the sample.

To examine whether a significant difference exists between an actual frequency of publication in each category and an expected number of publications based upon the null hypothesis, we employ the following χ^2 statistics:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(A_{ij} - E_{ij})^2}{E_{ij}} \tag{2}$$

where A_{ij} is the actual frequency of publication in category ij, and E_{ij} is the expected frequency of publication in category ij defined in (1).

The statistics in Eq. (2) follow the χ^2 distribution with degrees of freedom d.f. $= (r-1)(c-1)$. If the observed and expected frequencies of the publication in the category are close, the statistics in Eq. (2) will be small. On the other hand, if the divergence is sufficiently large, we can reject the null hypothesis that the frequency of publication is independent of the categories formed by sub-periods and the attributes of research.[6]

Examining the management accounting papers published in the two sub-periods, we find that the numbers of publications in these two periods are very similar. A total of 277 (47.8%) articles appeared in the first five-year period, while 303 (52.2%) articles were published during the second five-year period. This observation appears to indicate that the quantity of management accounting research did not change significantly over these two sub-periods after the establishment of specialized journals.

Using Shields' (1997) classification scheme, Panel A of Table 3 reports the frequency of publication of the two sub-periods by *Topics*. The distributions among research *Topics* in these two periods are also quite similar. For both periods, management control systems (116 articles or 41.9%, and 124 articles or 40.9%, respectively) was the most popular research topic, followed by the management accounting and information systems (42 articles or 15.2%, and 65 articles or 21.5%, respectively). One possible explanation for its popularity of published studies in management accounting information systems may be caused by the rapid developments in information technology in the 1990s. For instance, many Fortune 500 firms had begun to adopt and implement information technology that allows them to integrate management accounting systems within and among organizations. By establishing supply chains, companies also are building up their platform within their management accounting systems so that their suppliers, customers, and banks can effectively and efficiently connect to one another. Such rapid changes in information technology undoubtedly provide fertile grounds for cultivating new management accounting practices, thus create abundant opportunities for academic research. However, the result of χ^2 statistics reveals that the difference between the two sub-periods as to the *Topics* distribution is not significant ($\chi^2 = 10.26$, $p = 0.175$, d.f. = 7).

Panel B of Table 3 also indicates that there were no major changes as to the research *Methods* in management accounting research. In the sub-periods, surveys (58 articles or 20.9%, and 63 articles or 20.8%, respectively), analytic approaches (56 articles or 20.2%, and 44 articles or 14.5%, respectively), and case/field studies (52 articles or 18.8%, and 65 articles or 21.5%, respectively) appear to have been the most popular research methods identified. Based on the reported χ^2 statistics, the difference between the two sub-periods regarding research methods adopted is not significant either ($\chi^2 = 11.88$, $p = 0.157$, d.f. = 8).

However, the result reports that there was a significant shift in research *Settings* (Panel C of Table 3) from the first half to the second half of the 1990s. Although single industry and generic settings continued to dominate managerial accounting research, there was a significant increase in the number of studies conducted in government or not-for-profit organizations in the second half of the 1990s. When the research *Settings* of the papers published in the two sub-periods are compared, the difference is statistically significant ($\chi^2 = 13.41$, $p = 0.037$, d.f. = 6).

Examining the *Theories* applied in the published management accounting studies (Panel D of Table 3), the study finds that *Economics* dominated the first half of the decade (108 articles or 39.0%) and gained additional momentum during the second half (124 articles or 40.9%) of the studied period. Noticeably, *Sociology* and *Strategy Management* received significantly more attention during the second sub-period of 1990s. The other important observation is that journals appear to have been placing more emphasis on whether a researcher provides a theoretical foundation to support his/her article. As the results indicate, there was a significant decrease in the number of papers without theoretical support published during the studied period. The number of published articles in the "no theory" category dropped from 41 (14.8%) to 24 (7.9%) articles. Our conjecture about this evidence is that management accounting researchers may have gradually focused more on theoretical development in order to make their papers more publishable in leading journals. Overall, the difference in terms of *Theories* adopted between the 1991–1995 period and the 1996–2000 period is significant ($\chi^2 = 21.44$, $p = 0.006$, d.f. = 8).

In summary, the results of this study provide some evidence to support Shields' (1997) statements. That is, the emergence of journals specializing in management accounting may have affected the diversity and quality of published research in management accounting. However, there is no indication that quantity of management accounting research increased during the 1990s.

3.3. Non-Specialized Journals Versus Specialized Journals

To explore the effects of management accounting-specialized journals on management accounting research, the study compares and contrasts the articles published in specialized and non-specialized accounting journals. A tally of the number of articles published from 1991 to 2000 by the two types of journals indicates that 212 (36.6%) appeared in non-specialized journals and 368 (63.4%) were printed in specialized journals. Panel A of Table 4

Table 3. 1991–1995 Versus 1996–2000.

	1991–1995			1996–2000		
	N	%	% Dev.	*N*	%	% Dev.
Panel A: Topics: Difference (χ^2) = 10.26, $p = 0.175$, d.f. = 7						
Management control systems	116	41.9	1.2	124	40.9	−1.1
Cost accounting	41	14.8	4.7	41	13.5	−4.3
Cost management	29	10.5	−3.6	34	11.2	3.3
Cost drivers	14	5.1	54.3	5	1.7	−49.6
Management accounting, information, and systems	42	15.2	−17.8	65	21.5	16.3
Research methods and theories	16	5.8	1.5	17	5.6	−1.4
Capital budgeting and investment decisions	11	4.0	−4.0	13	4.3	3.7
Cover more than one topic	8	2.9	39.6	4	1.3	−36.2
Total	277			303		
Panel B: Methods: Difference (χ^2) = 11.88, $p = 0.157$, d.f. = 8						
Analytic	56	20.2	17.3	44	14.5	−15.8
Survey	58	20.9	0.4	63	20.8	−0.3
Archival	22	7.9	−17.7	34	11.2	16.2
Laboratory experimentation	24	8.7	−18.9	38	12.5	17.3
Literature review	27	9.7	4.7	27	8.9	−4.3
Case/Field study	52	18.8	−6.9	65	21.5	6.3
Behavioral simulation	4	1.4	109.4	0	0.0	−100
Normative	23	8.3	4.7	23	7.6	−4.3
Multiple research methods	11	4.0	15.2	9	3.0	−13.9
Total	277			303		
Panel C: Settings: Difference (χ^2) = 13.41, $p = 0.037$, d.f. = 6						
Single industry or activities	108	39.0	11.9	94	31.0	−10.9
Multiple industries or activities	17	6.1	−20.9	28	9.2	19.1
Governmental or not-for-profit organizations	13	4.7	−39.5	32	10.6	36.1
Generic (abstract/stylized/ simplified)	84	30.3	4.1	85	28.1	−3.7
Service industry	13	4.7	23.7	9	3.0	−21.7
Inter-organizational	3	1.1	−30.2	6	2.0	27.6
Other settings	39	14.1	−7.2	49	16.2	6.6
Total	277			303		
Panel D: Theories: Difference (χ^2) = 21.44, $p = 0.006$, d.f. = 8						
Economics	108	39.0	−2.5	124	40.9	2.3
Organizational behavior	27	9.7	10.9	24	7.9	−9.9
Psychology	20	7.2	−0.3	22	7.3	0.3
Production/operations management	23	8.3	23.5	16	5.3	−21.5

Table 3. (*Continued*)

	1991–1995			1996–2000		
	N	%	% Dev.	*N*	%	% Dev.
Sociology	17	6.1	−30.2	34	11.2	27.6
Strategic management	9	3.2	−49.1	28	9.2	44.9
History	9	3.2	10.9	8	2.6	−9.9
Using multiple theories	23	8.3	4.7	23	7.6	−4.3
No theory	41	14.8	32.1	24	7.9	−29.3
Total	277			303		

Note: See Exhibit 1 for the taxonomy of management accounting research by Shields (1997) and its adaptation for this paper. The column of "% Dev." is the percentage deviation from the expectation. It is computed as: $(A_i - E_{ij})/E_{ij}$, where A_{ij} and E_{ij} are the observed and expected frequency of publication in category on the *i*th row and *j*th column. E_{ij} is computed as R_iC_j/N, where R_i and C_j, are the totals in the *i*th row and *j*th column, respectively, and N is the total number of all cases. The chi-square statistics are $\chi^2 = \sum_i\sum_j(A_{ij}-E_{ij})^2/E_{ij}$, where A_{ij} and E_{ij} are defined above.

reports the frequency of publication between these two types of journals by their research *Topics*. From the panel, two observations can be made. Both non-specialized and specialized journals were interested in management control systems studies. However, there are noticeable differences between the two types of journals on the remaining *Topics*. Specialized journals seem to have been more interested in a broader spectrum of research, with a more even distribution among the *Topics* listed in Table 4. Examining the articles published according to the results of χ^2 tests, we find that there is a significant difference between the management accounting-specialized journals and the non-management accounting-specialized journals on research *Topics* ($\chi^2 = 33.05$, $p<0.001$, d.f. = 7).

As we turn our attention to research *Methods*, we find that 58 (27.4%) articles published in non-specialized journals implemented an analytic approach, followed by surveys with 39 (18.4%) articles (Panel B of Table 4). On the other hand, specialized journals published more articles based on case/field studies (91 articles, 24.7%), followed by survey research with 82 (22.3%) articles. In contrast, case/field studies were not as well received by the non-specialized journals. Only 26 (12.3%) articles using case/field studies successfully got into five non-specialized accounting journals. A χ^2 test reveals that the difference between the two groups of journals in frequency of publication by research method is statistically significant ($\chi^2 = 50.21$, $p<0.001$, d.f. = 8).

Contrasting the research *Settings* of the published papers between the two groups of journals (Panel C of Table 4), we find that all eight journals

Table 4. Non-Specialized Versus Specialized Journals.

	Non-Specialized			Specialized		
	N	%	% Dev.	*N*	%	% Dev.
Panel A: Topics: Difference (χ^2) = 33.05, $p<0.001$, d.f. = 7						
Management control systems	116	54.7	32.2	124	33.7	−18.6
Cost accounting	20	9.4	−33.3	62	16.8	19.2
Cost management	22	10.4	−4.5	41	11.1	2.6
Cost drivers	8	3.8	15.2	11	3.0	−8.8
Management accounting, information, and systems	33	15.6	−15.6	74	20.1	9.0
Research methods and theories	8	3.8	−33.7	25	6.8	19.4
Capital budgeting and investment decisions	5	2.4	−43.0	19	5.2	24.8
Cover more than one topic	0	0.0	−100	12	3.3	57.6
Total	212			368		
Panel B: Methods: Difference (χ^2) = 50.21, $p<0.001$, d.f. = 8						
Analytic	58	27.4	58.7	42	11.4	−33.8
Survey	39	18.4	−11.8	82	22.3	6.8
Archival	29	13.7	41.7	27	7.3	−24.0
Laboratory experimentation	28	13.2	23.6	34	9.2	−13.6
Literature review	18	8.5	−8.8	36	9.8	5.1
Case/Field study	26	12.3	−39.2	91	24.7	22.6
Behavioral simulation	1	0.5	−31.6	3	0.8	18.2
Normative	6	2.8	−64.3	40	10.9	37.1
Multiple research methods	7	3.3	−4.2	13	3.5	2.4
Total	212			368		
Panel C: Settings: Difference (χ^2) = 5.37, p = 0.498, d.f. = 6						
Single industry or activities	75	35.4	1.6	127	34.5	−0.9
Multiple industries or activities	15	7.1	−8.8	30	8.2	5.1
Governmental or not-for-profit organizations	18	8.5	9.4	27	7.3	−5.4
Generic (abstract/stylized/simplified)	69	32.5	11.7	100	27.2	−6.7
Service industry	6	2.8	−25.4	16	4.3	14.6
Inter-organizational	4	1.9	21.6	5	1.4	−12.4
Other settings	25	11.8	−22.3	63	17.1	12.8
Total	212			368		
Panel D: Theories: Difference (χ^2) = 57.66, $p<0.001$, d.f. = 8						
Economics	113	53.3	33.3	119	32.3	−19.2
Organizational behavior	18	8.5	−3.4	33	9.0	2.0
Psychology	17	8.0	10.7	25	6.8	−6.2
Production/operations management	8	3.8	−43.9	31	8.4	25.3

Table 4. (*Continued*)

	Non-Specialized			Specialized		
	N	%	% Dev.	*N*	%	% Dev.
Sociology	24	11.3	28.7	27	7.3	−16.6
Strategic management	7	3.3	−48.2	30	8.2	27.8
History	2	0.9	−67.8	15	4.1	39.1
Using multiple theories	19	9.0	13.0	27	7.3	−7.5
No theory	4	1.9	−83.2	61	16.6	47.9
Total	212			368		

Note: Same as in Table 3.

included in this study published more papers conducted in a single industry/activity setting (75 and 127 articles for non-specialized and specialized journals, respectively) than in any other type of research setting, followed by a generic or simplified setting (69 and 100 articles for non-specialized and specialized journals, respectively). In total, 144 (67.9%) and 227 (61.7%) studies conducted in these two types of settings were published in non-management accounting-specialized and management accounting-specialized journals, respectively. Hence, we conclude that management accounting issues studied under these two research settings were warmly welcomed by journal editors. When examining the difference between the two types of included journals in terms of research *Settings*, the difference between the two groups of journals is not statistically significant ($\chi^2 = 5.37$, $p = 0.498$, d.f. $= 6$).

As to the *Theories* employed (Panel D of Table 4), *Economics* is the most dominant discipline in both groups of journals, particularly for non-specialized journals. One hundred and thirteen (53.3%) articles appeared in non-management accounting-specialized journals using *Economics* as their underlying theory, followed by *Sociology* with 24 (11.3%) articles. Similarly, 119 (32.3%) articles published in specialized journals also applied *Economics* when conducting their studies. Among all articles, 61 (16.6%) articles published as specialized journals did not draw on any theory at all, which is a much higher percentage than we find in the non-specialized journals (4 articles, 1.9%). Overall, the difference between specialized and non-specialized journal groups in terms of the *Theories* adopted is statistically significant ($\chi^2 = 57.66$, $p < 0.001$, d.f. $= 8$).

In summary, the overall results of the comparison made between specialized and non-specialized journals indicate that the management accounting-specialized journals, namely, *AIMA, JMAR*, and *MAR*, have become important venues for quality management accounting research. The results support that these journals do enhance certain dimensions of the diversity, such as research *Topics* and *Methods*. Such observations are consistent with the statement made by Professor Epstein (1992) in the inauguration issue of *AIMA*. That is, the establishment of specialized journals in management accounting will include papers in any area, accept research using various research methods, and examine management accounting issues by adopting a boarder spectrum of theories.

3.4. The North American Versus the International Journals

Of the 580 management accounting papers published during the period of this study, 305 (52.6%) appeared in the North American journals and 275 (47.4%) in the international journals. Referring to Panel A of Table 5, we compare the frequency of publication of the North American and the international journals as to the research *Topics*. Journals in both groups appear to have been in favor of publishing papers addressing management control systems issues. In the 1990s, a total of 143 (46.9%) and 97 (35.3%) articles investigating issues in this area were published in the North American and the international journals, respectively. However, the two groups of journals appear to have had divergent interests on the second most popular research topic. The North American journals seem to have been more interested in traditional cost accounting topics, which could reflect the calls made by Kaplan (1983, 1984). On the other hand, the international journals may have been more receptive to newly evolving issues, such as management accounting information systems. A χ^2 test reveals that the difference in the frequency of publication of the two groups of journals as to research *Topics* is significantly different ($\chi^2 = 58.66$, $p<0.001$, d.f. $= 7$).

Referring to Panel B of Table 5, we find that 80 (26.2%) articles published in North American journals examining management accounting issues use an analytic approach. However, only 20 (7.3%) of the articles that appeared in the international journals employed this research method. In comparison, more articles accepted into the international journals used a survey approach (80 articles, 29.1%), followed by case/field studies (77 articles, 28.0%). Statistical results based on a χ^2 test reveal that the difference between the two groups of journals regarding research *Methods* employed is significantly different at a one percent level ($\chi^2 = 95.32$, $p<0.001$, d.f. $= 8$).

Contrasting the research *Settings* of published papers in the two groups of journals, the results show that more management accounting research was conducted in a single industry/activity setting or in a generic setting. Referring to Panel C of Table 5, both North American and international journals published more papers conducted in a single-industry setting than in any other *Setting* identified by Shields (1997). During the 1990s, the North American journals published 97 (31.8%) research studies conducted in this type of setting, while the international journals published 105 (38.2%) under the same setting. Moreover, during the same time span, a generic setting was also welcomed by journal editors in both groups, with 118 (38.7%) and 51 (18.5%) articles published in the North American and the international journals, respectively. However, the relative frequency in the international journals is 36.4% lower than the expected frequency. On the other hand, the international journals focused more on research based on government or not-for-profit organizations and international settings. Overall, the difference between the frequency of publication of the two groups of journals as to *Settings* is statistically significant ($\chi^2 = 46.70$, $p < 0.001$, d.f. $= 6$).

Regarding the underlying *Theories* applied in examining management accounting issues (Panel D of Table 5), *Economics* was the most dominant discipline in both groups of journals, particularly for those published in the North America. A total of 154 (50.5%) *Economics*-based articles appeared in five mainstream accounting journals in the North America. To a lesser extent, *Economics* was used to support papers published in the international journals. Researchers of 78 (28.4%) articles published in two international journals employed *Economics* theories to conduct their investigations. It is also noteworthy that articles accepted in *AOS* and *MAR* used a broader array of theories, including *Sociology*, *Strategic Management*, and *Organizational Behavior*. However, this observation cannot be made for the North American journals. Comparing the *Theories* used in articles in the two groups of journals, the overall difference between the published papers is statistically significant ($\chi^2 = 73.83$, $p < 0.001$, d.f. $= 8$).

In summary, the results show that there are significant divergences between management accounting research published in North American and international journals, in all categories: *Topics, Methods, Settings* and *Theories*. Although it is difficult to discern the underlying reasons for such differences, we offer the following ex post explanations to these observations. One is that these divergences may have been driven by the preferences made by the authors based on their doctoral education and research interests. For instance, those who chose to publish in international journals might be expected to have a more *Sociology*-based training, while those who chose to submit papers to North American journals could be better trained

Table 5. North American Journals Versus International Journals.

	North American			International		
	N	%	% Dev.	*N*	%	% Dev.
Panel A: Topics: Difference (χ^2) = 58.66, $p<0.001$, d.f. = 7						
Management control systems	143	46.9	13.3	97	35.3	−14.8
Cost accounting	49	16.1	13.6	33	12.0	−15.1
Cost management	38	12.5	14.7	25	9.1	−16.3
Cost drivers	16	5.2	60.1	3	1.1	−66.7
Management accounting, information, and systems	26	8.5	−53.8	81	29.5	59.7
Research methods and theories	15	4.9	−13.6	18	6.5	15.0
Capital budgeting and investment decisions	8	2.6	−36.6	16	5.8	40.6
Cover more than one topic	10	3.3	58.5	2	0.7	−64.8
Total	305			275		
Panel B: Methods: Difference (χ^2) = 95.32, $p<0.001$, d.f. = 8						
Analytic	80	26.2	52.1	20	7.3	−57.8
Survey	41	13.4	−35.6	80	29.1	39.4
Archival	42	13.8	42.6	14	5.1	−47.3
Laboratory experimentation	44	14.4	35.0	18	6.5	−38.8
Literature review	26	8.5	−8.4	28	10.2	9.4
Case/Field study	40	13.1	−35.0	77	28.0	38.8
Behavioral simulation	4	1.3	90.2	0	0.0	−100
Normative	15	4.9	−38.0	31	11.3	42.1
Multiple research methods	13	4.3	23.6	7	2.5	−26.2
Total	305			275		
Panel C: Settings: Difference (χ^2) = 46.70, $p<0.001$, d.f. = 6						
Single industry or activities	97	31.8	−8.7	105	38.2	9.6
Multiple industries or activities	31	10.2	31.0	14	5.1	−34.4
Governmental or not-for-profit organizations	16	5.2	−32.4	29	10.5	35.9
Generic (abstract/stylized/ simplified)	118	38.7	32.8	51	18.5	−36.4
Service industry	9	3.0	−22.2	13	4.7	24.6
Inter-organizational	5	1.6	5.6	4	1.5	−6.3
Other settings	29	9.5	−37.3	59	21.5	41.4
Total	305			275		
Panel D: Theories: Difference (χ^2) = 73.83, $p<0.001$, d.f. = 8						
Economics	154	50.5	26.2	78	28.4	−29.1
Organizational behavior	24	7.9	−10.5	27	9.8	11.7
Psychology	23	7.5	4.1	19	6.9	−4.6
Production/Operations management	25	8.2	21.9	14	5.1	−24.3

Table 5. (*Continued*)

	North American			International		
	N	%	% Dev.	*N*	%	% Dev.
Sociology	7	2.3	−73.9	44	16.0	82.0
Strategic management	10	3.3	−48.6	27	9.8	53.9
History	3	1.0	−66.4	14	5.1	73.7
Using multiple theories	19	6.2	−21.5	27	9.8	23.8
No theory	40	13.1	17.0	25	9.1	−18.9
Total	305			275		

Note: Same as in Table 3.

in *Economics*. The other possible explanation for these observations may be driven by the editorial focus implicitly or explicitly stated in the journals. Consistent with the editorial polices and their strategies, the editors of *AOS* and *MAR* have appeared to be more flexible than the editors of the North American journals regarding types of management accounting research published.

4. CONCLUSIONS AND DISCUSSIONS

The purpose of this study is to investigate whether the establishment of management accounting specialized journals (*AIMA, JMAR*, and *MAR*) has affected management accounting research paradigms and to examine whether these journals enhance the diversity and quality of management accounting research. Moreover, the study examines whether the editorial foci of the journals (North American versus international) differentiate the types of articles published during the 1990s. Applying Shields' (1997) classification schemes (by *Topics*, *Methods*, *Settings* and *Theories*) to each published management accounting research article, we compare and contrast the frequency of publication between (1) the first half and the second half of the 1990s, (2) management accounting-specialized and non-management accounting-specialized accounting journals, and (3) leading journals focused on North American versus those with an international focus.

Several research findings can be drawn based on the results of this study. First, the study indicates that the overall percentage of management accounting research published in non-management accounting specialized journals (*TAR*, *JAR*, *JAE*, *CAR*, and *AOS*) did not change significantly from 1991 to 2000. Using Shields' (1997) classification schemes (*Topics*, *Methods*, *Settings* and *Theories*), the study reveals that there are significant differences between the 1991–1995 period and the 1996–2000 period in research *Settings* and *Theories*. However, the research *Topics* and *Methods* remained the same during the studied periods. These overall results seem to point out that new areas/territories in management accounting are evolving slowly, and that researchers appear to be conservative in applying research methodologies to their research questions. The results of the study also indicate that management accounting researchers have become more focused on using established *Theories* to build their studies. This empirical evidence is encouraging, since several leading scholars have expressed concerns over the evolution of management accounting research, and argue for a strong theoretical framework to support management accounting research (e.g., Zimmerman, 2001).

Second, by comparing and contrasting articles published in management accounting-specialized journals and non-management accounting-specialized journals, the study found that there are significant differences between the two types of journals in three of the four classification schemes, except research *Settings*. In general, the journals aimed specifically at management accounting appear to have had broader interests in research *Topics*, to have been more flexible with regard to research *Methods* and to have been more open-minded about *Theories* than the non-management accounting-specialized journals. The results may suggest that management accounting-specialized journals have responded to the calls of several renowned accounting scholars and that management accounting research should be revitalized by exploring new topics (Kaplan, 1983, 1984 for activities-based costing), by applying new research methods (Hopwood, 1983; Kaplan, 1986 in favor of field study), and by experimenting with new theories and research paradigms (Zimmerman, 2001 for *Economics*; Simons, 1990 for *Strategic Management*).

Finally, when comparing the management accounting research published in the North American versus the international journals, the study indicates that there are significant divergences in all classification schemes (*Topics*, *Methods*, *Settings*, and *Theories*) based on Shields (1997). Such observations are insightful, because they could indicate that the journals with an international focus are more flexible when publishing various types of management accounting research. Knowing that their efforts could yield publishable papers in international journals, researchers may have become more willing to take risks by exploring new issues in management accounting. Therefore, it may be desirable for the editors of North American journals to take a similar role, to those of the international journals, who were supportive of researchers' explorations of new research directions and methods.

As stated in the Mensah, Hwang, and Wu (2004) study, such an endeavor could lift management accounting research to a higher plane and enhance the probability of major breakthroughs in management accounting research.

NOTES

1. Results of management accounting research are not included in the scope of this study.
2. Different from Shields' (1997) study, our focus is journals instead of authors.
3. As its masthead indicates, *AOS* is an international journal supported by its editorial board and authors' institutions. Similarly, the editors and publisher have been explicit about trying to make *MAR* a more international journal in terms of articles and subscriptions, thus it warrants classifying *MAR* as an international journal, which is consistent with CIMA's globalization strategy.
4. Examining the extant management accounting literature, Shields (1997) provides the most comprehensive research framework to address the research questions in this study. Such a framework was also adopted for the Mensah, Hwang, and Wu (2004) study.
5. For detailed discussions of major changes in management accounting after the 1980s, refer to Birnberg (1999).
6. See Siegel and Castellan (1988).

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DECISION OUTCOMES UNDER ACTIVITY-BASED COSTING: PRESENTATION AND DECISION COMMITMENT INTERACTIONS

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ABSTRACT

Activity-based costing (ABC) is presented in accounting textbooks as a costing system that can be used to make valuable managerial decisions. Little experimental or empirical evidence, however, has demonstrated the benefits of ABC under controlled conditions. Similarly, although case studies and business surveys often comment on business environments that appear to favor ABC methods, experimental studies of actual behavioral issues affecting ABCs usage are limited.

This study used an interactive computer simulation, under controlled, laboratory conditions, to test the decision usefulness of ABC information. The effects of presentation format (theory of cognitive fit and decision framing), decision commitment (cognitive dissonance), and their interactions were also examined. ABC information yielded better profitability decisions, requiring no additional decision time. Graphic presentations required less decision time, however, presentation formats did not significantly affect decision quality (simulation profits). Decision commitment beneficially affected profitability decisions, requiring no additional

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time. Decision commitment was especially influential (helpful) in non-ABC decision environments.

1. INTRODUCTION

Activity-based costing (ABC) methods enjoy popular acceptance in both academic and business environments.[1] While it is clear that ABC methods add precision to indirect cost assignment, the value of indirect cost assignments, precise or not, is questioned by some (Goldratt, 1984, 1994, 1999; Johnson, 1992; Cooper, Kaplan, Maisel, Morrissey, & Oehm, 1992; Anderson, 1995; Hiromoto, 1988). This issue was underscored at the 2004 IMA national conference in Chicago, which featured, during the "Battle of the Cost Accountants" session, a spirited debate centering on just how valuable ABC really is. Yet, ABCs popularity in the classroom and in practice remains well established. The presumption of ABC effectiveness lies in the rational position that better cost information leads to better decisions. While it can be demonstrated that ABC provides more accurate cost information, rationality aside, the extension of this position to the notion that better cost information yields better strategic decisions lacks empirical support.

Drake, Haka, and Ravenscroft (1999) found in an experiment using MBA students that behavioral influences on the use of ABC information had greater effects on (experimental) firm profits than the information content itself. The issue of information receptiveness and information processing, human cognition, underlies the decision usefulness of any analytic tool such as ABC. Receptiveness factors can amplify or impede decision processes, often strongly affecting decision-making outcomes. As Drake et al. (1999) demonstrated, behavioral factors may at times be more consequential than the information content itself.

Our study also looked beyond the "ABC, does it work?" question. We started with the simple, objective, ABC usefulness question, and then included the effects of two related cognition factors, presentation format and decision commitment. We built an interactive business simulation, as a platform, to measure the effects of ABC information and our two behavioral factors on decision quality (simulation profits) and decision efficiency (time). Our three conditions (ABC information, presentation format, and decision commitment) were tested using 48 accounting majors in their junior and senior years at a research university. A mixed-factor ANOVA using repeated measures for two of the three factors was used. All experimental conditions were completely counterbalanced.

Findings supported the notion that ABC information could be very relevant to successful decision strategies, as, under our experimental conditions, ABC information very significantly out-performed traditional, single-driver, traditional cost (TC) information. Importantly, the more detailed ABC information did not require more (or less) time to analyze. Graphic presentations did take more time for participants to analyze, however, results (profits) were not affected by presentation mode. Decision commitment, interestingly, improved decision profits in the non-ABC environment, but was not significant in the ABC interaction. Across all factors, decision commitment was significant, as a single factor, for the profitability response variable, while decision time again was not significant either in the single or mixed factor results.

That ABC information improved profits without requiring additional decision time is comforting to those favoring ABC, especially as it might have been argued that the better profits were attributable to more decision time had that been the case. Similarly, the presentation results complemented each other well. The fact that graphic presentations required more decision time, but yielded the same profits, supports the decision efficiency advantage of numeric formats in our setting. Had the graphs outperformed the numeric formats in profits realized, it would have obviated the efficiency (time) advantage of the numeric formats, as one would then have to give subjective weighting to the value of better decisions (higher profits) vs. faster ones. This did not occur; presentation affected decision time, without interference on performance. Of course, had either ABC or numeric presentation outperformed their counterparts in both profits and time, the conclusions would be simpler and more compelling. As it is the results are complimentary and consistent.

Our work on the effects of decision commitment built on cognitive dissonance decision research (cognitive dissonance impedes effective decision processes), including the effects of commitment, confirmation, and feedback on the usefulness of cost systems, and resistance to systems changes (Jermias, 2001; Brockner, 1992; Whyte, 1986; Straw, 1976). Decision-commitment favorably affected simulation profits overall, however, most revealing was that decision commitment most powerfully affected profits in the TC, and not the ABC environment. By its nature TC cost feedback was often inconclusive, perhaps misleading, causing frustration, and breaking down efficient problem solving decision approaches.

Strengthened commitment, apparently reduced frustration over the TC information disconnects; cognitive dissonance was less engaged. Those less committed endured more dissonance, frustration: their performed suffered.

ABC feedback was logically consistent; commitment had less effect on the cognitive process. In practice this underscores the paradoxical situations where business management may be more resistant to change and innovation in less favorable decision environments, such as direct labor overhead costing allocation systems, than in more productive costing systems such as ABC. Management, organizational, and accounting research frequently report studies showing organizational resistance to change, with its detrimental consequences. Accordingly our results indicate another potential ABC advantage: that information accuracy (ABC) may lead users to be more open to innovative approaches, less unproductively committed to futile strategies, and to be more open to dynamism in the workplace.

To operationalize our research objectives, ABC information and presentation factors were simply built into our study as the straight-forward and objective, dichotomous factors that they are: (1) cost information was calculated and presented as either ABC or traditional, single-driver data, and (2) the information was presented in either graph or numeric, table format.[2] A workable proxy for decision commitment, arguably a more complicated, subjectively measured factor, was achieved by using performance incentives that rewarded commitment to decision strategies. The experimental set-up moved through three levels of decision factor influences, from concrete to the abstract: first the face value of the information alone (ABC & TC), second, presentation format (spatial & symbolic) and third, decision commitment.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Information Content, Cognitive Fit, and Presentation

Although empirical support for the value of ABC information was a motivation for this study, the issues of ABC decision relevancy, information delivery, and effects on information processing are the more challenging, and perhaps interesting issues supporting our study. Our first objective remained, however, to establish that (at least within the confines of our experimental conditions) ABC had significant value, as measured by firm profits. We then interjected two behavioral decision making factors, presentation and decision commitment, both of which had been studied independently in decision theory. The interacting effects of all the combined factors completed the study. We added a second, important and related response variable to all phases of the study, decision efficiency [time]. Decision time, together with our first response variable [decision outcome/accuracy] define the real-world, practical value of decisions in most circumstances: effectiveness [accuracy] and efficiency [time].

The theory of cognitive fit holds that the mental representation appropriate to problem solution is a key aspect to solution accuracy and efficiency (Vessey, 1991, 1994). Decision outcome is influenced not only by information content (in our case, ABC and TC) but also by presentation mode: the manner in which information is delivered for cognitive processes. Presentation influences the palatability of the information, which in turn governs its efficient use. Information that is relevant to problem solution and is cognitively compatible satisfies the necessary initial steps of efficient mental processing (Vessey, 1991, 1994). This process is known as decision framing. Relevant information, suitably presented, contributes to effective decision framing. Detraction from either the relevance of information or its cognitive-friendliness negatively impacts the decision making process and the decision outcome suffers.

This line of research on cognitive decision processes, and specifically on the presentation effects on accounting information, gained in popularity and importance with the emergence of computing technologies in the 1970s (Simon, 1975, 1981; Libby, 1981; Ashton, Kleinmuntz, Sullivan, & Tomassini, 1988; Remus, 1984; Perrig & Kintsch, 1985; Kleinmuntz & Schkade, 1993; DeSanctis, 1984; Jarvenpaa, 1989; DeSanctis & Jarvenpaa, 1989; Davis, 1989; Anderson & Reckers, 1992; MacKay & Villarreal, 1987; Vessey, 1991, 1994; Benbasat & Dexter, 1985, 1986). The importance of this area continues with widespread Internet usage, network data-availability, database accessibility, and the increasing importance of visual imagery in practically all forms of communications. Research largely centered on the question of whether accounting information is best communicated in spatial or symbolic format. Spatial means pictures and analog processing; symbolic is the more traditional numeric accounting tabular presentations. Financial statements and other accounting information are traditionally presented in symbolic, numeric formats. The user "reads" the information, as opposed to spatial-type modes where the user is presented images and processes the information in a more conceptual or abstract process. Much accounting, and certainly economics information, however, seems particularly well suited to graphic, spatial presentation. Internet presentations certainly favor the more visual, graphic mode; our seemingly insatiable need for larger and faster computers is chiefly fed by computer visuals and imagery (certainly not text).

Research showed that the seemingly simplistic question examining graphs vs. tables, disguised the underlying complexity of human information processing, and cognition issues. In short, although much study had been completed through the 1980s, conclusions were not definitive. In some ways it seemed little progress has occurred since Washburne observed in 1927 that users were more accurate in identifying specific values from tables but identified data trends better from graphs.

In 1991, Vessey provided pivotal insight in a paper that used a theory of cognitive fit to bridge the gap between previous, seemingly conflicting graphic/tabular research. Her work achieved pointed to some consistency in explaining the previously seemingly conflicting results. Vessey categorized the tasks in prior presentation studies as being either spatial, symbolic, or both and used cognitive fit to explain how this spatial/symbolic categorization more consistently explained the results of other research.

Her approach held for simple information acquisition and evaluative tasks but not for more complex analytic ones. "In effect, these studies represent decision-making tasks that are too complex to be addressed by the paradigm of cognitive fit." (Vessey, 1991, p. 232) Complexity became confound beyond the limits of her spatial/symbolic cognitive fit theory. She defined complexity as tasks that involved a sequence of subtask decision strategies. They were not amenable to simplistic cognitive fit categorization, or to simplistic presentation fits.

Vessey's theory described task-oriented cognitive fit as the matching of problem representation with appropriate problem solving processing, as shown in Fig. 1. Different tasks are matched better with different mental representations. Cognitive fit affects task performance, which may explain graph vs. table performance. Vessey viewed the mental representation process as symbolizing the way working memory processes data to arrive at solutions. According to her model the characteristics of both the problem and the task reach optimal solutions when these characteristics are

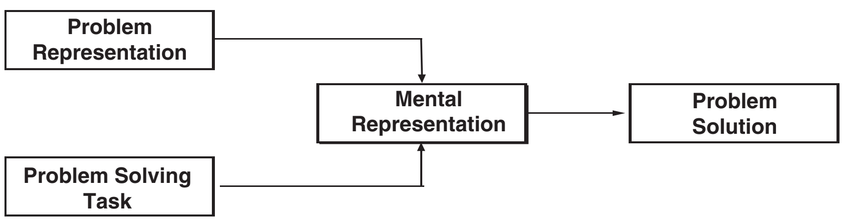

Fig. 1. Vessey's Cognitive Fit Model

harmonized initially. Thus efficiency is achieved when the format of problem representation matches the process required to solve the task. If the representation and the task are not coordinated, translation of the problem representation is first required before processing can occur. This extra step confounds the representation and cognitive processes; distortion and inefficiencies result. Optimal mental representation results when data presentation and task merge without further mental processing.

Vessey borrowed from the psychology literature to categorize data into two fields: images and words. Data exist in working memory as either images or words according to this line of thought. Graphs are images that convey spatial information. Tables are verbal and convey symbolic information. She speculates that spatial representation facilitates "viewing" the overall message/image of graphic information. Graphic presentation provides the best link to human perceptual or basic sensory type processing. Conversely, if identification of discrete data points is necessary for problem solution for simple analytical tasks, then symbolic presentation facilitates solution. So another important delineation of cognitive processing differences is whether they involve perceptual/sensory processing or analytic processing.

Dull and Tegarden (1999) extended the basic graph and table presentations to three-dimensional representations. "It is reasonable to conclude that if one's experiences are from a three-dimensional world, representations on which he or she might make decisions may be understood better in that format." (Dull & Tegarden, 1999). Vessey's cognitive fit explanation seems to coincide well with Dull's observation. Task orientation is probably manifested beyond simply spatial or symbolic representations; it presumably would be sensitive to representation. Dull and Tegarden (1999) found that the most realistic presentation formats (three-dimensional rotatable figures) resulted in greater trend prediction accuracy in a controlled experiment they performed. Cooper (1990) theorized that individuals might unconsciously translate two-dimensional representations into more realistic three-dimensional mental images. If so, this translation involves yet another stage in cognitive processing, and necessarily complicates the process. Thus spatial presentation, especially at the usual two-dimensional level, may itself add a level of complexity (translation to a three-dimensional mental representation) that independently adds to the overall complexity of the problem itself. Presentation format, mental representation, and cognitive processing are all closely related to the first factor of our research (ABC information content) as both presentation and complexity respond to decision commitment and, we theorize, to each other.

2.2. Decision Commitment and Cognitive Dissonance

Directly related to cognitive fit and decision-making processes are issues of cognitive dissonance, decision commitment, and resistance to change. The theory of cognitive dissonance, pioneered by Festinger (1957) posited that conflicting information conflicts with natural human tendencies to seek consistent behavior within them. Inconsistency in decision processes results in a stressful, uncomfortable state, which impedes effective decision-making. Decision commitment is a natural behavioral strategy that influences people to resist change, find comfort in previously accepted decision frameworks, and negatively bias conflicting information. Kahneman and Tversky (1984) showed that people selectively use information in decision making, by tending to select information that conforms to their initial mental representations. Brown, Peecher, and Solomon (1999) Kennedy, Kleinmuntz, and Peecher (1997) have researched this effect with auditors, noting that auditors are confirmation prone, tending to accept information friendly to their positions, and are overly critical of un-supporting data. Haynes et al. (1998) found similar biases, in a specific controlled study of client advocacy. Auditors, in these instances, follow the common human trait of "self-justification." Self-justified commitment reduces decision stress, is safe, comfortable and supports less dissonance. While commitment may lead to resisting pertinent new information, the trade-off between less stressful decision processes and the value of new information may make decision commitment a valuable attribute under some circumstances.

Vessey (1991, 1994) reminds us that cognitive fit is most influential as fit is reinforced; commitment reinforces and strengthens fit. We hypothesized that in our somewhat simplistic, experimental setting, free of the complexities of the workplace or the audit environment, decision makers with higher levels of commitment would exhibit less dissonance in their decision-making, and would perform better overall. Similar to our motivation in studying not only the simple information content effects, but also presentation effects on decision optimality, we were interested in the interacting effect of information content and decision commitment. Again, simplistically decision commitment would seem to reduce cognitive dissonance, improving decision performance. We were interested in how decision commitments might influence performance as the complexity of the decision environment increased.

In some contexts decision commitment is detrimental. Straw (1976) showed that not only would commitment bias decision positions, but that people will tend to escalate their commitment to failing courses of action.

Accounting literature refers to this as the sunk cost trap, which is a major element of popular variable cost decision strategies as taught in most managerial accounting courses. Greenwald, Leippe, Pratkanis, and Baumgardner (1986) refers to a classic study where people are three times more likely to properly identify blurred images given one slightly blurred picture than when people are allowed to view the picture continuously from a very blurred state to the slightly blurred state. Curiously, those given the additional information were much less likely to make correct identifications. The reason is that the additional information was used prematurely, and, importantly, resulted in a committed position. The premature decision, based on poor data, represented a mind-set, a commitment, which then interfered with subsequent effective interpretation of more precise information, and that such a mental commitment may have stronger effects in decision cost strategies, which is an interactive response we wanted to examine in our study.

Decision commitment effects are complicated and can be contradictory. As noted, commitment can reduce cognitive dissonance, leading to positive decision outcomes, contributing to valuable decision-making as we hypothesized in our general, one-effect rule. Commitment may stifle creativity, but creativity does not always lead to the best or most efficient or timely decision-making. Conversely commitment to a poor strategy impedes qualitative analysis and innovative thought, at times presenting persistent barriers to necessary change, which, as Straw (1976) and the audit studies noted, can detrimentally escalate the resistance for necessary change. A delicate and complex balance exists between the efficiency advantages of decision commitment, and the need for diligence and dynamism often countered by decision commitment.

We hypothesized that decision commitment would provide more decision value in the less reliable traditional-costing (TC) information than with ABCs better information. Non-ABC, TC information, is presented as direct labor dollar cost allocations, as is common in single cost driver industrial applications. TC, single-driver information is often misleading and includes more distractions and noise. Decision strategies are more difficult to reliably formulate, the process is more stressful, cognitively dissonant, and uncomfortable. We believed TC information would impede the cognitive fit process. Hence, decision commitment should have a stronger benefit (avoidance of dissonance, decision stress, and frustration) in the TC environment. Commitment will be most influential in the presence of the assumed weaker, less precise TC information. Given that the TC information contains much noise and is often misleading commitment should have a positive influence in this environment, with the positive effect on decision tranquility offsetting the possible benefits from innovative thought, which would not be of much help in the misleading TC situation.

Put another way, decision strategies in static decision environments that use consistent approaches (commitment), will benefit as the incongruence of the task and information increases. The more chaotic TC information is more incongruent, lending itself to overall positive commitment effects. TC decision feedback is somewhat "off-target," less easily interpreted into solution possibilities. In such situations decision commitment incentives that reinforce commitment influences should be effective for both ABC and TC, but decidedly more helpful in TC. This supports the findings noted above that auditors tend to favor information that self-justifies their (committed) positions, biased perceptions of new information results in less decision stress (dissonance). With ABC, cost information is more interpretable, its merits outweigh commitment's dissonance-reducing value.

The "less is more" paradox fits well with the theory of information overload as well (Vessey, 1994). Decision commitment can reduce apparent decision complexity and streamline decisions. That is, the level of potential complexity-induced decision confounding may vary, depending on the strength of commitment. Higher levels of decision commitment may improve the mental representation process, by filtering out the noise that decision complexity adds. Information noise is higher in the TC environment. The relative influence and value of commitment may change depending on the dynamic influences of other factors. These relationships underscore the importance of studying not just the main factor effects, but their interacting effects, which we predicted would be stronger in the TC environment.

2.3. Hypotheses Development

The research question that fundamentally motivates our research is simple: does ABC work? Firm profits and decision efficiency are the response variables. In addition to the ABC question, presentation and decision commitment are as compelling, more complicated, and perhaps more interesting additional independent factors. We use six hypotheses to test the main effects and two-way interactions for each of the two response variables.[3] To simplify the discussion of hypotheses, and because the response variables are strongly related in terms of decision value, the six hypotheses for each response variable (profits and time) are presented as one set of six (rather than 12) hypotheses.

The following three main effect hypotheses are straightforward, requiring no further discussion:

H#1. ABC information provides better information for decision-making than TC methods.

H#2. The format of information presentation, graphic (spatial) or tabular (symbolic), will have an effect on decision-making.

H#3. Decision commitment will have a positive effect on decision-making.

The following three interacting hypotheses are more complicated; they are followed by additional supporting discussions:

H#4. Presentation format will affect information processing differently depending on the congruence of the information with the problem solution (ABC vs. TC).

Problem solving is task oriented. Problem solving may be facilitated by presentation in either spatial or symbolic format. ABC information is more relevant to the problem solution, but it can be more complex than TC information. This additional information may or may not be processed more effectively through spatial or symbolic representation. Since the ABC information is more accurate, it should permit a more straightforward strategic analysis. TC information contains noise that tends to confound internal analysis. The TC clouding of information interrupts efficient mental representation and cognitive fit suffers. The interaction of content and presentation should show different responses as each is varied with the other. "Cognitive cost" should manifest differently between these two factors.

ABC information may present the most clear decision mental representation in the simplest of presentation modes (numeric), but numeric presentation may be less valuable for interpreting trends. The effect on TC information may be directionally similar, but of greater magnitude as the presentation mode changes. This is consistent with Vessey's (1991, 1994) mental representation, decision framing, and cognitive fit theories, Benbasat and Dexter's (1985) information overload theory, Davis' (1989) cognitive efficiency theory and Jarvenpaa's (1989) cognitive cost theories.

H#5. Decision commitment will have a more positive effect on TC decision-making than on ABC decision-making.

The decision problems presented are static. Effective solution requires comprehension of cues provided by the ABC or TC information after repeated trials. Decision commitment should be more helpful in deciphering the less accurate TC information than it will for the ABC information. Subjects are likely to be more prone to inconsistent, cognitively dissonant behavior using the confusing, less-reliable TC data. Decision commitment should be of the most benefit in this cluttered environment. The static, repetitive nature of the decision environment encourages the discipline that decision commitment adds to the analytic process, most positively where information cues are more frustrating.

Decision commitment should aid in providing a level of reference or consistency to help in analyzing the less relevant and less accurate TC feedback. The more relevant and accurate ABC information is not expected to benefit as much from commitment, following the reliably consistent ABC information is not a confounding experience. While commitment may be beneficial to both ABC and TC, it should be significantly more helpful to TC. The "cleaner" cognitive fit provided by ABC information is expected to be less affected by the positive influence of commitment.

H#6. Presentation format will affect performance differently depending on the strength of decision commitment present.

Spatially oriented subjects may be helped more through the positive effects of decision commitment because of the complexity of the graphic visualizations, than subjects for whom complex visualizations are more challenging to process. Presumably decision commitment will have a greater magnitude in effect for the mental representations afforded by visual graphics vs. numeric listings. The effects on performance in this static, analytic problem of repeated trials should be greater for one visualization than another.

3. METHOD

3.1. Experimental Design

The hypotheses were tested using a $2 \times 2 \times 2$ mixed-factor experimental design structured for ANOVA.[4] The underlying experimental condition of the study, ABC information, was between-subjects. The other two conditions, presentation and commitment, were within-subjects. The mixed-factor design divided the 48 participants into two groups, ABC and TC information only. Within each group participants repeated the experiment four times, representing the four possible combinations of the two crossed conditions (presentation and commitment). Crossed conditions were completely counterbalanced.

We developed a computerized, interactive business simulation that incorporated our three experimental conditions of interest. The simulation was a model of a profit-oriented business in which the participants' objective was to maximize profits. Participants made product volume decisions to maximize profits. They were offered incentives to maximize their game performances relative to other players. (Real money, with an expected value of $25 per player and extra course credit.)

The game was completely automated and player-interactive. Other than brief introductory greetings by the experimenter, players interacted one-on-one with the computer game, including game instructions. Computers were located in small individual cubicles in a behavioral lab. The computer automatically dispersed game instructions, collected demographic data, started each game at the players' prompting, ran the games, recorded detailed results of each game, and exited the program at the end of the games. The game utilized Microsoft Excel as a computing platform, using Excel's Visual Basic programming capability to automate the process, and to change the computer screen from the standard Excel format, to an attractive, colorful video game. Player choices and game play was completely controlled by the computer.

Players were accounting major volunteers that had completed their first two accounting principle courses, and two introductory computer courses required of accounting majors. Completion of the four simulation games plus an abbreviated preliminary practice game took the players about 2 h. The combination of the high potential player rewards ($100), the competitiveness of the situation, and the attractive computerization and video game atmosphere made the game interesting to the participants. At the completion of the experimental session, players were given two, 2 min spatial ability tests.

3.2. Decision Task, Game Mechanics, and Computerization

Players were told they were in the baseball equipment business. They had four baseball products (bats, balls, gloves, and pitching machines) for which they set production levels, which could vary from zero to large numbers of units. Demand was infinite and prices were fixed, eliminating the complexity of interpreting demand effects: cost analysis was the objective. Costs were governed by eight production functions, six of which were overhead. Half of the overhead functions were complex, non-linear functions, which were further complicated by volume interrelationships; production of one product affected the costs of other products. The cost structure of the game mimicked real business to the extent practical.

3.3. Operationalization of Experimental Conditions

Factor one, availability of ABC information was operationalized as a dichotomous variable where ABC information was either available or not. For ABC participants the cost information was displayed in eight lines of information: material, direct labor, and six overhead costs. The non-ABC, TC players got three lines of cost information: material, direct labor, and one overhead cost line. The ABC costs were assigned based on cost pool activities. TC costs were assigned on a direct labor dollar basis. Total overhead cost for all production combined was identical regardless of ABC/TC cost assignment. Cost assignment among the four products were, however, not identical. ABC assignments were more accurate. Regardless of cost assignment, total business costs and profitability were identical given identical production input decisions.

Factor two, presentation of cost and profitability information, was a within-subjects variable. Summary financials were given numerically regardless of the presentation condition, but the detailed product cost and profitability information (ABC or TC) was given either in graphic or tabular format. The graphs were simple bar charts.

Factor three, commitment, was also within-subjects. Commitment was injected into two of the four games that participants played. The operational design of the commitment condition was simple: two games included commitment and two did not. While graphs and ABC information were simple categorical conditions that were easily operationalized, the introduction of commitment was more complex. To establish decision commitment additional monetary incentives were used as a means to force a "decision commitment effect." Players assigned to this commitment condition were told that if their verbalized (written, for added reinforcement) strategy was correct, and they stayed with it, they would receive an additional $25 bonus for that game. The interactive game also informed them that if they met these conditions it would probably turn out that they had the best results in their group of eight so they would win the $100 top prize as well. The players that were not assigned the commitment condition were told to verbalize their strategy as well but were offered no additional monetary incentive.

Wicklund and Brehm (1976) and Church (1990) concluded that decision commitment is stronger when people verbally commit to a position and when they choose that position themselves. Accordingly players were instructed to input their decision strategies about halfway through each game. The bonus serves to intensify the commitment effect and thereby differentiate the commitment group.

4. RESULTS

4.1. Overall Findings

The ABC condition and the decision commitment condition influenced profits significantly. The ABC factor had a *p*-value of 0.002, which supports the basic premise of the research that ABC provides relevant decision-making information (Hypothesis #1). Profitability response variable results were also significant for the commitment condition (Hypothesis #3) and the ABC/commitment interaction (Hypothesis #5). The presentation condition was not significant for the profit response variable. Presentation did, however, significantly affect decision time (Hypothesis #2). Decision time was not significantly affected through any other conditions, which is to say that decision times were effectively the same under all conditions, except for changes in presentation format. ANOVA results are shown on Table 1.

All significant profitability results (information content, decision commitment, and the information content/decision commitment interaction) had no discernable time differences. This particular combination of profitability results for the factors other than presentation, with significant timing results for presentation only, is not a set of unrelated, mutually exclusive outcomes. Their particular combination of results complements each other well, and provides additional confidence in the overall experiment design. Put another way, a different combination of results might have implied that the model simply did not pick up some effects adequately because of poor design. These results, one pattern of effects for one response variable and a complete reversal of effects for the other response variable, indicates the model in fact differentiated well. (Complimentary results are discussed below.)

Further, all of the significant differences represented meaningful, practical differences. For example, Table 2 shows that the significant time differences for presentation were 1.6 min of 17 min total (10%), and the significant profitability differences were hundreds of thousands of dollars (over an average profitability range of, at most, $1.2 million). Table 2 presents the

Table 1. ANOVA Results.

	Response	Df	Mean Squares[a]	*F* Value	*P* Value
Hypothesized Effect:					
#1: Information content – (ABC/TC)	Profits	*1*	*7.0 E+13*	*10.45*	*0.002*[a]
	Time	1	1.75	0.03	0.866
#2: Presentation – (Graph/Table)	Profits	1	6.5 E+11	0.08	0.778
	Time	*1*	*127*	*5.06*	*0.029*[a]
#3: Decision commitment (Yes/No)	Profits	*1*	*6.7 E+12*	*6.15*	*0.017*[a]
	Time	1	8.49	1.65	0.206
Interactions:					
#4: Info. content & presentation interaction	Profits	1	7.5 E+11	0.09	0.763
	Time	1	1.86	0.07	0.787
#5: Info. content & decision commitment Interaction	Profits	*1*	*5.7 E+12*	*5.18*	*0.028*[a]
	Time	1	3.68	0.71	0.403
#6: Presentation & decision commitment interaction	Profits	1	7.3 E+11	0.49	0.489
	Time	1	4.5	0.43	0.514

Note: Response variability for *profits* was large, as evidenced by large mean squares. The large variances account for the reason that some seemingly large differences in average response (Table 2) were not significant.
[a]Significant differences (at $P<.05$) are shown in italic.

average profitability and elapsed time results for all significant differences. Player response ranges, and accordingly, the related variances were large.[5] Hence, significant differences tended to be meaningful on a practical as well as statistical level.

The game was discriminating in awarding profits, but had low tolerance for inputs outside its optimal operating ranges. Accordingly losses were common and sometimes high. We believed that this somewhat narrow range of profitability approximated true industry operating ranges, the elusive "sweet spot" where profits are maximized, outside of which results are disappointing.

4.2. Testing ABC Information Value

As predicted, players had better simulation profits when provided with ABC information than when they were given TC information. Average profits for the ABC players were \$213,038; the TC players lost an average of \$991,787. These differences were significant at $p = 0.002$.

Table 2. Average Results by Experimental Conditions (See Table 1 for Mean Squares and Significance Levels).

Experimental Condition	Profits Earned	Time: Minutes
ABC information	\$ 213,038[a]	17.0
TC information	(991,787)[a]	17.2
Graph presentation	(447,584)	17.8[a]
Table presentation	(331,164)	16.2[a]
Decision commitment present	102,246[a]	9.1
No decision commitment	(271,670)[a]	9.5
Interaction – information & decision commitment[a]:		
ABC: No decision commitment	157,790	9.6
With decision commitment	188,548	8.9
TC: No decision commitment	(701,131)[a]	9.2
With decision commitment	15,944[a]	9.4
Average for all conditions – complete games	\$ (389,374)	17.1

Note: Averages are calculated based on full game results (years 2–12 less worst) except for decision commitment conditions and Interactions which covered years 6–12 less worst.
[a]Denotes significant effect – (at 5%); t-test on ABC interaction component (profits), $p = 0.38$; t-test on TC interaction component (profits), $p = 0.034$; t-tests for time showed no significance for any of the interaction components.

It took essentially the same time to make decisions (17.0 vs. 17.2 min per game). This lack of difference could be a fault of the model design; it could simply be that while ABC contained more information, that information was more clear and easier/faster to process, or it could be a result of other offsetting influences, which are difficult to speculate about. While we speculated that ABC information to take more time to process, as we have noted, the fact that it did not, we believe, precludes the position that ABC might have performed better (in profits) resulting form more participant analytic decision time, rather than because of the superior ABC information content.

4.3. Information Presentation: Graphic vs. Tabular

Graphs took significantly longer to interpret than tabular presentations, but both presentations yielded similar game results. Graphs took an average of 17.8 min vs. tables, which took 16.2 min ($p = 0.029$). Cognitive processing of analytic information is task oriented. We did not predict whether task orientation would favor spatial or symbolic framing.

The experimental results indicate that graphic presentation added steps to mental processing rather than streamlined or focused processing. It took longer and more effort to arrive at solutions given graphic input, but the eventual solution was the same regardless of presentation format. We might contemplate that had we limited or fixed the decision time allowed, participants would have significantly worse profits under the graphic condition, however, we did not test for this.

The difference in average profits between graphs and tables was \$116,420. (A loss of \$447,584 for graphs vs. a loss of \$331,164 for tables.) While the monetary difference appears large, the variances between individual players and games were sufficiently large that they were not significant (see note 5). We can take some comfort in the fact that the direction – unfavorable for graphs – is consistent with the direction of the time effect, indicating that graphs were the poorer overall medium, which seems to be consistent with the extra time needed to work with the graphs.

4.4. Decision Commitment: Present or Not

The decision commitment condition was based on sound theoretic hypotheses but was an ambitious (and perhaps risky) operationalization. It was therefore rewarding to find that commitment did significantly affect the quality of decisions (profits). Importantly, the direction of differences, and the positive interaction effects (discussed below) supported the theory our predicted results indicated.

Players that were influenced to commit to decisions made better use of the game information and made better decisions. It took them no longer to make these better decisions. The lack of elapsed time differences is important. As noted elsewhere it gives additional theoretic support for the hypothesized commitment results, just as it additionally supported the information content (ABC/TC), results, and conclusions. Since decision time was (statistically) the same for the committed and non-committed conditions, and all other factors were strictly controlled at the same levels, the significant profitability results can be attributed to differences in commitment. Had decision time been more (or perhaps less) for the committed participants, additional decision time could not have been ruled out as the reason for the significantly better profits, and not necessarily the commitment level. This was not the case, which strengths the case for commitment causing better decision performance.

The more positively committed players made average profits of \$102,246. The uninfluenced players lost \$271,670. It took 9.1 min for the positively influenced players to make their decisions vs. 9.5 min for the uninfluenced.

Execution of the commitment condition included a monetary incentive that was not offered to the "non-committed" players. This situation invites the speculation that observed differences could be the result of motivational changes resulting from differing monetary incentives and not because of the desired commitment condition. Had the profitability differences been due to monetary incentives and motivation, however, one would expect that the financial incentive would have similarly motivated a more serious game approach that would have resulted in those players spending more time attempting optimization. That did not occur. Once again, the time-result, or lack of difference provides comforting negative assurance supporting our other, statistically significant findings.

If we take the position that time spent is a reasonable proxy for motivation, then we can infer that players with the commitment incentive were no more motivated that the non-incentive players. Further, the variances for the commitment incentive group were much smaller than the group without the incentive. Standard deviations were $ 202,337 for the incentive group vs. $1,654,584 for the non-incentive group. Smaller variances support successful implementation of the commitment condition. Decision commitment was designed to influence players to adhere to preliminary strategies in working toward final solutions. The fact that their decisions were better, their variances smaller, yet their times were the same provides further evidence of successful commitment operationalizations.

4.5. Interactions

Main effect analyses showed strong, favorable profitability effects for ABC information and commitment. The interaction between these two factors was also significant. Decision commitment helped the TC information group substantially more than commitment helped the ABC information group. Graphically the interaction effects are shown in Fig. 2.

These stronger TC and commitment effects were predicted. Although the profitability and cost functions changed from game to game, within each game (12 years of play) these functions remained exactly the same. Successful strategies were those that used yearly feedback to understand overhead cost functions. Commitment was valuable as it added focus to the process. In the ABC environment the focus was of some incremental value (average profits moved from $157,790 to $188,548 under the added influence of commitment) but not substantially so. In the more chaotic, less predictable TC environment, players had a more difficult time understanding overhead cost behavior. In this situation the focus that the commitment

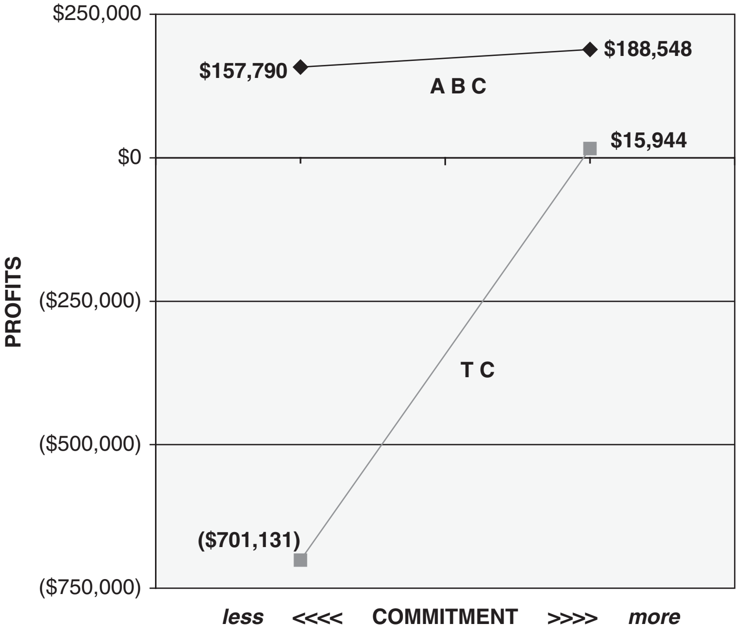

Fig. 2. Interaction Effects: Cost Information and Commitment

influence brought to the player's analysis was very helpful. Average profits went from a loss of $701,131 to a gain of $ 15,944.

Consistent with other findings, interaction decision times did not vary significantly from interaction condition to condition. As we discussed, this result strengthens the argument supporting successful commitment operationalization, in context with the significant findings for the profit response variable. Because decision times were essentially equal from condition to condition it seems that players were similarly motivated (but not similarly committed). It was decision information type and commitment strength that appeared to directly affect decision performance (profits), and not motivational differences. Commitment framed the decision but did not seem to add much motivational incentive (as measured in time elapsed).

The commitment condition was introduced after year five. The average times to complete games 6–12 (less the longest) were from 8.9 to 9.6 min. Interestingly in both the ABC and TC cases the non-commitment condition required more time (although not significantly more) on play, again at least intuitively supporting the success of the commitment condition vs.

motivational proxies. The other two interacting conditions, ABC/Presentation, and Commitment/Presentation, showed no significant profitability or time differences.

4.6. Covariance Analysis and Demographics of Participants

We collected information on eleven demographic variables and independently tested participant spatial abilities using standardized tests. We expected some covariate influences on items such as SAT and certainly on spatial ability for the presentation factor. As it turned out covariate variables were not influential. Using the commitment data, only two covariates approached significance. Spatial ability had a significance level at $p = 0.13$ and sex had a covariate value of $p = 0.15$.

5. CONCLUSIONS

Our study provides empirical evidence that ABC information adds analytic value to profit-oriented decisions in a controlled setting. Further supporting ABCs decision value, ABC information, although more detailed and complex, did not require more decision time. Our empirical support compliments industry, accounting and academic literature, which, although not without its detractors (as noted in our introduction), is overwhelmingly favorable to ABC methods. Further, our decision commitment findings support the argument that ABC methods may support the open, innovative, receptive decision environments favorable to today's dynamic business settings.

Intuitively ABC appears unchallengeable in providing more relevant information from which important, profit-dependent decisions can be made. To date, descriptive research seems to favor ABC. Yet, as we note ABC backlash remains. While this study may not convince the critics, we can at least say that, under the more pure decision environments afforded by laboratory conditions, people make far better decisions using ABC information, and do not appear to require more time to use the additional ABC information. Decision commitment, while not important to the efficacy of the ABC decision process, benefits the less reliable, TC cost information in decision accuracy. Finally people take longer to decipher graphic information in this setting than tabular information, although regrettably we could not discern presentation formats that favored decision accuracy in our model.

While our model did not reveal presentation effects for decision profits, the presentation/time results, that graphs took longer to arrive at essentially the same profits, is interesting and complements our other findings well. As we explained this combination of findings, positive profitability findings for ABC information, with no time differences, taken together with the lack of profitability differences for presentation, but with time differences, complement each other well and support the validity of the model. Had ABC required more time, it might have been the time and not the ABC information that yielded the better profit results, and had there profit differences in the presentation mode, interpretation of the time differences would be less conclusive. (Of course, we would not have objected to complimentary time and profit findings.)

Our decision commitment finding broadens our understanding of the importance of mental representation variations in the decision processes. It was particularly satisfying that our commitment factor had the most beneficial profit influences under the more chaotic decision environment offered by the TC condition. That interaction effect supports the hypothesized main effect conclusions for both ABC and commitment. Commitment was most beneficial in the less structured TC environment, with ABC information effective enough that even positive focusing and commitment influences seemed to not have much impact. As a result we have a greater appreciation for ABC accounting environments, that decision commitment plays a lesser role in such environments. ABC might have value in supporting a more innovative and reactive work environment, rather than supporting work environments married to unproductive or futile strategies. In more chaotic, less meaningful cost information settings, however, commitment to a course of action or decision strategy may provide value in which it reduces the stress or cognitive dissonance associated with conflicting information. The conclusion could be that better ABC cost systems, lead to less confusion, more decision confidence, and more openness to innovation and lines of thought. ABC has value in apparently not rewarding commitments to possibly unproductive courses of action, leaving the decision environment more open to change, as is characterized by the increasingly dynamic business environment of today.

Our research was limited such that although the model was effective in capturing presentation differences, as evidenced by significant time differences, it was not sufficiently robust to capture decision quality differences. Perhaps another presentation mode would, at least when interpreted by covariance for spatial ability, affect decision quality as well. Cognitive fit theory would predict synergistic findings for decision time and quality across experimental factors: longer decision time (for one factor of interest relative to another) implies involving a more complicated decision process, inferior cognitive fit, and poorer decisions. Apparently our model was not adequately selective to elicit such responses.

Had we constrained decision time in our model, it seems reasonable to conjecture that presentation differences would have manifested themselves in decision quality (profits), which suggests interesting insights, and the potential for alternative future inquiries. We were surprised that covariate effects, especially for spatial abilities, were not very influential. Perhaps this too was a reflection of the design of our presentation factors. More work in investigating presentation alternatives, perhaps coupled with research on spatial ability performance, could result in a more effective presentation design vehicle for further studies.

In addition to exploring the presentation design issues further, future research could investigate group decision dynamics by measuring the quality and time differences for groups playing the simulation. We believe time differences might prove to be of special interest in group settings. Cultural differences among group play might also be interesting. Further study might work with mental representations in more depth. The effect of decision confirmation on mental representations, and decision-making could be explored by extending the simulation to force preliminary decisions on participants that are given inadequate or misleading information. Presentation factors and related decision factors remain rich ground for future work.

NOTES

1. Horngren, Datar, and Foster (2002) Horngren et al. (2002) and Kaplan and Atkinson (1998) are but two of many well-known managerial accounting texts, each with lengthy sections explaining and endorsing ABC methods. While we know of no college managerial accounting texts that do not have ABC sections, perhaps some do not. Horngren et al. (2002) cites eight recent surveys documenting ABCs popularity in industry. ABCs popularity is similarly evidenced by numerous articles in business periodicals and journals. A recent search of our university database found 547 such articles.

2. We did not hypothesize the three-way interaction as it presented complicated relations about which we had little confidence.

3. Large variances notwithstanding, the ANOVA results were very significant; ANOVA analyses are notoriously robust to such large variances without compromising its "equal variance" assumption.

4. As was hypothesized and found to be true, the response variables were highly correlated. We ran MANOVA analyses, but they provided no new information or insights beyond that obtained from the standalone ANOVAs.

5. Large variances notwithstanding, the ANOVA results were very significant; ANOVA analyses are notoriously robust to such large variances without compromising its "equal variance" assumption.

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USING KNOWLEDGE MANAGEMENT SYSTEMS TO MANAGE KNOWLEDGE RESOURCE RISKS

Nabil Elias and Andrew Wright

ABSTRACT

One of the emerging roles of management accountants in organizations is the design and operation of their organization's knowledge management system (KMS) that ensures the strategic utilization and management of its knowledge resources. Knowledge-based organizations face identifiable general risks but those whose primary product is knowledge, knowledge-products organizations (KPOs), additionally face unique risks. The management accountants' role in the management of knowledge is even more critical in such organizations. We review the literature and survey a small convenient sample of knowledge-products organizations to identify the general risks knowledge-based organizations face and the additional risks unique to KPOs. The general risks of managing knowledge include inappropriate corporate information policies, employee turnover, and lack of data transferability. Additional risks unique to KPOs include the short life span (shelf-life) of knowledge products, the challenging nature of knowledge experts, and the vulnerability of intellectual property. The paper includes recommendations for management accountants in KPOs to develop and maintain competitive advantage through their KMS. These

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include developing enterprise-wide knowledge policies, fostering collaboration and documentation, addressing knowledge security, and evaluating the effectiveness of the KMS.

One of the emerging roles of management accountants in organizations is the design and operation of their organization's knowledge management system (KMS) that facilitates the strategic management of its knowledge resources.[1] This role is even more critical in organizations whose primary product is knowledge, the knowledge-products organizations (KPOs). Several authors have extensively discussed the value of KMS to a variety of organizations (e.g., Sveiby, 1994; Davenport & Prusak, 1998; Santosus & Surmacz, 2001), and the use of KMSs to add value to organizations through the strategic utilization, development, and maintenance of knowledge (e.g., Hansen, Nohria, & Tierney, 1999; Smith, 2004; Bryan, 2004).[2] However, there is little in the management accounting or KMS literature that addresses the unique aspects that KPOs must consider in the design and operation of their KMS. In addition to identifiable general risks that any knowledge-based organization faces, KPOs confront a unique set of risks that affect their KMS. Using a survey of a small convenient sample of KPOs, we explore both types of risks and how they are managed. This paper identifies the general risks knowledge-based organizations face in knowledge production, explores the unique risks that KPOs additionally confront and how they manage such risks, and offers recommendations in the design of KMS to improve the management of these risks.

This paper is organized in six parts. Part I briefly defines knowledge and distinguishes it from information. Part II describes knowledge management, explores the characteristics of organizations whose primary focus is producing knowledge products (KPOs), and provides an overview of the general business model of KPOs and their role in the current information marketplace. Part III consists of a description of a small convenient sample of KPOs used in our survey. Part IV identifies knowledge-related risks in general as well as unique knowledge risks specific to KPO, reviews how these risks apply to our small sample of KPOs, and explores how KMSs can be used by these organizations to manage and mitigate these risks. Part V includes recommendations that management accountants must consider in the selection of an appropriate KMS that is dependent on the nature of the competitive marketplace. Part VI provides a summary and conclusions including the critical role that management accountants can play in the knowledge management field.

PART I: INFORMATION VERSUS KNOWLEDGE

The differences between *information* and *knowledge* are often blurred as both organization theorists and marketing managers frequently, but erroneously, treat them as synonyms. The Operational Research Society (2004) has a brief webpage describing some of these errors.[3] Their examples include company logos and literature that wrap information and knowledge together as interchangeable. The distinction is critical, because each requires different management techniques (Wilson, 2002).

A key characteristic of information is that it contains a fact-based message involving data in a specific context that is relevant to the audience. Knowledge, on the other hand, is characterized by ideas, thoughts, and beliefs intended to convey a subjective message (No Doubt Research, 2003). Pyle (2003) sharpens the distinction by stating that "information is how you know [what happened]; and knowledge is what to do about it" (p. 97). According to Ackoff (1989), knowledge is derived from the internalization of information. Davenport and Prusak (1998) assert that knowledge implies experience of the communicator, practical utility toward problem solving, complexity vis-à-vis the problem at hand, and evolution from prior knowledge. All these writers agree that information begets knowledge.

Knowledge Dimensions

Knowledge can be classified in different useful ways according to several dimensions. For example, knowledge can be explicit or tacit, content-based or expertise-based, and common or distinctive.

Explicit knowledge is tangible and documented. In the words of Fairchild (2002), it is "what is left when people go home" (p. 243). *Tacit* knowledge, in contrast, is undocumented and often characterized as the experience and intrinsic knowledge of employees. *Content* knowledge, or know-what, is concerned with the theoretical concepts underlying knowledge. The knowledge that steel frames provide a suitable structure for hurricane-prone houses is an example of content knowledge. Brown and Duguid (1998) note that content knowledge is frequently held in explicit form, which eases the ability to share with others. *Expertise*-based knowledge, or know-how, is having the capacity to carry out a task.[4] An example of expertise knowledge is the capability to construct a steel-framed house. *Common* knowledge, according to Bryan (2004), "by definition, hardly needs trading" (p. 105) as it forms the root of basic, practical judgment. Common knowledge is derived from universally familiar and well-documented past experiences. On the other hand, *distinctive* knowledge stems from the expertise of the few. It is the source of organizational competitive advantage (Bryan, 2004) and forms the basis of knowledge products.

PART II: THE KNOWLEDGE-PRODUCTS ORGANIZATION (KPO)

Before we discuss the specific issues of knowledge risks, we first address what knowledge management is and is not, and the role of management accounting in knowledge management.

Knowledge Management and Management Accounting

For our purposes, we adopt the definition of knowledge management as provided by Carl Frappaolo (1998) of the Delphi Group, which states that "knowledge management is leveraging collective wisdom to increase responsiveness and innovation" (p. 2).

At its root, knowledge management seeks to apply structured managerial processes to the various and somewhat abstract knowledge assets of the firm (Newman, 1999). Newman explains that a well-designed KMS first identifies knowledge assets and then ensures their maximum contribution to the business through both content management and information processing. According to Prusak (2001), one of the first steps in implementing a KMS is to identify: (a) what do we know, (b) who knows it, and (c) what we should know that we do not know (p. 1002). Through a knowledge management system, an organization can identify and document the answers to these questions.

A core tenet of knowledge management is the selective conversion of tacit knowledge into explicit knowledge. This promotes the collective education of the organization and prepares for employee attrition. Tacit knowledge departs with the employees holding that knowledge, while explicit knowledge stays behind in the organization. Another key principle of knowledge management is collaboration, stressing the benefits from inter-departmental and intra-departmental cooperation through communication and sharing (Kirsner, 2001). Such an environment ensures that other units within the same organization benefit from each other's success and learn from their respective failures.

In summary, effective knowledge management offers the following:

(a) It supports the development and implementation of strategy in those organizations where knowledge resources are central to the organization's mission.
(b) It provides a means for management to make better-informed decisions related to its most valuable resources.
(c) It offers ways to measure knowledge and the contributions of knowledge assets to predetermined goals.

Clearly, KM is an interdisciplinary function in which the role of the management accountant is critical, particularly in strategy implementation, in tactical decision-making, and in the measurement of knowledge resources. Strategic management accounting tools such as the balanced scorecard can potentially inform organizational strategy development and implementation, support effective knowledge management (Fairchild, 2002), and facilitate the strategic deployment of intangible (knowledge) assets (Kaplan & Norton, 2004). The management accountant's measurement skills can benefit the organization in developing relevant qualitative, quantitative, and financial measures.

It is important to note what knowledge management is *not*. KM is not an answer to a specific question; it is not an ad-hoc "just in case" system; it is not a means of defining goals; and it is not a technology. KM clearly can benefit from the use of technology, but is not defined by that technology. Many companies already use technological applications such as email, customer relationship management (CRM) applications, or intranets as tools to manage their knowledge. Often, KM suggests various hardware and software systems as vehicles for knowledge creation, storage, retrieval, and analysis.

KMS as an Effective Tool

The archetypal KMS is the instrument by which the organization implements its knowledge management strategy; one is only useful in the presence of the other. Alavi and Leidner (1999) describe KMS as designed to move managerial activities beyond the scope of data and information systems, and focus "on creating, gathering, organizing, and disseminating an organization's knowledge" (p. 3).

KMSs should not be expected to solve critical business problems related to poor planning, lack of a solid business plan, or ineffective human relations. Malhotra, the founding chairman and chief knowledge architect of the BRINT Institute, explains that knowledge provides advantages to its owner only when acted upon (BMEE, 2003). The return on knowledge management investment stems from eradicating quality and control problems, finding efficiencies, securing knowledge assets, and most importantly responding appropriately to changes in the competitive environment.

Knowledge management strategies can be measured by the results of KMSs put in place (Alavi & Leidner, 1999). This means a KMS should "do something useful" (Davenport, De Long, & Beers, 1997, p. 2) to be effective. Davenport, Jarvenpaa, and Beers (1995) outline measurable KMS dimensions as: (1) the procedural conversion of implicit knowledge into tacit; (2) the improvement of knowledge to add value to the customer; (3) collaboration with the customer; (4) promotion of knowledge sharing as part of the work process; and (5) enhancement of production efficiencies. The benefits of effective KMS include substantial positive effects on profits, increases in the amount of useful knowledge a firm creates, and positive feedback and acceptance by the KMS users (Davenport et al., 1997).

The Emergence of KPOs

In a manufacturing-based economy, a company's research and development (R&D) department is the primary source producing as well as consuming the organization's knowledge assets. Because in-house knowledge systems reduce reliance on external sources, firms can protect their innovations and closely monitor product development. However, two trends in the US economy that have accelerated in the past three decades explain the explosion in the number and scope of KPOs. First, companies now compete in increasing arrays of dissimilar products, which widens the necessary focus of their expertise. Second, companies have grown more global in scope. Both of these trends have increased the need for external research resources.

The importance of knowledge resources is evidenced by statements made by a number of authors. Logan and Stokes (2004), for example, assert that "the culture of an organization is not just its social and business practices but also its organizational knowledge" (p. 226). Economists, organizational theorists, management consultants, and professional accounting organizations (CMA Canada, 2000) agree that knowledge and knowledge assets are the sine qua non of the modern economy. Looking into his crystal ball, Drucker (1994) expected knowledge workers and knowledge resources to dominate the coming society. Carlucci and Schiuma (2004) cite Wiig's affirmation that pins a firm's sustainability to how it manages and applies its knowledge assets. Malhotra (BMEE, 2003) suggests that intellectual capital deserves recognition on the corporate balance sheet and in the national accounts similar to the gross national product (GDP). Intangible knowledge assets are swiftly replacing tangible capital as the source of a company's distinction and basis for advantage in a competitive marketplace (Logan & Stokes, 2004). A comparison of market capitalizations for new versus old economy stocks particularly reinforces this idea.[5]

Recent surveys by the Industrial Research Institute of leading US companies document a current trend toward flat R&D budgets and higher targets of sales yield for R&D expenses (Grucza, Bianco, & Ayers, 2005). The National Science Board (2004) concludes that volatility in the economy and technology-based markets is forcing firms to "leverage the value of their R&D spending through alliances and collaborations" (Chap. 4, p. 23) in contrast to a single-source strategy. Going forward, US firms expect to increase alliances with knowledge producers, license technology from others, and increase overall efficacy of limited R&D dollars (Grucza et al., 2005).

The NSB (2004) research also indicates an increase in outsourcing R&D work. For example, the funding of external, contracted R&D for US firms grew by 12.2% per annum from 1993 through 2001, compared to only 8.5% during the same time period for in-house R&D funding. Since 1993, contract R&D expenditure growth outpaced internal spending six out of eight years (see Fig. 1). These observed trends clearly support the contention that firms will need to look to partnerships and alliances to enhance the bang for their R&D buck. It should be noted, however, that figures for 2001 point to the discretionary nature of R&D spending in times of recession. Firms that contract to perform research and development for other organizations appear highly vulnerable to macroeconomic cycles.

The Knowledge-Products Organization (KPO)

Advances in communication and computing technology are rapidly transforming the collection, synthesis, and dissemination of information needed for business decision support. Furthermore, the growth of US business and the increase in global competition have spawned a unique industry tailored toward distinctive knowledge creation. As a result, new organizations are moving to meet this accelerating demand for expertise. In doing so, they construct an entire business model around knowledge flow and use their specialized industry acumen to form a KPO.

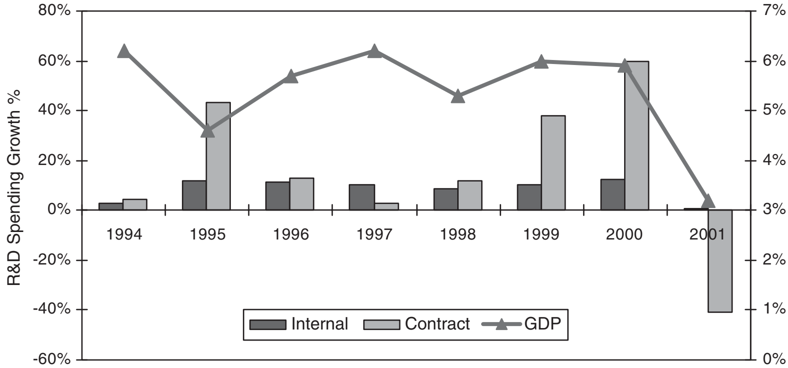

Fig. 1. Industrial R&D Expenditure Growth: Internal versus External Spending. *Notes:* Data are company and other non-Federal funds for industrial R&D performance in the United States within the Company and Contracted to External Organizations. Starting with the 1999 Survey, Estimates are Based on North American Industry Classification System. In Prior Years, Estimates were Based on the Standard Industrial Classification System. *Sources:* National Science Foundation, Division of Science Resources Statistics, and Survey of Industrial Research and Development, annual series, http://www.nsf.gov/sbe/srs/indus/start.htm; Bureau of Economic Analysis.

According to Dietz and Elton (2004) of McKinsey & Co, partnering with these new KPOs can be lucrative for a firm. They claim that "[t]he most common organizational shortfall is a failure to recognize that in-licensing (the licensing or purchase of [Intellectual Property] and related assets from external organizations) can boost a company's performance and growth as much as homegrown R&D" (para. 4). They suggest that companies who actively "in-license", that is, outsource intellectual property, enjoy innovation, improvement, and expansion, which increases their competitive advantage. As noted above, the Industrial Research Institute's (2005) research indicates that organizations are beginning to understand the value of purchasing knowledge products. Sveiby (1994) describes knowledge organizations as a sub-component of the service sector, identified by their small size, creativity and high education, among other factors. Their product is "solving problems that are hard to solve in a standardized manner" (Chap. 1, para. 4). According to Sveiby, the business model of such a firm revolves around "attracting the personnel, attracting the customers, and then matching the capacity and the chemistry of the personnel and the customer" (Chap. 1, para. 6).

The knowledge products organization is one that sells internally created knowledge packaged as products with reliance on subject-matter expertise. KPOs tend to focus on *distinctive*, rather than common, knowledge products. The product may be specific to a subset of an industry such as financial market prediction, or broad such as process improvement. Knowledge-producing organizations rely upon a mix of expertise and content knowledge, depending on the requirements of the marketplace. Delivery of tacit knowledge may require personal interaction as with a consulting firm; while explicit knowledge is imparted in the style of periodicals, manuals, or electronic media. In short, the KPO is a for-hire R&D unit of the pre-knowledge economy with the flexibility and technological tools of the New Economy.

KPO Structure

The organizational structure of the KPO maps very closely to other industries. In this way, the selling and financing of knowledge is minimally different from a typical service, retail or manufacturing firm. The sales force must be well informed of product capabilities and market demand; the finance team must ensure that the books are properly maintained and that the firm is capable of increasing shareholder value in view of the absence of significant tangible assets. In fact, knowledge production may follow a work flow similar to a typical manufacturing firm.

The manufacturing model consists of several phases, including "product design and documentation, material selection, planning, production, quality assurance, management, and marketing of goods" (Rehg & Kraebber, 2001, p. 2). Like a manufacturer, the KPO must gather marketing intelligence on the competitive product space. In designing a product, marketing research identifies strengths, weaknesses, opportunities, and threats (Brooksbank, 1994). Unlike the manufacturing firm whose raw materials are typically derived from outside resources, the KPO's production materials can be found from within the organization (e.g., experience of the knowledge workers, data warehouses, and project documentation), as well as from exogenous sources (e.g., collaborative relationships with clients, secondary data providers, and user communities). The means of production for both types of firms involves combining the raw materials with the expertise knowledge of the workers.[6]

To monitor the quality of production, each may use control measures, including statistical metrics, service calls, and reviews of work in-process. While a material good can be "stress tested" to determine failure rates and measure tolerances, the KPO may use comparative analysis with benchmarking and "best practices" as determinants of quality control. The knowledge product, like the final material good, must be delivered to the end user in a manner that is convenient and efficient. Because explicit knowledge requires no specific medium and tacit knowledge is intangible, knowledge products can be transmitted through electronic channels, printed documents, and personal communication.

Post-sale support ensures that the product functions as intended, and fosters the relationship between producer and customer. Each type of firm must deal with related technical problems such as integration with existing systems. For the KPO, this means technical and data support, production of "white papers" and other accessory knowledge products, and resolving inevitable discrepancies with other sources of knowledge. Fig. 2 shows a model of this production process, highlighting the stages described above and pointing out the similar and different approaches to each stage of the production cycle.

Developing and constructing quality knowledge products on a given topic requires the KPO to retain one or more subject matter experts (SMEs) to oversee alignment of company practices with changes in the industry landscape. For example, a technology research firm would have experienced IT managers or developers on staff who ensure that the knowledge created by the firm stays abreast of advances in the field. A KPO may send its SMEs to industry conferences and client sites, or have them participate in user groups. The firm relies heavily upon this SME position for mid-term and long-term strategic guidance. SMEs may also be in the position of, or report to, the chief information officer (CIO) or the recently developed position of chief knowledge officer (CKO). According to Thurow (2004), the CKO is one "who provides honest, unbiased intelligence about the world around a company and where the company stands in that world" (p. 91).

Taxonomy and Examples

A general taxonomy of the prototypical KPO is shown in Fig. 3, using the various knowledge dimensions previously discussed. In reality, firms may actually straddle multiple classifications.

Examples of KPOs include:

Management consultants: for-profit firms, serving management in client organizations in support of project oversight, process engineering, and general expert advice in organizational strategy. Hargadon (1998) calls these KPOs "knowledge brokers" (p. 210).

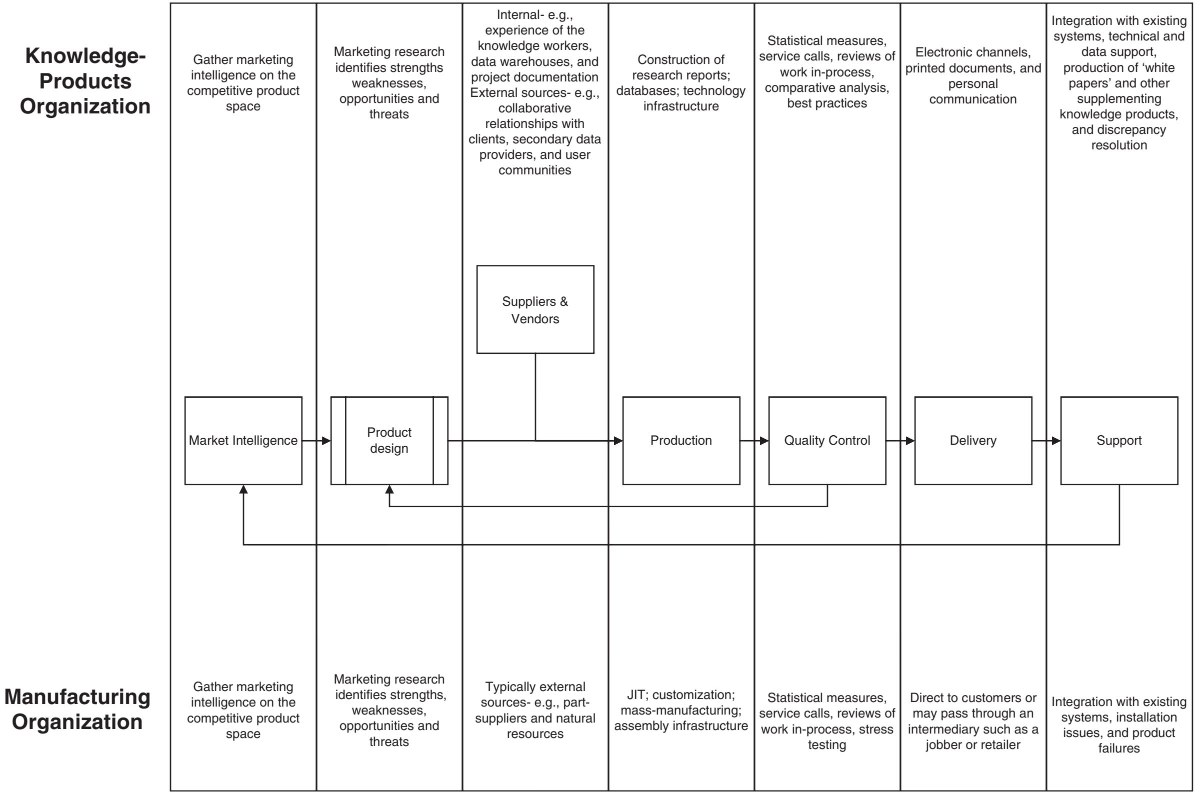

Fig. 2. Manufacturing Firm versus KPO.

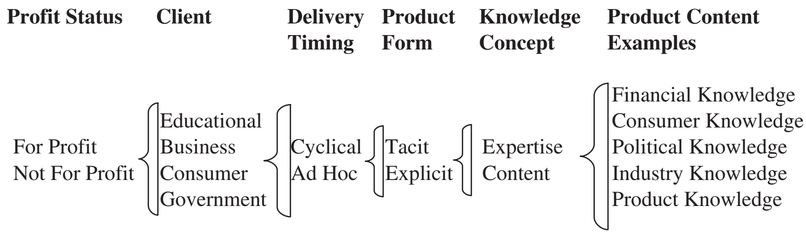

Fig. 3. General Knowledge-Producer Taxonomy.

Real estate brokers: for-profit firms serving businesses and/or individuals with ad hoc knowledge of real estate markets.

Educational institutions: typically not-for-profit, researching any number of subjects for internal consumption as well as furthering external and private interests. While most research is project-oriented, cyclical knowledge products include such services as the distinctive knowledge that accompanies the University of Michigan's monthly Survey of Consumers.[7]

Investment banks: for-profit organizations serving the needs of institutional clients and individual investors with both ad hoc and cyclical knowledge products oriented toward finance and investment.

Information Providers and Software Developers

Many organizations create informational products that do not meet the requirement of distinctive knowledge. While their contributions to the economy and society are remarkable, their aim is to collect and reproduce information, leaving application or interpretation to the consumer. These include search engines (e.g., Yahoo!, Google), fact-finding agencies (e.g., US Census Bureau, Bureau of Labor Statistics), and reproducers of publicly available information (e.g., libraries). The litmus test of a KPO is that it sells "expertise" as opposed to "facts".

We suggest that software is a medium for managing knowledge but it is not knowledge. In the absence of artificial intelligence, knowledge remains a product of human interaction with information. Software development companies facilitate the ability of others to produce knowledge, but are not themselves KPOs. However, developments in neural networks, "thick" modeling, data-mining, and other forms of information systems that attempt to create artificial intelligence are rapidly approaching knowledge production and are frequently the de facto tools of a KPO.

Whether an organization is or is not a KPO, does the difference really matter? As described in Part IV, the subjectivity of knowledge creates a unique set of risks beyond those of information-based companies. Before we discuss these risks, we describe our small sample survey in the next section.

PART III: SURVEY OF KNOWLEDGE-PRODUCTS ORGANIZATIONS

In order to develop an understanding of KPOs and their knowledge resource risks we conducted a survey of a small convenient sample of six KPO companies.[8] The purpose of conducting the survey is to explore the risks KPOs face and how they manage these risks. Since our survey is primarily qualitative,[9] the small sample is sufficiently informative.[10] The six respondents consist of US companies; a consulting firm focused on quantitative real estate research, a firm specializing in real estate research, a large publicly held financial services firm, a firm specializing in industry sales knowledge and market expertise providing its services to Fortune 500 companies, a financial research firm, and a firm with expertise in general industry compliance.[11]

The survey consists of questions related to knowledge products, competition, and KMS; the survey questions appear in the appendix. Interestingly, three of the six respondents see their products as information-based, and the other three respondents see their products as knowledge-based. This probably reflects the confusion alluded to earlier of using information and knowledge as synonyms. We maintain that the nature of KPOs is different from information-products organizations due to the unique risks they confront and the different requirements of their KMS. The majority of respondents show that they create standard rather than customized products. Two respondents indicate that their products are mature rather than innovative, and three indicate that their knowledge employees apply more tacit, personal knowledge rather than explicit, written instructions in problem solving. All respondents are able to identify at least a few direct competitors, and two respondents cite a recent increase in competition.

Of the six respondents, the most common preferred medium for knowledge dissemination is website and email (four respondents). Only one indicates that the preferred medium for knowledge dissemination is networked databases, and one prefers printed documents. Two respondents state they use their CRM and web activity auditing systems as their formal KMS.

Three respondents employ various forms of repositories and libraries to store their information and knowledge assets. Only one firm cites no formal KMS.

Three of the organizations use personal relationships to bring in knowledge resources from outside the firm. Two organizations rely on surveys as their source of information for knowledge products, while one firm relies solely on secondary data sources.

Three respondents use no formal collaborative tools to share knowledge between employees; one of these respondents explains that the lack of such tools is due to the firm's small size. A fourth firm relies on instant messaging, email, and electronic documentation to share and collaborate around the organization. The fifth respondent uses formal enterprise content and KMSs. None of the six firms has a formal chief information/knowledge officer (CIO/CKO) position, nor plans to create one, although the financial research firm does have a director of operations who performs a similar function.

Each of the respondents identifies some area in need of improvement in managing their internal knowledge and their knowledge products. The most common deficiencies are the lack of coordination of their knowledge assets (four respondents) and knowledge retrieval inefficiencies (three respondents). Two firms note that their employees are reluctant to use the in-place KMS; one of the two indicates that the systems are "too cumbersome" and inflexible to meet the needs of disparate business units. Redundancy and over departmentalization are additional shortcomings noted by another respondent. Each of the six respondents ties the firm's competitive advantage to its industry expertise or to its customer service.

Responses to the survey indicate that KPOs consistently credit their version of KMSs with increased efficiencies in select areas such as project management (our current systems allow us to keep on top of projects, manage client workloads, and understand pressing client concerns), error reduction (the ability to see how others have managed/worked issues … there has been a cutback in repeated mistakes as a result), and better communication (keeps [knowledge workers] on the same page when you can upload new instructions to the system and have everyone view at the same time).

The most frequently stated benefits of KMSs are project management (three respondents), followed by centralization of knowledge assets (two respondents). Faster creation and easier updates of knowledge products are identified as benefits by one respondent, while creating valuable documentation for new employees is identified as another benefit by a different respondent.

Respondents to our survey appear to gauge success of their KMS in only one or two areas simultaneously. In order to carry out their knowledge management strategies, KPOs in our sample tend to employ a mix of third-party solutions (e.g., CRM software; document management) in conjunction with homegrown or ad hoc solutions to managing their knowledge resources (e.g., intranets, proprietary documentation, tacit knowledge sharing).

The chief operating officer of the real estate research firm in our sample disapproves of a formal, enterprise KMS, stating "I don't like intranets!" This executive prefers to be surrounded with handpicked managers who are the subject of the executive's great confidence to achieve the research firm's objectives. While this informal approach to knowledge management may reinforce corporate information policies from the perspective of this executive, it does not consider what might happen when these managers leave the firm.

PART IV: KNOWLEDGE-RELATED RISKS

All firms, whether KPOs or not, and regardless of their business model, face a varied set of knowledge-related risks. They face several obstacles or barriers to effective knowledge management, which have been addressed in the recent literature. Most critical to the knowledge organizations are the following impediments.

Weak or Missing Corporate Information Policies

This barrier identifies a systemic issue that could afflict several different business units within the firm. Without enterprise-wide information policies, the company becomes a set of conflicting data fiefdoms building knowledge-based systems to their own specifications and rules (Loshin, 2001). Examples of damaging information policies include the recent mismanagement of sensitive information from Bank of America, Reed Elsevier and Choicepoint (Goldfarb, 2005).

Four firms that responded to our survey described multiple independent systems for managing and sharing knowledge, and decentralized content management. This highlights a potential deficiency in KM in the KPO. KPOs' knowledge management may benefit more from a systemic approach in their KMS. The financial services firm in our sample concedes that weaving together disparate tools focused on individual problems creates "a lot of redundant systems that are not in synch with one another". Without an enterprise-wide policy covering security, use and definition of information resources, an organization runs the risk of failing to meet strategic business objectives. Surprisingly, none of the respondents indicates that their firm has a dedicated knowledge manager such as a CKO.[12] This reflects a potentially serious void, and underscores the opportunity that management accountants have in spearheading an interdisciplinary systemic approach to managing knowledge resources and products.

Employee Turnover

Every firm experiences the risk of employee attrition. Knowledge organizations, because they build products from the wisdom and experience of their employees, are especially vulnerable to this risk. Consider the collective knowledge of baby-boomer employees walking out relatively en masse once retirement age hits. Some turnover can be healthy, in the range of 5–20% leading to growth and corporate stimulation (Sveiby, 1994); but above and below this threshold, the company could be either leaking knowledge assets or risking complacency.

Three survey respondents point to the advantage of having documented knowledge in their KMS as a means to support the training of employees and to recall lessons learned from previous projects. With heavy reliance on tacit knowledge, the industry-sales expert firm appears to be an excellent candidate for a formal collaborative system to improve efficient knowledge production and ensure codification of critical knowledge assets. The vulnerability to leaking knowledge is greater when the number of ''knowledge'' employees is relatively small. According to an executive respondent from the real estate research provider, departing employees have caused disruptions in general operations and knowledge creation from time to time.

Lack of Data Transferability

Loshin (2001) suggests that data created by one party will often fail to meet the quality needs of another. That is, data has a theoretical maximum quality that fits the needs of the creator but falls short for others. This is perhaps one of the most serious challenges faced by any organization, because the other party could be a paying client. Loshin explains that poor communication between the creator and the user of an information asset causes this disconnect, as different business units within a company have the ability to create duplicate, yet exclusive information and management systems. We believe this to apply equally to knowledge assets.

Four respondents noted a problem with lack of coordination between knowledge assets. If divisions are unable to integrate or coordinate their knowledge assets internally, it could indicate difficulties in adjusting to shifting customer demands.

On the other hand, one firm appears to have dealt successfully with this issue. A principal with the real estate consulting firm made the following statement: "we do a good job of communicating and sharing information with vendors and clients and always attempt to anticipate the information/knowledge requirements for ourselves and clients". As an example, this firm interviews a sample of their clients' to fully understand the scope of their clients' consulting projects. Furthermore, a respondent from the industry compliance expert organization noted that their firm "guides" customers on how to make successful business decisions using the firm's knowledge products. This KPO also actively solicits customer feedback concerning product quality. This approach suggests a solution to lack of data transferability problem,[13] and to the problem of the short shelf-life of knowledge (see the next section). Delighting the customer and providing useful innovations require such collaboration with the end user.

In addition to the above general barriers to effective knowledge management, we identify three other critical knowledge management challenges that are unique to KPOs.

The Short Life Span of Knowledge Products

As the speed of conducting business increases, managers must accelerate their decision-making process. In order to remain relevant, knowledge access and dissemination must exceed this pace. But knowledge has a finite shelf-life. Senior managers of knowledge producing firms must contend with these shrinking life spans when developing product strategy.

Communication and collaboration with customers of KPOs can help manage this risk. Two firms in our survey highlight their dedicated collaborative efforts with external customers as their success measures. We believe that this is an appropriate strategy to manage the problem of product shelf-life.

The Challenging Nature of Knowledge Experts

For any manufacturer, a primary business challenge is obtaining raw materials, converting them into a finished product, and then duplicating this process at increasingly lower costs. The raw material for knowledge production comes from the collective experience, insight, and interaction of the KPO's employees, especially subject mater experts (SMEs). This resource cannot be instantly grown or mined, as it is generated over time. The greatest opportunity for knowledge creation results from engaging a sizable and diverse SME base. But at the same time, the disparate nature of geographic locations, skill sets, cultures and backgrounds of a diverse population presents the greatest challenges for collaborative techniques that are so essential for generating knowledge (Bryan, 2004).

According to an interview with the respondent from the real estate research provider, the lack of formal communication channels causes the details of many significant projects to be overlooked to the detriment of their knowledge products. The same problem is identified by the respondent from the large financial services company in our sample, which recognizes the need to improve communication between departments in order to learn from each other's successes and mistakes. However, the size of a KPO may affect its requirements for collaboration. For example, an officer at the industry sales knowledge and market expertise firm suggests that the organization is too small to require formal collaborative tools. However, the same respondent concedes that the firm has neither a tool to review knowledge-in-process nor a central repository for idea sharing among employees.

The Vulnerability of Intellectual Property

Business processes, designs, and equipment are swiftly duplicated – or worse improved – by competitors, often with little legal recourse. Brown and Duguid (1998) conclude that expertise knowledge, or know-how, is an advantage comparatively easy to safeguard, versus content knowledge, or know-what, which is vulnerable to infringement. To remain competitive, KPOs must have the content knowledge to design appropriate products, but additionally the complementary expertise knowledge to properly execute. Simply relying upon great ideas leaves the KPO open to duplication by competitors. Customers and investors will seek out the firm that can provide an elegant solution, not necessarily the one with the most bells and whistles.[14]

Only one of the respondents, the real estate consulting firm, described its products as both innovative and customized. Another respondent, the industry sales expert company, considered its products as innovative, yet standardized (pre-formatted, canned). These two companies are the only respondents that listed expertise and experience as sources of competitive advantage. We suspect that the competitive advantage of the other four KPO firms is especially vulnerable because it is primarily derived from determinants other than the effective mix of expertise and content knowledge.

Other Risk Considerations

Two additional risks related to KPOs that are not included in the above discussion appear relevant. These are KPOs outgrowing their customers, and bias in knowledge products. In his analysis of the KPO, Sveiby (1994) notes an interesting phenomenon where a firm's knowledge employees "outgrow the KPO's customers" (Chap. 16, item 3). Specifically, the firm's knowledge capacity develops or matures faster than market demand. The result is that resources are squandered on overly sophisticated knowledge products. Knowledge and information bias result when factual information is distorted by the communicator, the receiver, or both. Knowledge products are especially vulnerable to personal bias. Consumers of knowledge products will consider this bias heavily in their purchase decisions (Eiser, 2004).

Because knowledge and knowledge-related assets are the primary income-producing resources of the KPO, poor knowledge management practices expose KPOs to these risks. In the next section, we offer recommendations for effective KMS, which are particularly applicable to KPOs.

PART V: RECOMMENDATIONS FOR EFFECTIVE KMS IN KNOWLEDGE-PRODUCING ORGANIZATIONS

This section includes recommendations related to the development of a competitive advantage by KPOs through the KMS and to the selection and implementation of an effective KMS. The management accountant in a KPO can use these recommendations in spearheading an interdisciplinary systemic approach to managing knowledge resources and knowledge products.

Developing a KMS Competitive Advantage

To develop competitive advantage via the KMS, this sub-section offers four recommendations: (a) developing enterprise-wide knowledge policies; (b) fostering collaboration and documentation; (c) addressing knowledge security; and (d) evaluating the effectiveness of KMS.

Developing Enterprise-Wide Knowledge Policies
As with any corporate-level control system, effective deployment requires buy-in from senior executives, that is, finding champions who can empower SMEs to take ownership of products and processes (Poon & Wagner, 2001). Policies governing the entire knowledge product lifecycle are required to guarantee success and impart the importance of knowledge to employees. A strong corporate knowledge and information policy sets common strategies and goals to ensure minimum standards. The policies should include details on privacy, integrity, security, and storage.

Fostering Collaboration and Documentation
Researchers have shown the positive effect of collaboration on knowledge management (Qureshi & Zigurs, 2001; Qureshi, Hlupic, de Vreede, & Briggs, 2002), on operations (Myhr & Spekman, 2002), and on obtaining competitive advantage (Monczka, Trent, & Callahan, 1993). In a study of knowledge management's role within the learning organization, Lu and Tsai (2004) stress that heightened levels of competition between firms require coordination of knowledge assets between functional teams and departments. Bryan (2004) suggests that creating and exchanging knowledge generates not only significant value but also significant challenges for an organization.

Furthermore, successful collaboration produces robust documentation as a requisite by-product. The conversion of tacit into explicit knowledge contributes to the prosperity and survival of the KPO, regardless of whether the knowledge is expertise- or content-based. Neither collaboration nor documentation will retain employees, but they could alleviate knowledge asset attrition and enhance data quality. Benefits include increased efficiencies for new hires and innovative problem solving throughout the company (Logan & Stokes, 2004).

However, care should be taken to avoid codifying all the tacit knowledge of the SMEs. As Pfeffer and Veiga (1999) warn, a firm runs the risk of destroying its knowledge assets when experts are forced to explain complex concepts and judgments to novices. Because so much of their expertise is wrapped up in experience, replicating these competencies in a system designed to assist the inexperienced will cripple the decision-making process, and paradoxically force out the wisdom that was intended to be captured. One of the primary goals of the KPO is to bring a number of employees up to the competency level of SMEs by allowing the experts to share their tacit knowledge through collaboration. Like apprentices working along side a master artisan, collaboration with a SME imparts knowledge, understanding, and wisdom on non-expert colleagues. In this way, knowledge assets of the firm become diversified, and the risks from attrition are mitigated.

Collaboration can be internal or external. Internal collaboration occurs within the organization, for example between business units and team members. External collaboration is between the organization and its clients and suppliers. External collaboration requires active solicitation of feedback via surveys, panels and focus groups, and cooperation with all sources of knowledge from outside the firm. External collaboration may also include reactive feedback systems for customer complaints. KMS can automate both sides of the external collaboration effort, and assist with cursory analysis to spot trends and prevent critical failures. This analysis should feed directly into the production process so that customer and supplier feedback is integrated with new product development and existing product enhancement (see Fig. 4). KPOs employing these types of active and reactive communication systems with their clients and suppliers will enjoy a competitive advantage over those who forgo external collaboration.

Collaboration within the firm is achieved through an array of increasingly formalized channels (Sherman, 2004). These include standardized processes at the lowest level, up to project management and organizational matrix structures at the highest levels of integration. Knowledge management, as a strategy for internal collaboration, can significantly reduce the risks of uncertainty surrounding these resource requirements, as well as risks related to

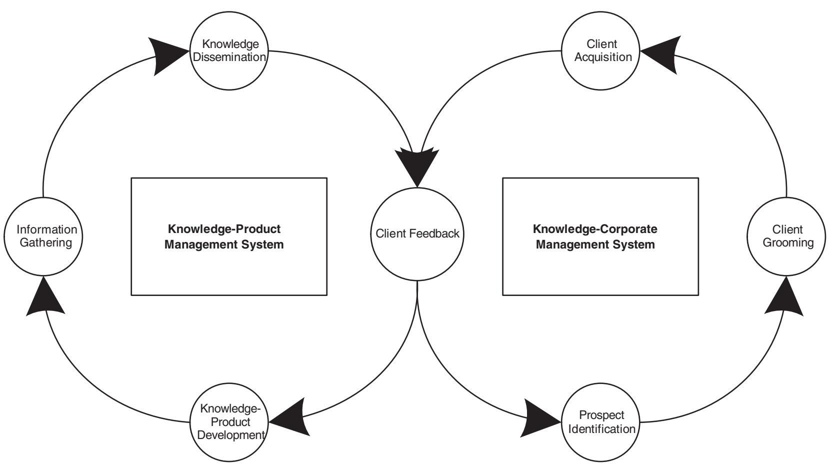

Fig. 4. Collaborative Workflow to Exploit External Knowledge Sources.

competition, market demand, and organizational capability. KM does this by enabling managers to review what resources are available to the firm, how the firm's marketplace is currently served by competing organizations, and what opportunities are there for enhancing the firm's knowledge products.

Though not a knowledge product, Sherman (2004) highlights the development of the Boeing 777 aircraft as an example of successful product development using collaborative technological tools and structural models of integration. Sherman contends that these collaborative tools allowed Boeing to share designs between permanent and ad hoc teams within the company as well as with suppliers, customers, and client support. The result was the first "paperless" airplane design, and one that tremendously advanced modern avionics. Bills (2005) discusses how electronic imaging software is improving internal collaboration between disparate units as well as providing customers with timely, accurate, and meaningful service.

Addressing Knowledge Security

An effective KMS will help protect the underlying knowledge assets from misuse and theft. The enterprise-wide knowledge policies should include provisions for those who can access the knowledge assets and information resources, and who can modify work in-process. In practice, this includes requiring credentials to log into sensitive networks and databases, acceptable use policies, auditing systems to record data access, physical access restrictions such as safe rooms for critical hardware, back-up systems for networks and power supplies, and a well-stated and enforced policy on what constitutes access violations and associated penalties. The organization may require non-compete and non-disclosure agreements from both its employees and customers as other forms of security.

Most KPOs' long-term assets such as customer or prospect lists, data warehouses, knowledge work-in-progress, research notes, product distribution, and communication channels are rooted in IT-based systems. Although a generally accepted method to determine the return on investment (ROI) for knowledge assets and information technology has not emerged, it is clear that losing one of these knowledge assets, even temporarily, can be very costly. If able to quantify the revenue lost when a knowledge asset becomes unavailable, the knowledge manager will be better able to identify and justify the organization's security needs (Wilson, 2003). A KMS may catalog hardware inventory, incorporate network intrusion detection systems, and generally provide knowledge managers with a flexible framework to review changes to and contributions from investments in knowledge. The

KMS need not use a specific technology, but the system should allow managers to make informed decisions about all their knowledge resources.

In manufacturing, employees must have proper training on acceptable use of materials, quality of outputs, and safety. While knowledge assets do not generally present any immediate physical danger, recent legislation such as the Gramm–Leach–Bliley Act (1999) is holding companies liable for violations of customer privacy and contact regulations. The KPO must secure its knowledge assets from maleficent or accidental alteration and ensure compliance with evolving privacy mandates. A violation of either could jeopardize financial stability.

Evaluating the Effectiveness of KMS

Measuring the quality of a KMS is a difficult task (Davenport, Jarvenpaa, & Beers, 1995). According to Guida and Mauri (1993), assessing the extrinsic quality of a KMS requires a review of cost/benefit, an evaluation of the effect of the system on the organization, and measurement of acceptance by the end user. As discussed earlier in Part II, Davenport et al. (1995) identify five tactics that can be used to evaluate the effectiveness of the KMS: (a) converting implicit knowledge into tacit; (b) improving knowledge to add customer value; (c) collaborating with the customer; (d) promoting knowledge sharing; and (e) enhancing production efficiencies.

KMS Selection and Implementation

According to Hansen et al. (1999), firms address three questions that shape knowledge management strategy.

(1) "Do you offer standardized or customized products?"
(2) "Do you have a mature or innovative product?"
(3) "Do your people rely on explicit or tacit knowledge to solve problems?" (p. 13).

The answers to these questions will determine whether the KPO is following a *codification* or a *personalization* strategy. The codification strategy depersonalizes knowledge and converts it from tacit to explicit (people to documents), for future retrieval and reuse. Companies use this strategy when multiple clients require the same type of solution, when employees are skilled as implementers rather than inventors, and when revenues are relatively stable forcing the organization to a cost management strategy. Hansen et al. (1999) describe the personalization strategy as a person-to-person collaboration, where knowledge is shared via a network of individuals.

Hansen et al. (1999) advocate this strategy when clients' needs are heterogeneous, when the level of depth and breadth of knowledge does not lend itself to transcription, and when many employees are already SMEs.

Smith (2004) uses these two strategies to contrast the documented approaches of Boston Consulting Group and Ernst & Young to internal knowledge management. Ernst & Young, a professional services firm, prefers to recycle their previous work from codified sources where possible in order to decrease costly resources associated with starting a project from scratch. In contrast, Boston Consulting's approach to KMS seeks to develop personal connections between the firm's knowledge employees utilizing the relationships built from personal contact.

In a complementary approach to designing KMSs, Ofek, and Sarvary (2001) determined that professional service organizations (e.g., consulting, accounting, and advertising firms) should choose a KMS designed *either* to decrease costs of knowledge production and dissemination *or* increase service quality. The former approach of improving operational efficiencies typically includes automation of knowledge documentation and retrieval. Increasing service quality, on the other hand, taps into external resources of knowledge and product enhancement. According to Ofek and Sarvary (2001), the selected strategy is determined by the relative strength of the need to find long-term efficiencies in the production process (operational cost reduction), or to exploit a growing customer base (increasing subscribership through quality).

Ofek and Sarvary (2001) propose that KPOs in a monopolistic environment will choose to increase supply-side returns to scale in order to reduce costs. This is because clients have no substitute firm to choose from. In contrast, most KPOs in a competitive industry should select a KMS that increases the demand-side returns to scale in order to attract new clients. According to Ofek and Sarvary, the rationale behind increasing service quality in a combative marketplace is twofold: first, there is a bandwagon psychological factor whereby customers gravitate to a company that already has a significant, reputable client base; and second, adding new clients provides a store of rich, experience-based knowledge for future assignments.

Hansen et al. (1999) recommend choosing one dominant strategy instead of trying to straddle different approaches. They contend that "a company's knowledge management strategy should reflect its competitive strategy: how it creates value for customers, how that value supports an economic model, and how the company's people deliver on the value and the economics" (p. 108). Thus, the options for a KPO are to choose a personalization or a codification strategy; and decrease costs or increase service quality (see Fig. 5).

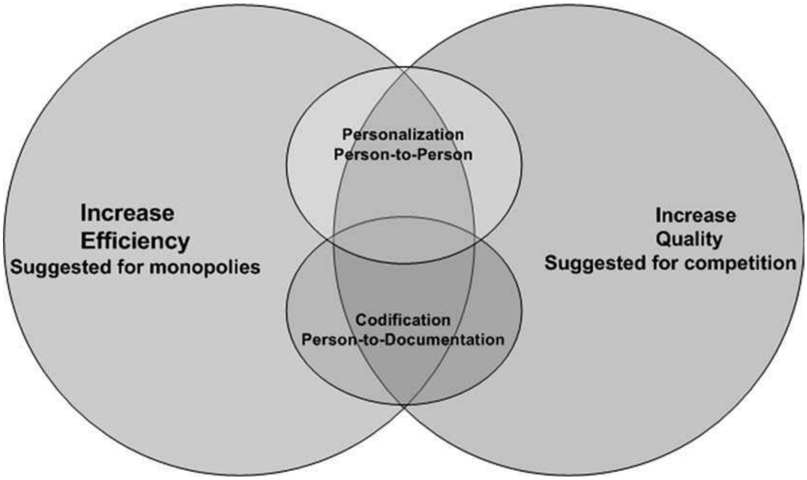

Fig. 5. Knowledge Management System Strategies: Exclusive and Complementary Options for Managing the Knowledge Production Process.

Many respondents to our survey have primarily concentrated on achieving operational efficiencies, which contradicts the competitive nature of their markets. In a competitive environment, increasing service and product quality generates greater return on investment than trying to reduce production costs (Ofek & Sarvary, 2001). Quality can be enhanced by increasing collaboration, more rigorous hiring practices, and improving distribution or changes in product scope to fit client needs. When deciding between a strategy of knowledge codification or personalization, the KPO must consider its market strategy and whether it serves clients best through de novo solutions or adaptation of prior work.

PART VI: CONCLUSION

We have attempted to identify knowledge risks, particularly as they affect KPOs. The survey we conducted indicates that the KPOs in our sample do not generally appear to have a systemic approach to managing their knowledge resources and are thus prone to many of these risks. The role of a CKO or equivalent does not seem to have developed in our small sample. If this is a reflection of a general trend, then this void provides a unique opportunity to management accountants in general, but especially management accountants in KPOs to spearhead an interdisciplinary systemic approach in their KMS to effectively manage knowledge resources and products.

Companies can no longer look inward to find new products and new markets, but must seek expertise through partnerships, alliances, and knowledge retailers. Research shows that the growing trend of partnering with a KPO stimulates innovation and can potentially increase shareholder value. It has been recognized for more than a decade that the raison d'etre of the emerging knowledge marketplace is to manage the human intellect. According to Quinn, Anderson, and Finklestein (1996):

> In the postindustrial era, the success of a corporation lies more in its intellectual and systems capabilities than in its physical assets. The capacity to manage human intellect- and to convert it into useful products and services- is fast becoming the critical executive skill of the age (p. 71).

The success of KPOs vying for contracts that add value to customer organizations will be determined by the KPO's respective abilities to resolve key knowledge-related risks. Each KPO must survey its shortcomings, and design a KMS that continuously promotes collaboration, quality, and knowledge creation unique to the competitive landscape and knowledge product scope.

To survive, the knowledge company must prove itself an expert in data collection, knowledge synthesis, and dissemination. The successful KPO will manage its knowledge assets to protect them against both attrition and unauthorized access, while exploiting collaborative opportunities. Firms that isolate their knowledge assets should consider moving toward the development of a triadic model whereby knowledge is shared within functional teams, across complementary teams inside the firm, and with external sources such as customers and suppliers. KPO industry leaders will use KMSsto manage the various knowledge domains while simultaneously avoiding the knowledge-related risks discussed in this paper. We believe that the skills, expertise, and knowledge of management accountants can help organizations generally, and KPOs specifically to develop, utilize, and maintain a more comprehensive and systemic approach to knowledge management.

NOTES

1. The role of management accountants in knowledge management is evolving. For example, see Bhimani, Alnoor, 2003 (Editor), Management Accounting in the Digital Economy, Oxford, and CMA Canada, 2000.

2. It is important to note that the technical dimension of KMSs should be subordinated to the strategic management of knowledge.

3. See http://www.theorsociety.com/about/topic/projects/notorious/2_1_knowledge_info.htm.

4. Acuña, Lopez, Juristo, and Moreno (1999) use the terms *strategic knowledge* and *tactical knowledge*, respectively to describe what we call *content knowledge* and *expertise knowledge*. Brown and Duguid (1998) use the terms *know-what* and *know-how* to describe a similar dimension. We prefer to use *content* and *expertise* knowledge as we feel these terms better describe the dichotomy between mastery and capability.

5. Events such as the late 1990s dot-com meltdown also underscore the importance of knowledge management.

6. For an in-depth discussion of how organizational knowledge is created, see Nonaka (1994).

7. One may argue that the Consumer Surveys are actually *common* knowledge, since they aggregate a population of individual perceptions without additional discourse. In our opinion the University of Michigan uses its experience and expertise to interpret these survey results, producing distinctive knowledge in the form of additional analysis and commentary concerning the role of consumers in the US economy. See the research reports found at http://www.sca.isr.umich.edu/documents-menu.php?class=s for examples of such distinctive knowledge.

8. Over a period of five months, we contacted 40 individuals from 35 different KPOs and obtained six responses. Even though the respondent sample was small, the information we gathered was useful in exploring the risks and issues related to KMS of KPOs. The survey was qualitative in nature, as we did not intend it for purposes of hypotheses testing.

9. It is important to note that this is a qualitative survey and is not intended for hypothesis testing; rather it is intended to gather information to understand the KPO risks and how they are managed. This is the same objective that is common in case studies.

10. Many of the firms that did not participate in the survey declined to contribute, citing policies against participating in outside surveys.

11. We also received knowledge management-related documentation from a global multi-industry consulting firm which declined to complete the survey. Additionally, we conducted in-depth interviews with the chief operating officer and vice president of technology at the real estate research firm that participated in the survey.

12. One respondent, a US financial research firm, indicated it has a director of operations who is responsible for maintaining best practices.

13. Although Loshin (2001) describes this problem as it relates to data and information assets, we believe that it is equally applicable to knowledge, which is derived from data.

14. This may explain why Google (GOOG), a firm with negligible tangible assets, can buy the largest US automaker, DaimlerChrysler AG (DCX), with enough capital left over to pick up Ford (F), and General Motors (GM), as of October 21, 2005.

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APPENDIX. SURVEY QUESTIONNAIRE

Company Name Participant Name Participant Title

General Description of Company

The above General Description will be used to publicly characterize your firm in the final research publication. Please feel free to make changes as necessary to protect your identity. Your Name, Title and Company Name will not be publicly visible, and are used for internal record keeping only. Section 1 Knowledge Product-related Questions

1. Do you consider Knowledge or Information to be your company's primary product? What does the difference (knowledge vs. information) mean to you (or your business)?

Check One: ☐ **Knowledge** ☐ **Information**

Comments:

2. Does your company offer a standard or a customized product? (Scale of 1-5)

1=Standardized, pre-formatted, canned research

5= Customized, each project/client is unique

Check One: ☐ ☐ ☐ ☐ ☐
1 2 3 4 5

Comments:

3. Does your firm have a mature or innovative product? (Scale of 1-5)

1= Mature, industry-standard research

5= Innovative, proprietary and not-reproduced

Check One: ☐ ☐ ☐ ☐ ☐
1 2 3 4 5

Comments:

Section 2 Competition

4. What companies (or types of companies) would you consider to be your firm's competitors? If you benchmark, please explain by name or description.

5. What defines your competitive advantage vis-à-vis your competitors?

Section 3 Knowledge Management Systems

6. What formal or informal Knowledge Management systems do you have in place to manage, create, protect, and exploit your knowledge assets? Do you believe these systems help give your firm advantage over competitors?

7. What are your general methods for gathering the information components that feed your knowledge product? E.g. telephonic surveys, relationships with data sources, panel of experts.

8. What is your preferred medium for knowledge dissemination? E.g. Internet, personal consulting, networked databases, etc.

☐ **Web site** ☐ **Face-to-face contact** ☐ **Networked databases** ☐ **Email**
☐ **Other**

If "Other", please explain:

9. Do your employees use explicit or tacit knowledge to solve problems? (Scale of 1-5)

1= Explicit, written instructions

5= Tacit, personal knowledge & experience

Check One: ☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

Comments:

10. Does your firm employ formal collaborative tools to share knowledge between employees? If so, what are they?

11. Do you have a formal Information or Knowledge Officer? If so, what are his/her primary duties? If not, would you consider creating such a position?

12. What shortcomings have you identified in your Knowledge Management systems?

13. What benefits have you identified from your Knowledge Management systems?

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IFAC'S CONCEPTION OF THE EVOLUTION OF MANAGEMENT ACCOUNTING: A RESEARCH NOTE

Magdy Abdel-Kader and Robert Luther

ABSTRACT

IFAC's Management Accounting Practice Statement Number 1, revised in 1998, is concerned with management accounting practices. This research note describes an operationalization of its conception of the evolution of management accounting. The paper is informed by experience in developing and applying an IFAC-based model to survey the stage of evolution of the management accounting practices in a United Kingdom industry sector. The model is intrinsically interesting and has the potential for replication in other contexts and in comparative cross-national, inter-industry or longitudinal studies.

1. INTRODUCTION

In 1989 the International Federation of Accountants[1] (IFAC) issued a statement summarizing its understanding of the scope and purposes of management accounting and the concepts which underpin it. The statement was revised and released in 1998 as *Management Accounting Concepts* – Number 1 in the series of International Management Accounting Practice

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Statements. Through its members (the national accountancy bodies of all major economies) IFAC represents "2.5 million accountants employed in public practice, industry and commerce, government, and academe" (IFAC, 2005), and the 'flagship' statement in its management accounting series therefore merits attention.

Statement 1 does not explicitly identify a central purpose but comprises an introduction and the following sections: Evolution and Change in Management Accounting (paras 7–20); Management Accounting and the Management Process (paras 21–36); The Conceptual Framework (paras 37–72); and Using the Conceptual Framework (paras 73–77). The Conclusion (paras 78–79) contends that the statement can be used by managers "for understanding, evaluating and developing," by professional accountants in management for "focusing, benchmarking and developing," by educators "in refocusing and consolidating their efforts" and by professional associations "in reformulating and consolidating the work technologies to be associated with management accounting now and in the future." In this research note we concentrate on the first section, entitled Evolution and Change in Management Accounting.

Our purpose is to describe an operationalization of IFAC's conception of the evolution of management accounting. The note is informed by our experience in developing and applying an IFAC-based model to survey the stage of evolution of the management accounting practices (MAPs) in food and drinks companies in the United Kingdom. We submit that our model, explained in Sections 4 and 5, is intrinsically interesting and has the potential for replication in other, wider, contexts.

During the 1980s Kaplan, in his review of *The Evolution of Management Accounting,* and with Johnson in the *Relevance Lost* book, leveled criticism at the MAPs of the day. Since then a number of innovative management accounting techniques[2] have been developed across a range of industries and publicized internationally. These have been designed to support modern technologies and management processes and companies' search for a competitive advantage to meet the challenge of global competition.

It has been argued (Otley, 1995; Kaplan & Atkinson, 1998; Hoque & Mia, 2001; Fullerton & McWatters, 2002; Haldma & Laats, 2002) that the 'new' techniques have affected the whole process of management accounting (planning, controlling, decision-making, and communication) and have shifted its focus from a 'simple' or 'naive' role of cost determination and financial control, to a 'sophisticated' role of creating value through improved deployment of resources. In 2001 Ittner and Larcker claimed that "companies increasingly are integrating various [innovative] practices using a comprehensive 'value-based management' … framework" (p. 350).

This 'received wisdom' begs a number of questions. We recognize, but set to one side, the question of whether the term evolution, with its implication of progress, is an appropriate description of what may be (just) change. Likewise, we are not concerned with philosophical issues such as the relationships between concepts (or more broadly, theory) and practices, or which is the 'cart and which the horse?' Our purpose is not to address such questions, but rather to recognize that IFAC has a strong claim to formally 'speak for' management accounting and that its framework of evolution can be useful in studies aiming to answer questions such as: To what extent are the practices advocated by academics, textbooks and professional institutes actually applied in organizations? At what stage of evolution is the management accounting of particular organizations, industries or countries?

Elsewhere (Abdel-Kader and Luther, 2006), in the full report of our empirical findings we provide a description of the MAPs of companies in a specific industry and located their levels of evolution on the IFAC spectrum. That sort of positivistic study is encouraged by, for instance, Ittner and Larcker who stress that "[i]t is difficult to imagine how research in an applied discipline such as management accounting could evolve without the benefit of detailed examination of actual practice" (Ittner & Larcker, 2002 p. 788). This research note describes how our research approach (being IFAC-based) has wider relevance, and how it can be applied in other contexts.

2. IFAC'S CONCEPTION OF MANAGEMENT ACCOUNTING EVOLUTION

Although the IFAC (1998) framework is focused on concepts rather than practices, there is some lack of clarity about this. For instance, para (19) describes "the way in which management accounting as a field of activity is positioned within organizations;" it seems that those who drafted the statement view concepts merely as derivatives of practices. Another *caveat*, recognized by the statement, is that the scope, role and organizational positioning of management accounting differ across organizations, cultures and countries. This problem is compounded (unless one believes that concepts are in vogue at the same time throughout the world) by the identification, in the Statement, of evolutionary stages with dates in history.

An attempt is made to clarify this by referring to "leading edge practice internationally" (para 3), presumably (in this context) meaning leading edge conceptual practice! Nevertheless, despite its limitations (consideration of which is beyond the scope of this research note) the framework provides an interesting view of history and a useful set of parameters. The four stages of evolution identified by IFAC (1998) are shown in Fig. 1 and described below. It should be pointed out that the stages are not mutually exclusive; each successive stage encompasses the concepts of the previous stage, and incorporates additional ones that arose out of a new set of conditions.

Stage 1 – Cost Determination and Financial Control (pre-1950)

IFAC describes management accounting before 1950 as "a *technical* activity necessary for the pursuit of organizational objectives" (para 19). Its focus was mainly oriented toward the determination of product cost. Production technology was relatively simple, with products going through a series of distinct processes. Labor and material costs were easily identifiable and the manufacturing processes were mainly governed by the speed of manual

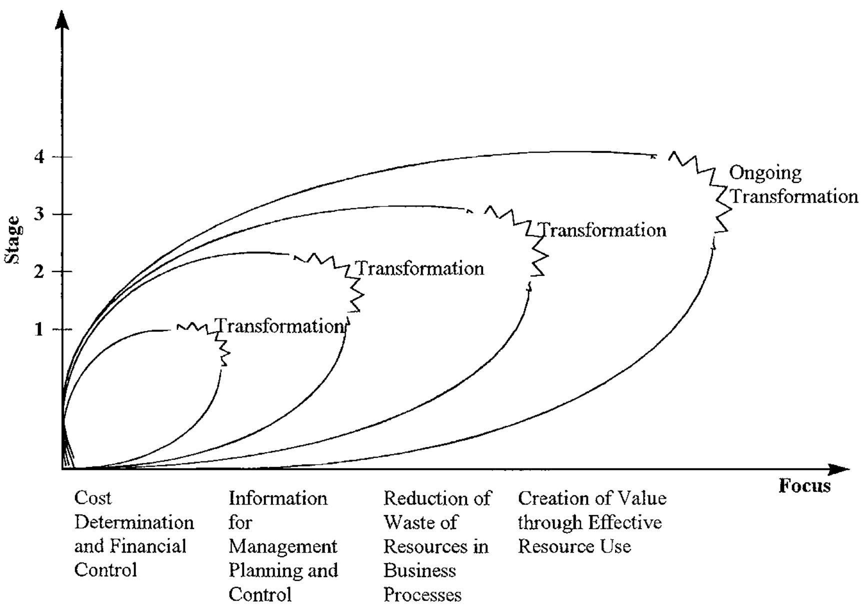

Fig. 1. Evolution of the Focus of Management Accounting. *Source:* IFAC (1998).

operations. Hence, direct labor provided a natural basis for assigning overheads to individual products. The focus on product costs was supplemented by budgets and the financial control of production processes.

The strong position held by Western countries in international markets made their products to be highly regarded. They could be sold relatively easily, and competition on the basis of either price or quality was relatively low. There was little innovation in products or production processes as existing products sold well and the production processes were well understood. Accordingly, management was concerned primarily with internal matters, especially production capacity. The use of budgeting and cost accounting technologies was prevalent in this period. However, the dissemination of cost information tended to be slight, and its use for management decision-making poorly exploited (Ashton, Hopper, & Scapens, 1995).

Stage 2 – Information for Management Planning and Control (by 1965)

In the 1950s and 1960s the focus of management accounting is seen to have shifted to the provision of information for planning and control purposes. In Stage 2 management accounting is described by IFAC as "a *management* activity, but in a *staff* role" (para 19). It involved *staff* support to *line* management through the use of such technologies as decision analysis and responsibility accounting. Management controls were oriented toward manufacturing and internal administration rather than strategic and environmental considerations. Management accounting, as part of a management control system, tended to be reactive, identifying problems and actions only when deviations from the business plan took place (Ashton et al., 1995).

Stage 3 – Reduction of Resource Waste in Business Processes (by 1985)

The world recession in the 1970s following the oil price shock and the increased global competition in the early 1980s threatened the Western established markets. Increased competition was accompanied and underpinned by rapid technological development, which affected many aspects of the industrial sector. The use, for example, of robotics and computer-controlled processes improved quality and, in many cases, reduced costs. Also developments in computers, especially the emergence of personal computers, markedly changed the nature and amount of data, which could be accessed by managers. Thus the design, maintenance and interpretation of information systems became of considerable importance in effective management (Ashton et al., 1995).

The challenge of meeting global competition was addressed by introducing new management and production techniques, and at the same time controlling costs, often through "reduction of waste in resources used in business processes" (IFAC, 1998, para 7). In many instances this was supported by employee empowerment. In this environment there is a need for management information, and decision making, to be diffused throughout the organization. The challenge for management accountants, as the primary providers of this information, is to ensure through the use of process analysis and cost management technologies that appropriate information is available to support managers and employees at all levels.

Stage 4 – Creation of Value Through Effective Resources Use (by 1995)

In the 1990s, world-wide industry continued to face considerable uncertainty and unprecedented advances in manufacturing and information-processing technologies (Ashton et al., 1995). For example, the development of the world-wide web and the associated technologies led to the appearance of E-commerce. This further increased and emphasized the challenge of global competition. The focus of management accountants shifted to the generation or creation of value through the effective use of resources. This was to be achieved through the "use of technologies which examine the drivers of customer value, shareholder value, and organizational innovation" (IFAC, 1998, para 7).

A critical difference between Stage 2 and Stages 3 and 4 is the change in focus away from information provision and toward resource management, in the form of waste reduction (Stage 3) and value creation (Stage 4). However, the focus on information provision in Stage 2 is not lost, but is refigured in Stages 3 and 4. Information becomes a resource, along with other organizational resources; there is a clearer focus on reducing waste (in both real and financial terms) and on leveraging resources for value creation. Accordingly, management accounting is seen in Stages 3 and 4 as "an integral part of the management process, as real time information becomes available to management directly and as the distinction between staff and line management becomes blurred." (IFAC, 1998, para 19) The use of resources (including information) to create value is seen to be an integral part of the management process in contemporary organizations.

3. RESEARCH ORIENTATION AND DATA

A significant body of empirical research has been published in the field of MAPs. For example, Chenhall and Langfield-Smith (1998), Ghosh and Chan (1997), Guilding, Lamminmaki, and Drury, (1998), Luther and Longden (2001), Wijewardena and Zoysa (1999), Mendoza and Bescos (2002), Yohikawa (1994) and Drury, Braund, Osborne, and Tayles (1993). These studies report on the use of various management accounting techniques in different countries.[3] Our study was informed by that tradition. However, it differed in looking at a broad set of MAPs (budgeting, performance evaluation, costing, decision-making, communication and strategic analysis) and doing so within the IFAC framework described above. It was a response to the call for research with "greater understanding of both individual practices and macroscopic relationships among practices … we found very little of the latter in the extant literature" (Anderson & Lanen, 1999, pp. 408–409).

A postal questionnaire was the principal source of empirical data.[4] The criteria used in selecting companies for inclusion in the sample were: a SIC UK industry code of '15' (manufacture of food products and beverages),[5] employment of at least 30 people, and being active and independent companies. Management accountants in 650 companies were asked to indicate the frequency of use of 38 MAPs using a five point Likert-type scale (1 indicating *never* and 5 indicating *very often*). Completed questionnaires were received from 121 companies. A limitation of surveys is that questions may lack specificity and to overcome this and ensure consistency of responses, each MAP was briefly explained. Respondents were also asked to rate the importance of each technique/practice using either '*not important*,' '*moderately important*' or '*important*.' The 38 MAPs, which had been derived from the literature, relate to costing systems, budgeting, performance evaluation, information for decision-making, and strategic analysis.

4. INNOVATIONS IN DATA ANALYSIS AND INTERPRETATION

Our purpose was to apply the IFAC framework to investigate the sophistication level of management accounting in the sample industry. Increased sophistication is manifested by a move along the spectrum from cost determination and financial control at one extreme to value creation at the other. Our questionnaire sought respondents' opinions on the perceived value of both traditional and 'newer' management accounting techniques and the extent to which they are used.

To measure the sophistication level it was necessary to extend IFAC's four-stage management accounting evolution framework. Although the framework describes some broad characteristics of each stage, it does not provide illustrations of specific MAPs related to particular stages of evolution. In order to do this we had to, first, 'flesh out' the nature of each stage. This was done by supplementing the text of IFAC (1998) with insights from wider literature on the development of management accounting (e.g. Kaplan, 1984; Scapens, 1991; Ferrara, 1995; Allott, 2000; Allott, Weymouth, & Claret 2001; Birkett & Poullaos, 2001; Garrison, Noreen, & Seal, 2003). From this we were able to summarize the characteristics of each stage across the following four main dimensions

- the approximate period in history with which each stage is principally associated,
- the typical organizational positioning, or location, of management accounting at that stage,
- the principal role of management accounting, and finally,
- the main focus of management accounting's attention.

Table 1 shows our understanding of the characteristics of management accounting systems in each stage of evolution.

Armed with these characteristics we then used our judgement, informed by the literature and consultations with colleagues and participants at conferences,[6] to classify each of 38 MAPs into a stage of the evolution. Classification against four criteria was an interesting process, which inevitably required some compromise so we accept that the positionings are not unambiguous and, in some cases, are anachronistic. Nevertheless, the internal consistency of MAPs included in each stage was confirmed by Cronbachs' alpha[7] tests applied to our data. It should be remembered that, as shown in Fig. 1, each stage of evolution encompasses the practices in the previous stage in addition to the new set; for example, Stage 2 includes all MAPs that are included in Stage 1 as well as those arising at Stage 2. Table 2 shows the outcome of our classification of practices into each stage. The descriptive statistics of 'importance' and 'usage' and a statistic we describe as 'emphasis' (being the product of 'usage' and 'importance'), derived from our data, are included to help the illustration.

Again for the purposes of illustration, it is helpful to look at the extreme positions apparent from Table 2. Four MAPs were found to be indisputably

Table 1. Characteristics of Management Accounting Practices in Four Stages of Evolution.

	Stage 1: Cost Determination and Financial Control	Stage 2: Provision of Information for Management Planning and Control	Stage 3: Reduction of Waste in Business Resources	Stage 4: Creation of Value through Effective Resources Use
Representative period	Prior to 1950	1950–1964	1965–1984	1985 to date
Where positioned in organization	Similar to company secretarial	A 'staff' management activity	Management accounting an integral part of management. 'Owned' by all managers as the distinction between 'staff' and 'line' management becomes blurred	
Role	A necessary technical activity in 'running' an organization	Providing information to support 'line' management's operations	Managing resources (including information) to 'directly' enhance profits by bearing down on inputs	Directly enhance outputs and add value through strategy of 'leveraging' resources (especially information)
Main focus	Cost determination and controlling expenditure	Information for management planning, control and decision-making. Including basic model building	Reduction of waste/loss in business resources through process analysis and cost management technologies	Creation of value through using resources effectively to drive customer value, shareholder value and innovation

Table 2. Classification and Descriptive Statistics of Management Accounting Practices in the UK Food and Drinks Industry.

	Importance[a]		Usage[b]		Emphasis[c]	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Stage 1. Cost determination and financial control (CDFC)						
Using a plant-wide overhead rate	1.61	0.76	2.12	1.42	4.34	4.54
Budgeting for controlling costs	2.66	0.62	4.12	1.05	11.25	4.28
Flexible budgeting	2.05	0.78	2.70	1.40	6.32	4.82
Performance evaluation based on financial measures	2.71	0.59	4.08	1.20	11.43	4.42
Evaluation of major capital investments based on payback period and/or accounting rate of return	2.32	0.73	3.24	1.32	8.16	4.79
Stage 2. Provision of information for management planning and control (IPC)						
A separation is made between variable/incremental costs and fixed/non-incremental costs	2.32	0.74	3.30	1.27	8.43	4.73
Using departmental overhead rates	1.67	0.74	2.12	1.30	4.36	4.03
Using regression and/or learning curve techniques	1.17	0.45	1.24	0.61	1.64	1.83
Budgeting for planning	2.68	0.63	4.33	0.91	11.88	4.05
Budgeting with ‘what if analysis’	2.15	0.71	2.88	1.17	6.94	4.26
Budgeting for long-term (strategic) plans	2.33	0.75	3.05	1.25	7.76	4.45
Performance evaluation based on non-financial measures related to operations	2.16	0.78	2.97	1.40	7.33	4.98
Cost-volume-profit analysis for major products	2.36	0.72	3.14	1.26	8.17	4.63
Product profitability analysis	2.69	0.54	3.90	1.07	10.91	4.04
Stock control models	2.16	0.74	2.83	1.26	6.69	4.40
Evaluation of major capital investments based on discounted cash flow method(s)	1.92	0.77	2.32	1.31	5.27	4.47
Long-range forecasting	2.33	0.69	3.17	1.28	8.00	4.64

Table 2. (*Continued*)

	Importance[a]		Usage[b]		Emphasis[c]	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Stage 3. Reduction of waste in business resources (RWR)						
Activity-based costing	1.57	0.69	1.83	1.14	3.45	3.60
Activity-based budgeting	1.81	0.73	2.34	1.33	4.87	4.24
Cost of quality	1.73	0.70	2.05	1.16	4.18	3.70
Zero-based budgeting	1.54	0.70	1.99	1.28	3.82	4.15
Performance evaluation based on non-financial measure(s) related to employees	1.75	0.64	2.09	1.13	4.27	3.61
Evaluating the risk of major capital investment projects by using probability analysis or computer simulation	1.37	0.59	1.48	0.93	2.50	3.06
Performing sensitivity 'what if' analysis when evaluating major capital investment projects	1.87	0.73	2.38	1.28	5.29	4.38
Stage 4. Creation of value creation through effective use of resources (CV)						
Target costing	1.79	0.77	2.36	1.39	5.19	4.71
Performance evaluation based on non-financial measure(s) related to customers	2.32	0.71	3.04	1.33	7.63	4.68
Performance evaluation based on residual income or economic value added	1.43	0.62	1.63	1.03	2.80	3.21
Benchmarking	1.65	0.64	1.97	1.08	3.81	3.26
Customer profitability analysis	2.53	0.65	3.46	1.27	9.28	4.64
For the evaluation of major capital investments, non-financial aspects are documented and reported	2.19	0.72	2.94	1.23	7.21	4.44
Calculation and use of cost of capital in discounting cash flow for major capital investment evaluation	1.75	0.74	2.10	1.21	4.44	4.00
Shareholder value analysis	1.32	0.59	1.50	0.88	2.40	2.81
Industry analysis	1.41	0.61	1.65	1.14	2.89	3.43

Table 2. (*Continued*)

	Importance[a]		Usage[b]		Emphasis[c]	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Analysis of competitive position	2.19	0.75	2.89	1.19	7.03	4.28
Value chain analysis	1.69	0.79	2.10	1.38	4.51	4.70
Product life cycle analysis	1.46	0.66	1.65	0.93	2.87	2.92
The possibilities of integration with suppliers' and/or customers' value chains	1.68	0.74	2.08	1.17	4.21	3.89
Analysis of competitors' strengths and weaknesses	2.17	0.69	2.66	1.06	6.23	3.61

[a]Based on 3-point scale (1 = not important, 2 = moderately important, 3 = important).
[b]Based on 5-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often).
[c]The means of the emphases (usage × importance) for each firm – not the product of the mean usage and the mean importance. Surprisingly, perhaps, this would give different figures.

widely used and important (Those with mean 'emphasis' values, across the whole sample, above 10 – out of a possible 15). Two in the category relating to cost determination and financial control are *Budgeting for controlling costs* and *Performance evaluation based on financial measures*. The other two relate to provision of information for planning and control and are *Budgeting for planning* and *Product profitability analysis*. At the other end of the scale, are six well known practices that (with mean emphasis values below three) may be dismissed as peripheral. They are two 'operations research type' practices – *Regression and Learning curve techniques,* and *Risk evaluation with probabilities and simulation* – and four more modern techniques that are associated with 'strategic management accounting', i.e., the analysis of *Economic value, Shareholder value, Industry analysis* and *Product life-cycles.* This basic 'high-low' snapshot provides a strong indication that traditional management accounting seems 'alive and well.' The observation was supported by the means, by category, of the values reported for individual practices; these are shown in Table 3. It can be seen that the mean values for practices in categories CDFC and IPC are noticeably higher than those for less traditional categories RWR and CV.[8]

The next level of our analysis was the compilation of two lists with all 38 practices ranked in order of the perceived importance and usage

Table 3. Mean Values of Importance and Usage of Management Accounting Practices.

	Importance of MAPs (scale 1–3)	Usage of MAPs (scale 1–5)
Stage 1 practices. Cost determination and financial control	2.27	3.25
Stage 2 practices. Information for planning and control	2.16	2.94
Stage 3 practices. Reduction of waste of resources	1.66	2.02
Stage 4 practices. Creation of value	1.83	2.29

Table 4. Prediction of the Usage of Management Accounting Practices.

	Practices That Will be Phased Out	Practices That Will be Increasingly Adopted
CDFC		
	Plant-wide overhead rates	
IPC		
	Separation between fixed and variable costs	Cost-volume-profit analysis for major products
	Departmental overhead rates	Investment appraisal using DCF
	Non-financial measures related to operations	
RWR		Info concerning cost of quality
		Non-financial measures related to employees
CV		Analysis of competitors' strengths and weaknesses

respectively. From this we were able to identify those practices, which are placed significantly[9] different. On the assumption that, over time, the ranking of usage will, in many cases, move toward the ranking of importance, our interpretation is that practices ranked markedly higher in terms of 'importance' than 'usage' are likely to become more widespread and vice versa. On this basis we made the predictions shown in Table 4.

It can be seen that the data in Table 4 show that the practices with higher ranking of usage than importance dominated the more traditional 'Cost determination and financial control' (CDFC) and 'Information for planning and control' (IPC) categories. By contrast the practices showing markedly higher importance than usage dominated the 'younger' categories 'Reduction of waste' (RWR) and 'Creation of value' (CV).

The ultimate aim of our research was to arrive at a summary assessment of the state of evolution of a particular industry's management accounting. To this end, it was necessary to classify each respondent firm into one of the four stages of evolution. For each firm, an average composite score was calculated (based on the *emphasis* – importance $\times$ usage – indicated by respondents) across the MAPs grouped together by our categorization of practices shown in Table 2. Thus every firm had an average emphasis score for the four categories (predictor variables): CDFC, IPC, RWR and VC.

Cluster analysis was then applied. Cluster analysis is a statistical technique, which classifies a large set of objects (people, firms, etc.) into distinct subgroups based on predictor variables. If the cluster analysis is successful it should produce homogenous groups with respect to the group's scores on the predictor variables (Coolidge, 2000). The hierarchical agglomerate method was used to combine firms into four clusters, thereby permitting us to consider each cluster as representing a stage of evolution. Ward's method was used to measure the distance between each combination of two subgroups. This is commonly used to form clusters based on the squared Euclidean distance measure. First, the means for all predictor variables are calculated. Then, for each case, the squared Euclidean distance to the cluster means is calculated. These distances are summed for all the cases. At each step, the two clusters that merge are those that result in the smallest increase in the overall sum of the squared within-cluster distances (Norusis, 1994).

The output of the clustering procedures was that 30 firms were categorized in Cluster A, 21 in Cluster B, 47 in Cluster C and 15 in Cluster D. The mean scores of variables within each cluster are presented in Table 5, with F-tests for each clustering variable.[10,11]

Having established the theoretical validity of the cluster analysis, the next step involved labeling the clusters on the basis of our interpretation of the shared characteristics of its components. This was done by matching the clusters to related stages of evolution (Stage 1, Stage 2 etc.). According to IFAC's theoretical conception of management accounting evolution, companies in Stage 1 have more emphasis on CDFC practices and less emphasis on the practices in other sets (i.e. those relating to IPC, RWR and CV). Companies in Stage 2 place emphasis on practices in both CDFC and in IPC and less emphasis on practices in the other two sets (RWR and CV). Companies in Stage 3 have emphasis on CDFC, IPC and RWR and less emphasis on the fourth set CV. Finally, companies in Stage 4 have more emphasis on all four sets of CDFC, IPC, RWR and CV.

Table 5. Classification of Companies using Hierarchical Cluster Analysis.

Number of firms in each cluster	Clusters[a]				*F*-test	*P*
	A ($n = 30$)	B ($n = 21$)	C ($n = 47$)	D ($n = 15$)		
CDFC	9.74 (2.11)	5.94 (3.67)	8.29 (2.49)	10.53 (1.88)	12.28	0.000
IPC	8.87 (1.24)	4.54 (1.96)	6.77 (1.58)	10.14 (1.34)	51.23	0.000
RWR	5.10 (1.27)	2.01 (1.11)	2.83 (1.15)	6.50 (1.22)	63.38	0.000
CV	5.98 (0.99)	3.06 (1.88)	4.36 (1.29)	8.89 (1.14)	65.81	0.000
	Stage 3	Stage 1	Stage 2	Stage 4		

Note: The analysis was based on 113 companies due to incomplete responses from eight of the firms.
[a]Values in the table are mean scores of variables within clusters (standard deviation).

An inspection of the mean scores of CDFC, IPC, RWR and CV in Table 5 provides bases for preliminary labeling of the empirically derived clusters. Mean scores of firms in Cluster B are the lowest for all sets (CDFC, IPC, RWR and CV) – this suggests that Cluster B represents Stage 1 of the evolution of management accounting. Companies in Cluster C have higher mean scores for all of CDFC, IPC, RWR and CV than those of Cluster B. Thus, Cluster C can represent Stage 2 of the management accounting evolution.

Clusters A and Cluster D have higher mean scores for all sets of CDFC, IPC, RWR and CV than those of Clusters B and C. Also, mean scores of CV in both Clusters C and D are higher than those of RWR. Because the mean scores of all four sets of CDFC, IPC, RWR and CV in Cluster D are higher than those in Cluster A, we have considered that Cluster D best represents Stage 4. Thus, Cluster A represents Stage 3.

The data in Table 5 allowed us to conclude that of the 113 firms, 19% (21) are in Stage 1, 41% (47 firms) are in Stage 2, 27% (30) are in Stage 3 and 13% (15) are in Stage 4 of management accounting evolution. About 40% of firms have management accounting systems in either Stage 3 or Stage 4 of IFAC's evolution.

5. SUMMARY

The aim of this research note was to describe an application of the IFAC framework of the evolution of management accounting to a particular industry sector. In this note we have highlighted the following issues and research approaches:

- The IFAC framework has authority by virtue of the massive constituency that IFAC represents. Furthermore the framework is cited in academic and professional journals (e.g. Ittner & Larcker, 2001; Birkett & Poullaos, 2001; Sharman, 2003) and is being applied in programs such as the Malaysian National Awards for Management Accounting Best Practice (Abd Rahman, Omar, & Sulaiman, 2005). There is also a suggestion,[12] following IFAC's competency profiles pronouncement (IFAC, 2002) that it is the appropriate basis for assessing the practical experience of the Canadian Certified General accountants.
- In Tables 1 and 2 we have 'fleshed out' and operationalized the IFAC framework by classifying individual MAPs into one of four developmental stages. This provides a template useful for other empirical researchers, or the basis for academic dispute by theorists with alternative classifications.
- By multiplying scores of importance and usage we derive a composite statistic of 'emphasis' on each practice. As an absolute measure emphasis is not especially meaningful. It does, however, provide useful supplementary information, since for a practice to score highly, it is necessary for it to be both considered *important* and also *often* used. These are the practices that need to be particularly well documented by researchers and understood by aspirant practitioners.
- By identifying practices where perceived importance is significantly higher (or lower) than the present level of usage we suggest a basis for indicating that accounting practices will become increasingly used and those that will gradually be phased out.
- We provide an illustration of the application of cluster analysis to group firms according to their scores on the four stages of management accounting sophistication. This allowed us, in the underlying empirical study (Magdy Abdel-Kader & Robert Luther, 2006) to come to a conclusion as to the location of our sample on the IFAC spectrum of evolution.

We submit that our overall approach, and individual components, could be usefully applied in other contexts and in comparative cross-national, inter-industry or longitudinal studies.

NOTES

1. "IFAC is the global organization for the accountancy profession. It works with its 163 member organizations in 119 countries to protect the public interest by encouraging high-quality practices by the world's accountants" IFAC (2005).

2. Such as activity based techniques, strategic management accounting and the balanced scorecard.

3. For a review of empirical management accounting in North America, see Ittner and Larcker (2001) and Shields (1997), and within European countries see Bhimani (2002).

4. In addition, face-to-face interviews were carried out to refine the questionnaire ex ante and to check the reliability of the survey results ex post and seek further explanation for some of the responses.

5. It is the largest industry sector in the UK; Mann et al. (1999) indicate that it provides employment for over three million people from primary producers to manufacturers and retailers, and it accounts for 9% of gross domestic product. Despite this the sector is under-researched in the management accounting field.

6. Early drafts of the paper were presented at several workshops and conferences.

7. Cronbachs' alpha tests of internal consistency of MAPs, shown below, confirmed that the alphas for each stage had an acceptable level of reliability.

	Theoretical Range		Actual Range		Mean	Std. dev.	Alpha
	Min	Max	Min	Max			
Cost determination & financial control	1	15	1.75	15.00	8.467	2.957	0.6349
Management planning & control	1	15	1.27	12.50	7.366	2.362	0.7697
Reduction of waste in business resources	1	15	1.00	8.57	3.772	1.941	0.6954
Value creation through effective resource use	1	15	1.21	11.14	5.137	2.178	0.7890

8. For elucidation of these acronyms see Table 2.

9. Those in which the ranking of importance is three or more places are different from the ranking of usage.

10. The *p* values of the *F*-tests indicate that statistical differences exist for individual variables across clusters, but do not indicate that statistical differences exist between pairs of clusters.

11. To validate the cluster analysis, we performed multiple discriminant analysis on the four sets of composite management accounting practices (CDFC, IPC, RWR and VC) and the classification derived from cluster analysis. The results show that the four variables played significant roles in correctly classifying 95.5% of the firms

into their respective groups. More specifically, 95.2%, 93.5%, 100% and 93.3% of companies were correctly classified into clusters A, B, C and D, respectively.

12. www.caaa.ca/faculty_development/practice/comptencyreport.html.

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A NOTE ON THE IMPORTANCE OF PRODUCT COSTS IN DECISION-MAKING

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ABSTRACT

This paper uses the results of a questionnaire survey to conduct exploratory research into the importance of product costs in decision-making. The results of the research reveal that product costs are at least important in selling price, make-or-buy, cost reduction, product design, evaluating new production process and product discontinuation decisions. Product costs that were used directly in decision-making were more important than those that were used as attention directing information and they were more important in product mix, output level and product discontinuation decisions in continuous production processes manufacturing. In general, the importance of product costs in decision-making did not vary between the methods used to allocate and assign overheads to product costs, and it was not related to operating unit size, product differentiation, competition and the level of satisfaction with the product costing system.

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INTRODUCTION

Only a limited amount of research has examined the importance of product costs in decision-making. Some researchers have considered the importance of cost information, in general, without referring specifically to product costing. For example, in the USA, Emore and Ness (1991) found that cost information had a critical role in pricing, make-or-buy, cost control and product/market strategy decisions. In Belgium, Kerremans, Theunisse, and Van Overloop (1991) observed that cost information was rated as at least very relevant for decisions relating to sales strategy, investment and evaluating the efficiency of the production process. In addition, it was less relevant for production strategy decisions. In Finland, Virtanen, Malmi, Vaivio, and Kasanen (1996) noted the most important use of cost information was for product mix decisions followed by make-or-buy and pricing decisions, but it was not important in cost reduction decisions. In New Zealand, Hoque (2000) observed that cost information was important to management. It was important in pricing decisions, but the research did not subsequently consider its importance in other types of product-related decisions.

Four studies have considered the importance of product cost information and all of these have confirmed the importance of product costs in pricing decisions. In the USA, Cooper and Kaplan (1987) found that product costs were important in decisions relating to the pricing, introduction, discontinuation and the amount of effort given to selling products. In Finland, Lukka and Granlund (1996) observed that product cost information had its greatest importance in pricing, tendering and cost reduction decisions. Similarly, in Italy, Cescon (1999) noted the most important uses of product costs were in cost reduction, pricing, make-or-buy and investment decisions, and its least important role related to decisions about distribution channels. In Australia, Joye and Blayney (1990) found product costs were of major importance in the pricing decisions of the majority of companies.

Given the limited quantity of research into the importance of product costs in decision-making more research is needed to confirm the results of this descriptive research. In addition, there is a need to extend research to conduct exploratory research to assess the relationship of importance with other product costing and operating unit constructs. As a consequence, this paper uses the results of a questionnaire with qualified management accountants working in operating units in British manufacturing industry to conduct exploratory research to identify the importance of product costs in different types of decisions. We then develop a series of propositions about the extent to which the importance of product costs in decision-making varies between the methods used to allocate and assign overheads to products, between the use of product costs as either attention directing information or directly in decision-making, and between discrete part and assembly manufacturing and continuous production process manufacturing. In addition, we develop further propositions which consider whether the degree of importance of product costs in different decisions is related to the size of the operating unit, the degree of product differentiation of the products produced by the operating unit, the level of competition in the marketplace and management accountants' satisfaction with the product costing system.

The remainder of the paper is organized in the following way. The second section develops a series of research propositions. The third section describes the research method in terms of a questionnaire survey. The fourth section presents the research results and the final section concludes the paper.

RESEARCH PROPOSITIONS

Introduction

Given the exploratory nature of the research, the research objectives derived from the questionnaire are described in terms of seven propositions, rather than hypotheses, relating to the importance of product costs in decision-making. As this is exploratory research all of the propositions are expressed in null form.

Allocation and Assignment of Overheads

There are a number of methods that can be used to allocate and assign overheads to product costs. A number of organizations simplify the process of allocating and assigning overheads by calculating a blanket (or plant-wide) overhead rate for a factory or a group of factories irrespective of the production departments in which products were produced. Product costs calculated using blanket overhead rates, however, may not be accurate enough for decision-making. Drury and Tayles (1994) argue that it is difficult to justify the use of blanket rates because the availability of information technology allows firms to allocate and assign overheads to products at a relatively low cost using either production department overhead rates or production and service/support department overhead rates. An alternative method of incorporating overheads into product costs is to use activity-based costing (ABC) systems, which emerged in the mid-1980s to meet the demand for more accurate cost information. The potentially arbitrary nature of allocating and assigning overheads to products has led to some companies adopting direct (or variable) costing, whereby indirect overheads are excluded from product costs.

These methods of allocating and assigning overheads to products can be listed in order of decreasing detail and accuracy as an ABC system, the use production and service/support department rates, the use of production department rates, the use of a blanket rate and not assigning overheads to products by using direct costing. Given that Karmarkar, Lederer, and Zimmerman (1990) argued that the higher the importance of costs the more sophisticated should be the costing system, it is possible that operating units using more detailed methods to allocate and assign overheads to products and hence calculate more accurate product costs are more likely to place a higher level of importance on this cost information in decision-making than those using less detailed methods. Hence:

P1. The importance of product costs in decision-making does not vary with the methods used to allocate and assign overheads to products.

The Use of Product Cost Information in Decision-Making

Cooper and Kaplan (1991) argue that it is not practicable to generate the different relevant costs to use directly in each decision because of the large number of possible decisions, and hence the large number of possible costs that can be applied in those decisions. In this situation, it is necessary for organizations that sell many products to use product cost information as attention directing information to highlight those products for which special studies are required prior to a decision being made about those products. The special studies are used to estimate the incremental costs of decisions involving changes in the shared resources of support activities for each product or group of products. Thus, in this situation product cost information should not be used directly in decision-making. To the authors' knowledge there has not been any empirical research that has considered the importance of product cost information and the application of product costs as either attention directing information or directly in decision-making. Hence:

P2. The importance of product cost information in decision-making does not vary with the use of product cost information as attention directing information or directly in decision-making.

Discrete-part and Assembly Manufacturing and Continuous Production Process Manufacturing

Most discrete-part and assembly manufacturing are convergent manufacturing processes, whereby parts are manufactured into sub-assemblies that are combined to form the finished product. Reeve (1991) argues that the overhead costs relating to this type of manufacturing are high and can be as high as direct material costs, which explains why some of the initial efforts to describe the application of ABC were in this environment. Continuous manufacturing processes are divergent manufacturing processes. Here common raw materials enter the production process and by the end of production this input is divided into many different products with differing colors and sizes. Reeve (1991) argues that the differences between convergent and divergent manufacturing lead to problems accepting ABC in the latter environment. Specifically, Reeve (1991) notes that in continuous production process manufacturing overheads relating to, for example, raw material management and procurement do not make up a large proportion of overheads and hence it is less important to understand the cost drivers of these activities. Krumwiede (1998) and Ittner, Lanen, and Larcker (2002) have empirically tested Reeve's arguments and obtained the opposite result; namely that ABC is less likely to be adopted in discrete-part and assembly manufacturing environments. Research, however, has not considered whether the level of importance of product cost information in decision-making varies between these two types of manufacturing. Hence:

P3. The importance of product costs in decision-making does not vary between discrete-part and assembly manufacturing and continuous production process manufacturing.

Operating Unit Size

It has been argued that larger firms have the range and depth of facilities and resources to employ the skilled and qualified workforce to adopt innovations (Damanpour, 1992). In the context of management accounting, prior research has shown that larger companies have the resources to adopt innovative techniques, such as ABC (Booth & Giacobbe, 1998; Krumwiede, 1998; Clarke, Hill, & Stevens, 1999). Following on from this, it is possible that larger operating units will find product costs to be more important in decision-making. When the size of an operating unit is defined as its turnover and number of employees this leads to the following propositions.

P4a. The importance of product costs in decision-making unrelated to the turnover of the operating unit.

P4b. The importance of product costs in decision-making is unrelated to the number of employees in the operating unit.

Product Differentiation

Johnson and Kaplan (1987) note that the increasing automation of the production process has led to companies expanding the range of products they produce. To meet customer demand companies are able to produce differentiated products, as well as standardized products. The production of differentiated products has led to an increase in support department costs associated with their production and, associated with this, the need to record these costs accurately in product costs. It is possible that product cost information may be more important in these circumstances. Hence:

P5. The importance of product costs in decision-making is unrelated to the degree of product differentiation.

Competition

A firm that is in an increasingly competitive environment is likely to require a more accurate cost system for decision-making (Kaplan & Cooper, 1998). If not, competitors are likely to take advantage of incorrect decisions made from data obtained from an inaccurate cost system. The higher the level of competition, the higher will be the degree of exploitation by competitors arising from a company making incorrect decisions after using an inaccurate cost system. Thus, operating units facing a high level of competition may regard product costs as being more important in decision-making because of the need to make correct decisions. Hence:

P6. The importance of product costs in decision-making is unrelated to the level of competition facing operating units.

Satisfaction with the Product Costing System

The more satisfied management accountants are with the accuracy of costs produced by their product costing systems, it is possible that product cost information will be more important in decision-making because management accountants will have more confidence in its accuracy and appropriateness in decision-making. Hence:

P7. The importance of product costs in decision-making is unrelated to the management accountants' satisfaction with the product costing system.

RESEARCH METHODS

A questionnaire was used as part of a wider research project about product costing in manufacturing industry to obtain information about the importance of product costs in decision-making.[1] Potential questionnaire respondents were obtained from a list of 854 members of the Chartered Institute of Management Accountants (CIMA) in Great Britain with job titles of cost, management or manufacturing accountant, and employed in British manufacturing industry. An introductory letter was posted to all potential respondents explaining the research objectives and informing them that they would receive a questionnaire in two weeks time. The questionnaires were accompanied by a covering letter, which assured them of the confidentiality of responses, and a stamped-addressed envelope. Any non-respondents to the mailing of the questionnaire were posted a follow-up letter two weeks later, and a further follow-up letter, questionnaire and stamped-addressed envelope were posted to non-respondents four weeks after the questionnaire had been sent out. After identifying potential respondents who worked in the same operating unit, operating units which had closed down, potential respondents who had left their operating unit and those who were not involved in manufacturing industry or product costing, the total working in independent operating units declined to 673. A total of 280 usable responses were received (effective response rate = 41.6%) of which 274 used product costs in decision-making.

The operating units of the 274 respondents that used product costs in decision-making had a mean turnover of £138.0 m (standard deviation = 431.1), a 5% trimmed mean of £63.1 m and a median of £30.0 m (useable $n = 271$). Also, these operating units had a mean number of employees of 715.5 (standard deviation = 1,372.4), a 5% trimmed mean of 483.5 and a median of 340 employees (useable $n = 266$).[2]

Information about the importance of product costs in decision-making was obtained by asking respondents to rate the importance of product costs in each of selling price, make-or-buy, cost reduction, product mix, output level, product design, evaluating new production process and product discontinuation decisions with responses of: 1 = very important, 2 = important, 3 = neither important nor unimportant, 4 = unimportant, 5 = very unimportant and 6 = do not make this type of decision. By identifying the respondents who did not make a particular decision it was possible to determine the extent to which product costs were important when a particular decision was taken, and these scores were reverse scored for data analysis.

Information about the allocation and assignment of overheads to products was obtained by responses to a question asking how each operating unit calculated overhead rates with responses of using a blanket overhead rate, production department rates, production and service/support department rates, ABC and direct (or variable) costing. Details of how product cost information was used in decision-making was obtained from a single question with responses of used as attention directing information, as a guide to whether further investigations should be conducted; used directly in decision-making and other. A single question asked respondents to specify the type of manufacturing undertaken with responses of discrete-part and assembly manufacturing, continuous production process manufacturing and other.

Two separate questions asked respondents to indicate their operating unit's size by specifying the approximate turnover and the approximate number of employees working at their operating unit. The three psychometric constructs measured the level of product differentiation, competition and satisfaction with the product costing system were developed by the authors and consisted of two-item measures with responses on a five-point Likert scale. The measure of product differentiation required responses to two questions, with responses to one question ranging from 1 = virtually all customized products to 5 = virtually all standardized products, and the other ranging from 1 = at least 95% of products produced are unique and produced to satisfy individual customer's orders to 5 = at least 95% of products are identical products produced in large quantities. The measure of competition asked for responses to two questions about the general level of competition in the marketplace. Responses to the first question ranged from 1 = very intense to 5 = very slack, and to the second question from 1 = very high to 5 = very low. Satisfaction with the product costing system was measured by responses to two questions with possible responses ranging from 1 = very satisfied to 5 = very dissatisfied. The responses to each of the psychometric constructs were summed and reverse scored for data analysis.

The discriminant validity of the three psychometric constructs was confirmed first by a factor analysis of the six items making up the psychometric constructs using a principal components analysis with a varimax rotation.

This confirmed that the six items loaded into a pure three-factor solution relating to each of the three proposed two-item constructs. The second method of confirming discriminant analysis involved calculating the product moment correlation coefficients between the factors and these confirmed that they were not related significantly and appear to be measuring different constructs.[3] The reliability of the three psychometric constructs was confirmed by Cronbach's (1951) α and these were all satisfactory. The α were for product differentiation ($\alpha = 0.95$, useable $n = 266$), competition ($\alpha = 0.84$, useable $n = 271$) and satisfaction with the product costing system ($\alpha = 0.90$, useable $n = 274$).

RESULTS

Table 1 shows the levels of importance that questionnaire respondents attached to the use of product costs in different decisions. Over 75% of the respondents felt product costs were either important or very important in selling price, cost reduction and evaluating new production process decisions. Just over half felt it was at least important in make-or-buy, product design and product discontinuation decisions. It was particularly important in selling price decisions with 81.0% of respondents stating that product costs were at least important in this decision. The respondents indicated that product costs were of least importance in product mix and output level decisions.

The results of the Kruskal–Wallis tests in Table 2 show there is no significant difference ($p \geqslant 0.05$) in the level of importance of product cost information in decision-making between the methods used to allocate and assign overheads to product costs.[4] Table 3 shows the results of the independent sample t-tests comparing the level of importance of product costs in decision-making when the information is used as attention directing information and when it is used directly in decision-making.[5] In all cases product cost information is more important when it is used directly in decision-making, and this difference is significant ($p < 0.05$) in selling price, make-or-buy, cost reduction, product mix and product design decisions.

Table 4 reveals there are no significant differences ($p \geqslant 0.05$) between the importance of product costs in decision-making between operating units in discrete-part and assembly manufacturing and continuous production process manufacturing for selling price, make-or-buy, cost reduction, product design and evaluating new production process decisions.[6] For product mix, output level and product discontinuation decisions the level of importance

Table 1. The Importance of Product Costs in Decision Making.

Level of Importance	Type of Decision															
	Selling Price		Make-or-buy		Cost Reduction		Product Mix		Output Level		Product Design		Evaluating New Production Process		Product Discontin-uation	
	N	(%)	*N*	(%)	*N*	(%)	*N*	(%)	*N*	(%)	*N*	(%)	*N*	(%)	*N*	(%)
Very important	112	(44.0)	67	(29.2)	87	(33.5)	33	(14.0)	22	(9.0)	59	(23.1)	75	(28.6)	60	(24.5)
Important	111	(43.7)	130	(56.8)	125	(48.1)	80	(33.9)	69	(28.4)	128	(50.0)	136	(51.9)	97	(39.6)
Neither important nor unimportant	21	(8.3)	21	(9.2)	36	(13.8)	80	(33.9)	83	(34.2)	41	(16.0)	41	(15.7)	48	(19.6)
Unimportant	7	(2.8)	9	(3.9)	11	(4.2)	31	(13.1)	52	(21.4)	21	(8.2)	9	(3.4)	29	(11.8)
Very unimportant	3	(1.2)	2	(0.9)	1	(0.4)	12	(5.1)	17	(7.0)	7	(2.7)	1	(0.4)	11	(4.5)
Total making this decision	254	*(100.0)*	229	*(100.0)*	260	*(100.0)*	236	*(100.0)*	243	*(100.0)*	256	*(100.0)*	262	*(100.0)*	245	*(100.0)*
Do not make this decision	15		30		7		36		27		16		10		26	
Total useable respondents	269		259		267		272		270		272		272		271	
Median[a]	4.00		4.00		4.00		3.00		3.00		4.00		4.00		4.00	
Mean[a]	4.27		4.10		4.10		3.38		3.11		3.82		4.05		3.68	
Standard deviation[a]	0.82		0.78		0.82		1.05		1.06		0.97		0.78		1.10	

[a]The statistics represent the importance of the decision for those making the decision based upon a five-point scale ranging from 5 = very important to 1 = very unimportant.

Table 2. Kruskal–Willis Tests of the Differences of the Importance of Product Costs in Decision Making between the Methods of Allocating and Assigning Overheads.

Type of Decision	Chi-square	*P*
Spelling price decisions	4.681	0.322
Mark-or-buy-decisions	5.149	0.272
Cost reduction decisions	1.154	0.886
Product mix decisions	1.863	0.761
Output level decisions	1.337	0.855
Product design decisions	6.341	0.175
Evaluating new production process decisions	4.325	0.364
Product discontinuation decisions	0.720	0.949

Table 3. Independent Sample *T*-Tests of the Difference in the Importance of Product Costs in Decision Making between the Use of Product Cost Information in Decision Making.

Type of Decision	Use as Attention Directing Information			Use Directly in Decision Making				
	N	Mean[a]	Standard Deviation[a]	*N*	Mean[a]	Standard Deviation[a]	*t*	*p*
Selling price decisions	112	4.04	0.86	121	4.46	0.76	3.920	0.000
Make-or-buy decisions	99	3.83	0.86	114	4.32	0.67	4.653	0.000
Cost reduction decisions	113	3.96	0.84	125	4.27	0.73	3.103	0.002
Product mix decisions	103	3.23	0.98	115	3.56	1.09	2.297	0.023
Output level decisions	106	3.02	1.10	118	3.23	1.04	1.488	0.138
Product design decisions	110	3.65	0.92	126	3.98	1.00	2.555	0.011
Evaluating new production process decisions	114	3.96	0.75	127	4.13	0.79	1.796	0.074
Product discontinuation decisions	108	3.57	1.10	120	3.81	1.09	1.619	0.107

[a]The statistics represent the importance of the decision based upon a five-point scale ranging from 5 = very important to 1 = very unimportant.

Table 4. Independent Sample T-Tests of the Difference in the Importance of Product Costs in Decision Making between Discrete-part and Assembly Manufacturing and Continuous Production Process Manufacturing.

Type of Decision	Discrete-part and Assembly Manufacturing			Continuous Production Process Manufacturing				
	N	Mean[a]	Standard Deviation[a]	*N*	Mean[a]	Standard Deviation[a]	*t*	*p*
Selling price decisions	98	4.19	0.97	120	4.29	0.73	0.850	0.396
Make-or-buy decisions	92	4.09	0.77	103	4.08	0.83	0.081	0.935
Cost reduction decisions	100	4.15	0.69	121	4.03	0.92	1.079	0.282
Product mix decisions	88	3.14	1.11	114	3.53	1.03	2.581	0.011
Output level decisions	95	2.87	1.07	112	3.20	1.09	2.138	0.034
Product design decisions	100	3.93	0.96	118	3.71	0.92	1.717	0.087
Evaluating new production process decisions	102	4.02	0.76	124	4.03	0.81	0.121	0.904
Product discontinuation decisions	98	3.42	1.19	111	3.86	1.00	2.907	0.004

[a]The statistics represent the importance of the decision based upon a five-point scale ranging from 5 = very important to 1 = very unimportant.

of product costs in decision-making was significantly ($p < 0.05$) higher in continuous production process manufacturing.

In general, there is no relationship between the importance of product costs in decision-making and operating unit size, product differentiation, competition and the level of satisfaction with the product costing system. An exception is the selling price decision where there is a significant and negative correlation between importance and operating unit turnover ($r = -0.185$, $p = 0.004$, useable $n = 245$) and number of employees ($r = -0.138$, $p = 0.033$, useable $n = 239$),[7] and a significant and positive correlation with product differentiation ($r = 0.144$, $p = 0.023$, useable $n = 248$) (see Table 5). This result shows that product costs are more important in selling price decisions in smaller operating units than larger operating units, and in operating units selling differentiated products.

Table 5. Product Moment Correlation Coefficients between the Importance of Product Costs in Decision Making and Operating Unit Size, Product Differentiation, Competition and Satisfaction with the Product Cost System.

Type of Decision	Operating Unit Size		Product Differentiation	Competition	Cost System Satisfaction
	Turnover	Number of Employees			
Selling price decisions	$r = -0.185$[a] ($n = 245$)	$R = -0.138$[b] ($n = 239$)	$r = 0.144$[c] ($n = 248$)	$r = 0.048$ ($n = 251$)	$r = 0.072$ ($n = 254$)
Make-or-buy decisions	$r = 0.044$ ($n = 220$)	$r = 0.055$ ($n = 216$)	$r = -0.033$ ($n = 221$)	$r = 0.079$ ($n = 226$)	$r = 0.091$ ($n = 229$)
Cost reduction decisions	$r = 0.065$ ($n = 250$)	$r = 0.101$ ($n = 244$)	$r = -0.049$ ($n = 252$)	$r = -0.040$ ($n = 257$)	$r = 0.053$ ($n = 260$)
Product mix decisions	$r = -0.093$ ($n = 229$)	$r = -0.017$ ($n = 223$)	$r = 0.016$ ($n = 230$)	$r = -0.005$ ($n = 234$)	$r = 0.019$ ($n = 237$)
Output level decisions	$r = -0.006$ ($n = 236$)	$r = 0.023$ ($n = 230$)	$r = 0.057$ ($n = 237$)	$r = 0.006$ ($n = 241$)	$r = 0.113$ ($n = 244$)
Product design decisions	$r = 0.035$ ($n = 247$)	$r = 0.024$ ($n = 241$)	$r = 0.019$ (n = 248)	$r = 0.087$ ($n = 253$)	$r = 0.057$ ($n = 256$)
Evaluating new production process decisions	$r = -0.095$ ($n = 254$)	$r = -0.094$ ($n = 248$)	$r = 0.093$ ($n = 254$)	$r = -0.031$ ($n = 259$)	$r = 0.107$ ($n = 262$)
Product discontinuation decisions	$r = -0.024$ ($n = 238$)	$r = -0.046$ ($n = 232$)	$r = 0.094$ ($n = 237$)	$r = -0.025$ ($n = 242$)	$r = -0.053$ ($n = 245$)

[a] $p = 0.004$.
[b] $p = 0.033$.
[c] $p = 0.023$.

CONCLUSION

This exploratory research has used a questionnaire to examine the importance of product costs in decision-making. Product cost information was found to be at least important in selling price, make-or-buy, cost reduction, product design, evaluating new production process and product discontinuation decisions. Product cost information was significantly more important when used directly in decision-making than when used as attention directing information in pricing, make-or-buy, cost reduction, product mix and product design decisions. This may be because product cost information may be regarded as being more important when it is actually being used in a decision rather than as a guide for possible future decisions. Product cost information may be significantly more important in continuous production process manufacturing than in discrete-part and assembly manufacturing for product mix, output level and product discontinuation decisions because continuous production processes lead to the production of many different products for which a variety of product related decisions will need to be made.

In general, the importance of product costs in decision-making did not vary with the methods used to allocate and assign overheads to products and was not related to operating unit size, product differentiation, competition and the level of satisfaction with the product costing system. Exceptions to this were a significant and negative correlation between the importance of selling price decisions with operating unit size and a positive correlation with product differentiation. Product cost information may be more important in smaller operating units because this may be one of the few pieces of information they have when making pricing decisions. As a consequence, this product cost information is more important in a smaller operating unit than in a larger operating unit that may have access to a wider variety of information, including market-based information. Similarly product cost information may be more important in the selling price decisions of operating units producing a variety of products because of the need to record accurately the profit of each product as a means of assisting with the pricing decision.

The limitations of this research stem primarily from the use of a questionnaire, which may mean that the results suffer from non-response bias, question misinterpretation etc. Furthermore, the measures of importance in each decision were measured by a single item for which the reliability could not be assessed. Given the dearth of prior research that has examined the importance of product costs in decision-making there is a need to replicate this research. There is a need to extend the research to consider whether the importance of product cost information varies between different manufacturing industries.

In addition, there is a need to consider whether the frequency of use of product costs in decision-making varies for different types of decision and to examine the relationship between the frequency with which product costs are used in each type of decision and the importance of product costs in that decision to confirm whether or not costs which are used frequently in decision-making are also important in decision-making. Also, the research should consider whether the importance of product costs varies with other constructs like different types of competition (Khandwalla, 1972), competitive strategy (Miles & Snow, 1978) and perceived environmental uncertainty (Milliken, 1987).

Research should also consider the extent to which non-accountants, such as production, marketing and general managers use product costs in decision-making and the relative importance they give to product cost information compared to other information. For example, Tornberg, Jämsen, and Paranko (2002) found that product designers in a Finnish manufacturing company regarded cost information as important in product design decisions but less important than quality, durability, performance and meeting customers' specifications.

This paper represents an exploratory examination into the importance of product costs in decision-making. It is hoped that the paper will be of interest to other researchers to conduct further research in this area in the future.

NOTES

1. A copy of the questionnaire is available from the first author.
2. As the distributions of the turnover and number of employees were positively skewed, the 5% trimmed mean and median turnover and number of employees are also reported. The 5% trimmed mean excludes the largest 5% and smallest 5% of observations from the distributions of turnover and number of employees.
3. The results of the factor analysis and the correlations between the constructs are available from the first author.
4. The low sample sizes especially for operating units using ABC ($n = 7$) means that a non-parametric Kruskal–Wallis test is used instead of a parametric one-way ANOVA.
5. Operating units that use product costs both as attention directing information and directly in decision making are not included in the analysis because it is not known whether product costs are used in each of the decisions as either only attention directing information, only directly in decision making or in both of these ways.

6. Operating units that use either both of these or other types of manufacturing are excluded from the analysis.

7. As the distributions of both measures of operating unit size are positively skewed the correlation between importance and of operating units size is based on a $\log_{10}$ transformation of the size measures.

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DECISION CONTROL OF PRODUCTS DEVELOPED USING TARGET COSTING

Robert Kee and Michele Matherly

ABSTRACT

For firms using target costing, separating decision management from decision control helps to minimize the agency costs incurred throughout a product's economic life. Prior literature focuses on decision-management issues related to target costing, such as new product development (i.e., initiation) and production (i.e., implementation). In contrast, this article highlights the decision control aspects of target costing, which consist of ratifying product proposals and monitoring the product's implementation. While products initiated with target costing are chosen because they meet their allowable cost, product ratification requires assessing how well products contribute toward strategic goals, such as improving the firm's market value. To facilitate the ratification decision, this article develops an equation for determining a product's net present value (NPV) based on the same accounting data used during the initiation process. The article also describes monitoring a product's implementation through periodic comparisons to flexible budgets and a post-audit review at the end of the product's economic life.

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Target costing is a process of managing the development and production of products to ensure that they earn a satisfactory level of profitability. Consequently, target costing acts as both a cost management and profit management system. The technique was initially developed at Toyota Motor Corporation and is widely used among Japanese manufacturing firms (Bayou & Reinstein, 1997). Several large international U.S. and European manufacturing firms, such as, Boeing, Caterpillar, Texas Instrument, and DaimlerChrysler, have also adopted target costing (Ansari & Bell, 1997). The philosophy underlying target costing is that 80–85% of a product's life cycle cost is determined during the development stage. As a result, the greatest potential for influencing or managing a product's cost occurs during its development. The target costing process begins with market analysis to decide upon a product's price and sales quantity. A product's target cost is computed by subtracting the firm's desired profit margin from the product's market price. Designers and engineers then create the product to meet its allowable cost.

A critical aspect of any process, such as target costing, is the separation of decision management and decision control (Fama & Jensen, 1983). Decision management involves the initiation of a proposal and its implementation, while decision control consists of ratifying the proposal and monitoring its execution. The separation of decision management and control encourages individuals who initiate and implement a decision to act in the firm's best interest, rather than their self-interest. For instance, without adequate separation of decision management and control, a manager could pursue projects that maximize short-run earnings to influence his/her near term performance and reward. Conversely, a manager may be averse to accepting risky projects whose unsystematic risk the firm can diversify away, which the manager cannot. Consequently, separating decision management from decision control minimizes agency costs by reducing opportunistic and suboptimal decisions for the firm.

The academic and practice literature provide an extensive coverage of the decision-management issues associated with target costing. Field studies and surveys describe in detail target costing initiation and implementation. However, little appears to be known about the decision control aspects of target costing. Consequently, managers have limited theoretical and/or practical guidance for the ratification and monitoring aspects of target costing. The purpose of this paper is to discuss the target costing issues relevant to decision control and to demonstrate how decision ratification and monitoring can be performed consistently with the goal of maximizing firm value.

The remainder of the paper is organized as follows. The next section outlines the different approaches to product development, and reviews studies of target costing. The following section describes target costing decision management and control. The subsequent sections discuss economic value added (EVA[1]) and develop mathematical equations to aid managers in determining a product's impact on the firm's market value. A numerical example then illustrates how to use the mathematical equations for product ratification and how to monitor the product throughout its life cycle. The final section presents the paper's summary and conclusions.

PRODUCT DEVELOPMENT

Many U.S. and European firms follow a cost-based approach to product development. Under this methodology, firms design a proposed product, estimate its cost, and then add the desired profit margin to arrive at the product's selling price.[2] However, the market, rather than the firm, establishes the relationship between a product's price and sales volume. If the product's price exceeds the market price, the firm may not sell a sufficient quantity of the product to earn its desired profit margin. Consequently, the firm must consider lowering its price to increase sales volume as well as reducing the product's cost to increase its profit margin. However, 80–85% of a product's life cycle costs are committed during the development stage. Therefore, limited potential exists for reducing a product's cost after production begins. A firm in this situation faces abandoning the product, redesigning the product, or selling the product and earning a minimal or negative return.[3]

Target costing overcomes this deficiency of the cost-based approach to product development by recognizing the primacy of a product's market and structuring the development process to incorporate market demands and constraints. Target costing takes a product's expected market price less its expected profit margin to obtain the product's allowable cost. A product's market price is frequently determined using market research and analysis. The results of this analysis facilitate understanding the functionality and quality that customers desire in a product, and the price they are willing to pay for these features. When evaluating the market price, the firm must also consider additional information, such as forecasted demand for the product and the impact of competing products.

The next step in target costing is to estimate the profit margin necessary for the firm to manufacture the proposed product. Firms use a variety of techniques to compute a product's profit margin. Cooper and Slagmulder

(1997) report that a sample of Japanese firms assigned profit margins to new products based on the margin earned by similar products in the past. Conversely, Gagne and Discenza (1995) note that firms selected a profit margin consistent with the profitability goals in the firm's strategic plan, while Kato, Böer, and Chow (1995) indicate that firms established profit margins based on medium-term plans consistent with the corporate strategic plan. Once selected, the desired profit margin is subtracted from a product's market determined price to estimate its allowable cost. The allowable cost represents the maximum product cost which the firm can incur and achieve its profit objectives.[4]

Under target costing, a multidisciplinary team works within the constraint of the product's allowable cost to design the product and its production processes to meet the functionality and quality demands of customers.[5] In effect, the market attributes of a product become inputs into its development process. Using functional cost analysis, the team decomposes the product's target cost into functions, and then into the components that provide these functions (Yoshikawa, Innes, & Mitchell, 1994, 1995). The team then endeavors to design the product and its components to meet the desired functionality, quality, and cost.

As the design evolves, the product's cost is estimated and compared to its target cost. Typically, the estimated cost will exceed the product's allowable cost. The difference between estimated and target cost represents the cost reduction facing the product development team. When a product's estimated cost exceeds its target cost, value engineering is used to analyze the functions of a product to find ways to achieve these functions more efficiently. For example, value engineering may be used to simplify how components are produced and to determine how they may be manufactured with fewer inputs and/or lower-cost inputs. After redesign, the product's revised cost is compared to its target cost. The redesign process continues until either a product's expected cost is equal to or less than its target cost or the potential for further cost reductions are minimal.

At the beginning of the product life cycle, the target costing process explicitly considers the level of profitability necessary to justify a new product's production. The process ensures that products are produced at a cost sufficient to generate their desired profit. In fact, the cardinal principle of target costing is that firms should only manufacture a product with an expected cost less than or equal to its target cost (Cooper & Slagmulder, 2002).[6] This principle preserves the discipline of target costing during product development. Once a product enters production, Japanese firms use Kaizen costing to increase the efficiency of a product's production processes.

Kaizen costing is important to maintain a product's profitability when the firm confronts increased competition and/or future unanticipated price reductions (Cooper & Slagmulder, 1997).

Target Costing Research

Studies of target costing have examined the characteristics of adopting firms, factors that affect target costing performance, and problems and limitations of its use. Much of the target costing literature describes either case-study observations (e.g., Shank & Fisher, 1999; Bhimani & Neike, 1999; Schmelze, Geier, & Buttross, 1996) or in-depth field studies (e.g., Lin & Yu, 2002; Nicolini, Tomkins, Holti, Oldman, & Smalley, 2000; Lee & Monden, 1996) of firms adopting target costing. These descriptive studies focus on the product development and implementation aspects of target costing. In addition, several surveys of management accounting practices identify how prevalent target costing use has become (e.g., Chen, Romocki, & Zuckerman, 1997). For instance, separate surveys of Indian and Malaysian companies report target cost adoption rates of 35% and 41%, respectively (Sulaiman, Ahmad, & Alwi, 2004).

The characteristics of firms that use target costing have been explored with both small samples (e.g., Swenson, Ansari, Bell, & Kim, 2003; Hibbets, Albright, & Funk, 2003; Ellram, 2000) and surveys (e.g., Tani, 1995; Dekker & Smidt, 2003). These studies reveal that, while cost reduction is the primary reason, most firms have multiple reasons for adopting target costing (Ellram, 2000; Dekker & Smidt, 2003).[7] Other motives for target-cost adoption include cost disclosure and understanding, continuous improvement and competitiveness, improved supplier communications and early supplier involvement, and improved design and accountability (Ellram, 2000). Target-cost users also operate in intensely competitive environments (Swenson et al., 2003; Hibbets et al., 2003; Dekker & Smidt, 2003). According to Hibbets et al. (2003), rivalry among competitors may be the strongest competitive force faced by target-cost users. Additional characteristics of firms that use target costing include extensive supply chains and relatively long product development cycles (Swenson et al., 2003).

Experimental settings have been used to examine how organizational characteristics influence target-costing decisions. For instance, Monden, Akter, and Kubo (1997) investigated how participation in the target-setting process and controllability of the performance-evaluation information affect cost-reduction performance. Their results suggest that a target-cost environment, which allows individuals to participate in the target-setting process and evaluates them strictly on controllable information leads to better performance. In a similar experiment, Akter, Lee, and Monden (1999) examined how the specificity and difficulty of the target cost influence cost-reduction performance. After splitting their sample based on the degree of goal acceptance, Akter et al. (1999) found that, regardless of goal specificity, high-goal acceptance accompanied by tight goals led to better performance. Finally, Everaert and Bruggeman (2002) explored the influence of time pressure on new product development with and without target costs. The low-pressure group achieved lower product costs when provided with target cost data than without the data. However, supplying the high-pressure group with target costs had little impact on their product cost. Instead, the combination of high time pressure along with target cost data resulted in longer development times compared to the high-pressure group without target costs.

Nicolini et al. (2000), Kato et al. (1995), and Davila and Wouters (2004) have discussed problems and limitations of target costing. For instance, Nicolini et al. (2000) describe the difficulties they encountered when trying to establish a target-costing process in the UK construction industry. Kato et al. (1995), after studying two Japanese firms that use target costing, assert that it can produce "longer development times, employee burnout, market confusion, and organizational conflict." (p. 49) Finally, Davila and Wouters (2004) suggest that target costing is inappropriate for firms in high-technology industries because it (1) focuses attention away from revenue drivers, and is (2) too time-consuming, (3) too linear and bureaucratic, and (4) too detailed.

TARGET COSTING DECISION MANAGEMENT AND CONTROL

Fama and Jensen (1983) describe the four different aspects of the decision process as initiation, ratification, implementation, and monitoring. Decision initiation, the first step in the decision process, involves analyzing alternatives and proposing a course of action for management to ratify. During the decision-ratification process, managers review the proposals and recommendations from various groups. The ratification process leads to accept or reject decisions regarding which proposals the firm will pursue. Ratified proposals are then implemented. Throughout the implementation phase, monitoring activities are used to review and reward performance. Fama and Jensen (1983) refer to the combination of decision initiation and implementation as decision management, and decision ratification and monitoring as decision control. According to agency theory, separating decision management from decision control limits the ability of managers to pursue goals that conflict with those of the firm (Weir, 1996).

With target costing, individuals at different levels within the firm, with different skills and perspectives, are responsible for decision management and control. Decision management is a product-oriented process. The personnel involved in decision management specialize in engineering, production, purchasing and other areas with expertise in the design, development, and manufacturing of the firm's products. As part of product initiation, these operational employees use their unique skills and knowledge to design a product and its production processes within the constraints of customer expectations of the product, and at a cost sufficient to justify its production. For firms in highly competitive markets, satisfying both these constraints may require intensive analysis and redesign of a product. During product implementation, operational employees engage in an ongoing process of product and production process improvement. Development teams initiating a target-costing proposal have a strong commitment to their recommendation and a significant investment of time and effort in preparing the proposal for ratification. Similarly, managers implementing a product also have considerable interest in its success. Consequently, personnel involved in decision management risk a loss of reputation and lower performance evaluations, if a product proposal is rejected and/or poorly implemented.

In a target-costing environment, the firm's personnel responsible for decision control ratify proposals prepared during product initiation, and monitor product implementation. Unlike the target costing development team, managers ratifying product proposals do not have an emotional attachment to the product or the personal investment of time and effort. Consequently, managers who ratify product proposals are less biased in their analysis and in their decision of whether to produce the product. Likewise, the individuals monitoring a product's implementation are expected to provide an impartial review of its performance over time and an objective analysis of the need for taking corrective action.

Managers make the decision to ratify a target costing product proposal from a strategic, rather than an operational, perspective. Financial theory suggests that one of management's primary goals is to maximize the firm's share price (Stewart, 1991). As a result, the managers who ratify proposals should integrate the potential effect a product will have on the firm's stock market value into their analysis. Furthermore, since managers review competing proposals for the firm's resources, they must also incorporate into their analyses the capital asset investment needed to support a prospective product's production. Financial theory advocates evaluating investments using discounted cash-flow techniques. Thus, decision control involves assessing a product's impact on the firm's stock market value, while taking into account the product's investment in capital assets based on its discounted cash flows. Recent advances in financial theory suggest that EVA can deal with these issues simultaneously.

EVA AND DECISION CONTROL

In the 1990s, Stewart (1991) proposed using EVA to enhance a firm's market performance. Operationally, a firm's EVA reflects the difference between its net operating profit after taxes less a charge for the cost of capital used to earn the profit. Stewart (1991) asserts that a firm's stock market performance is more closely associated with EVA than with accounting measures of income.[8] By letting EVA guide resource allocation decisions, managers can make economic choices congruent with the firm's goal of increasing its stock market performance.

Firms commonly use EVA at the corporate, divisional, and strategic business unit level of their organizations. However, EVA supporters advocate using it at successively lower levels of a firm's operations. For example, Kaplan and Cooper (1998) propose driving EVA down to the firm's activities, products, and customers by integrating it with activity-based costing (ABC).[9] As noted by Kaplan and Cooper (1998), ABC overcomes the distortions of traditional cost systems associated with assigning overhead to cost objects, while EVA corrects the failure of financial accounting to include the cost of capital as an economic expense. Integrating EVA and ABC allows managers to identify which products offer a return greater than the firm's cost of capital. Equally important, managers can assess the efficient and inefficient use of capital in the firm's operations. Finally, managers can determine where cost improvement efforts are needed and where divesture decisions may be required.

Firms can integrate EVA and ABC by tracing assets, along with other resources, to the activities where they are involved in providing an activity's service (Kee, 1999). The book value of the assets used by an activity times the firm's cost of capital represents the activity's capital cost. An activity's capital driver rate is computed by dividing its capital cost by the practical capacity of the activity's service or cost driver. Then, capital cost is charged to a product based on the quantity of the capital driver consumed by the activity during its production. Finally, the sum of the product's cost of capital for each activity is subtracted from its after-tax income to compute its EVA. In effect, integrating EVA and ABC means treating the cost of capital similar to other resources that are traced to activities and then to the products that consume an activity's output. By incorporating EVA, ABC no longer measures a product's accounting profitability but rather its economic income.

EVA represents the value added or destroyed during some period of time. Stewart (1991) notes that the present value of a firm's future EVAs is the firm's market value added, which is the premium or discount between the firm's market value and its capital. Hartman (2000) and Shrieves and Wachowicz (2001) provide mathematical proofs that discounting an investment's EVA over successive periods of its expected life to an investment's acquisition date is equivalent to its net present value (NPV). Similarly, the present value of a product's EVA over its life equals its NPV.[10] Employing Stewart's (1991) concept of market value added, the discounted value of a product's EVA over its life, which is its NPV, reflects the incremental effect the product is expected to have on the firm's market value.

The mathematical proofs by Hartman (2000) and Shrieves and Wachowicz (2001) demonstrate that a product's EVA based on accounting income, rather than its cash flows, can be used to measure its NPV. Their work has several important implications for decision control. First, by discounting a product's EVAs to when production begins, managers assess the product's expected impact on the firm's market value by relying on the same data used for product development (i.e., initiation). Second, managers who base their assessment on the product's discounted EVAs also simultaneously consider the economic feasibility of the capital asset investment used to manufacture the product. Finally, comparing a product's planned and actual discounted EVAs reflects the economic value created or destroyed from product implementation.

A MODEL FOR DECISION RATIFICATION OF TARGET COSTING PRODUCTS

Before ratifying recommendations made by the target costing development team, managers need to consider the product's expected impact on the firm's market value. As part of the ratification decision, managers can assess whether the proposed product will create or destroy market value by discounting the product's EVA over its expected life, which is equivalent to computing its NPV. A product's NPV will be derived using the following notations:

i = period index, $i = 1, 2, \ldots, N$,
j = activity index, $j = 1, 2, \ldots, M$,

P_i = unit price in period i,
$C_{i,j}$ = operating cost of activity j in period i,
Q_i = quantity produced and sold of a product in period i,
$I_{i,j}$ = book value of long-term assets used by activity j in period i,
I_{WC} = investment in net working capital for a product,
r_i = cost of capital rate in period i, and,
t_i = effective tax rate in period i.

When a subscript or index is omitted, the variable has been summed over the missing subscript. For example, C_i, or the unit cost of the product in period i, represents the sum of the operating cost of $C_{i,j}$ for each activity j. Similarly, C is the unit cost of a product over each period of its life when C_i is the same for each i. The subscripts for the other variables can be interpreted in a similar manner.

Using Hartman (2000) and Shrieves and Wachowicz (2001) mathematical proofs, a product's NPV over its economic life may be expressed as

$$NPV = \sum_{i=1}^{N}\sum_{j=1}^{M}\frac{(P_i - C_{ij})Q_i(1-t_i)}{(1+r_i)^i} - \sum_{i=1}^{N}\sum_{j=1}^{M}\frac{r_i I_j(N+1-i)}{N(1+r_i)^i} - \sum_{i=1}^{N}\frac{r_i I_{WC}}{(1+r)^i} \quad (1)$$

On the right-hand side of Eq. (1), each term is discounted to when production of the product will start, i.e., the beginning of period one. The first term measures a product's operating income after taxes,[11,12] while the second and third terms measure the cost of capital for the investment in production assets and working capital, respectively. In the second term, the expression $(N+1-i)/N$ adjusts the assets' book value as successive period's depreciation expense is taken. By summing across each activity used to manufacture a product, Eq. (1) may be restated as

$$NPV = \sum_{i=1}^{N}\frac{(P_i - C_i)Q_i(1-t_i)}{(1+r_i)^i} - \sum_{i=1}^{N}\frac{r_i I(N+1-i)}{N(1+r_i)^i} - \sum_{i=1}^{N}\frac{r_i I_{WC}}{(1+r)^i} \quad (2)$$

If a product's price, unit operating cost, annual product demand, effective tax rate, and cost of capital rate are constant over a product's life, Eq. (2) simplifies to

$$NPV = \frac{(P-C)Q(1-t)\left[1-(1+r)^{-N}\right]}{r} - \frac{I}{1}\left[\frac{1}{1} - \frac{1-(1+r)^{-N}}{Nr}\right] I_{WC}\left(1-(1+r)^{-N}\right) \quad (3)$$

Similar to Eq. (1), the first term on the right-hand side of Eq. (3) is the present value of a product's operating income after taxes, while the second and third terms measure the cost of capital on the investment in operating assets and working capital, respectively. Throughout the remainder of the paper, Eq. (3) will be referred to as the NPV model. As indicated in this model, the present value of the cost of capital on the investment in operating assets equals the difference between the value of the funds initially invested, or I, and the present value of the depreciation expense taken over the product's life. Conversely, the investment in working capital, or I_{WC}, is the difference between the initial outlay for working capital and the present value of the funds recovered at the end of the product's life.

Basing the final decision to accept or reject a product on the NPV model has several advantages.[13] First, managers relying on this model will make a product's ratification decision with the same accounting data used by the target costing development team. Therefore, this model minimizes potential confusion between the team initiating the decision and managers ratifying it. Second and more importantly, the NPV model incorporates into the ratification decision the economics of the capital asset and working capital investments needed to manufacture the product. Thus, through a product's NPV, managers gain insight into the expected impact of the product upon the firm's market value.

ILLUSTRATION OF THE TARGET-COSTING DECISION PROCESS

This section provides a numerical example illustrating how a firm can use a product's NPV to separate decision management and decision control in a target-costing environment.

Decision Initiation

Consider a firm evaluating whether to manufacture Product X and/or Product Y. Market research indicates that customers are willing to pay \$48.50 and \$19.00 for Products X and Y, respectively. The research further suggests that at these prices, annual product demand will be 500,000 and 2,000,000 units, respectively, over each product's three-year economic life. The firm requires a profit margin of 10% on products similar to X and Y. Each product's target cost is computed by taking the product's market price less its unit profit, or desired profit margin, times the product's price. As indicated in Panel I of Table 1, the allowable costs of Products X and Y are \$43.65 and \$17.10, respectively.

To achieve the products' allowable cost, a multidisciplinary team was commissioned to design each product and its production processes. After the initial design, the team compared the estimated cost of Products X and Y to their target cost. Like most firms using target costing, the estimated cost of each product's initial design exceeded its allowable cost. The product development team worked to reduce each product's estimated cost using value engineering to identify different product and process design alternatives. This iterative process of product development continued until each product's estimated cost was less than or equal to its allowable cost or further cost reductions were no longer feasible. Table 1 lists the resulting resource requirements, required investment, cost driver rates, and projected unit costs in Panels II–V, respectively.

Panel II identifies each product's resource requirements. For example, each unit of Product X needs a half pound of material, one labor hour, and two machine hours in the assembly activity. The firm plans to manufacture Product X in batches of 1,000 units. Each production run requires two set-up hours and 20 purchase orders from the set-up and purchasing activities, respectively. Finally, to incorporate new features and technology, Product X calls for 600 engineering drawings from the engineering activity during each year of its economic life. The resource requirements for Product Y can be interpreted in a similar fashion.

Panel III identifies the investment in operating assets and working capital required to produce and sell Products X and Y. The first column of Panel III lists each production-related activity, along with its cost driver. The capital investment and the capacity these funds provide are given in the second and third columns for Product X and fourth and fifth columns for Product Y. For each production-related activity, the investment reflects the capacity needed to manufacture the product's expected demand. Product X requires \$30,000,000 of capital investment to acquire the machinery and other long-term assets needed for production-related activities, compared to \$32,280,000 for Product Y. The last item in Panel III is the net working capital required to support each product.

The cost driver rate computations for the overhead-related activities used to manufacture each product appear in Panel IV. The second column lists the cash expenditures needed to manufacture Product X. The third column contains the annual depreciation cost associated with each activity. The depreciation is computed using each activity's asset cost (Panel III) and assuming straight-line depreciation over a three-year economic life.[14,15]

Table 1. Investment, Cost, and Operating Data.

Panel I: Target Cost	Product X	Product Y
Desired Profit Margin	10%	10%
Market Based Price	$ 48.50	$ 19.00
Desired Profit Margin	4.85	1.90
Target Cost per Unit	$ 43.65	$ 17.10

Panel II: Product Resource Requirements	Product X	Product Y
Direct Material (Lbs @ $5/Lb)	0.5 Lbs /Unit	0.5 Lbs /Unit
Direct Labor (DLH @ $15/DLH)	1 DLH/Unit	0.5 DLH/Unit
Assembly (MH)	2 MH /Unit	0.5 MH /Unit
Set-up (Hours)	2 Hours/Batch	1 Hours/Batch
Purchasing (Orders)	20 Orders/Batch	12 Orders/Batch
Engineering (Drawings)	600 Drawings	500 Drawings
Batch Size	1,000	1,000
Expected Annual Demand (units)	500,000	2,000,000
Useful Life	3 years	3 years

Panel III: Required Investment	Product X		Product Y	
Activity (Cost Driver):	Invested Funds	Practical Capacity	Invested Funds	Practical Capacity
Assembly (MH)	$ 24,000,000	1,000,000	$ 24,000,000	1,000,000
Set-up (Hours)	1,200,000	1,000	2,400,000	2,000
Purchasing (Orders)	1,200,000	10,000	2,880,000	24,000
Engineering (Drawings)	3,600,000	600	3,000,000	500
	$ 30,000,000		$ 32,280,000	
Working Capital (net)	$ 1,200,000		$ 1,900,000	

Panel IV: OH-Related Cost Driver Rates	Cash Expenditures	Depreciation Expense*	Operating Cost	Practical Capacity	Cost Driver Rates
Assembly (MH)	$ 2,000,000	$ 8,000,000	$ 10,000,000	1,000,000	$ 10.00
Set-up (Hours)	200,000	400,000	600,000	1,000	$ 600.00
Purchasing (Orders)	600,000	400,000	1,000,000	10,000	$ 100.00
Engineering (Drawings)	240,000	1,200,000	1,440,000	600	$ 2,400.00
	$ 3,040,000	$ 10,000,000	$ 13,040,000		

Panel V: Projected Unit Cost	Cost Driver Rate	Input Quantity Product X	Input Quantity Product Y	Unit Cost** Product X	Unit Cost** Product Y
Direct Material (Lbs)	$ 5.00	250,000	1,000,000	$ 2.50	$ 2.50
Direct Labor (DLH)	$ 15.00	500,000	1,000,000	15.00	7.50
Assembly (MH)	$ 10.00	1,000,000	1,000,000	20.00	5.00
Set-up (Hours)	$ 600.00	1,000	2,000	1.20	0.60
Purchasing (Orders)	$ 100.00	10,000	24,000	2.00	1.20
Engineering (Drawings)	$ 2,400.00	600	500	2.88	0.60
				$ 43.58	$ 17.40

*Straight -line depreciation is used.

**Unit cost is the product of the cost driver rate and the input quantity needed to manufacture a product divided by the product's annual demand.

Each activity's operating cost, found in the fourth column, is the sum of its cash expenditures and depreciation expense. In the final column, each activity's operating cost is divided by its practical capacity to estimate its cost driver rate. For example, the assembly activity's cash expenditures are $2,000,000 and its annual depreciation expense is $8,000,000. Therefore, the assembly activity's annual operating cost equals $10,000,000. This amount is divided by the assembly activity's capacity of 1,000,000 machine hours to arrive at a cost driver rate of $10 per machine hour. The cost driver rates for the other activities listed in Panel IV are computed in a similar manner.

Products X and Y use the same activities and assets in their production. The operating cost of Product Y's activities and their capacities are assumed to be proportional to that of Product X. Consequently, the cost driver rates for the activities required to manufacture Product Y are the same as those for Product X.

Panel V shows the projected unit cost calculation of Products X and Y, which is based on the data from Panels II, III, and IV. The first column of Panel V lists the resource inputs and overhead-related activities, along with their related cost driver, needed to manufacture each product. The second column contains the cost driver rates originally presented in Panels II and IV. The third and fourth columns identify the quantity of inputs needed to manufacture Products X and Y, respectively. These amounts are estimated from the data provided in Panel II. The final two columns detail each product's projected unit cost, $43.58 for Product X and $17.40 for Product Y. The projected unit cost is computed by multiplying each activity's cost driver rate times the quantity of its cost driver needed, and then dividing by the product's annual demand. Comparing the data in Panels I and V reveals that Product X's projected cost is less than its allowable cost ($43.58 versus $43.65, respectively), while Product Y's expected cost is greater than its target cost ($17.40 versus $17.10, respectively). Based on their analyses, the multidisciplinary team recommended that management accept Product X and reject Product Y.

Decision Ratification

The managers ratifying Products X and Y should begin by reviewing the reliability of the product demand, cost, and investment data presented by the target costing development team (see Table 1). Next, to evaluate the products using the NPV model, the managers must determine an appropriate cost of capital rate and tax rate.[16] The managers ratifying Products X and Y estimated that a cost of capital rate of 10% appropriately reflected each product's risk, and that the firm's effective tax rate of 20% captured their tax effects upon the firm. Substituting these amounts into the NPV model, along with the relevant data for each product found in Table 1, yields an NPV for Products X and Y of –$535,778 and $372,367, respectively.[17] Despite exceeding its target profit margin of 10%, Product X's negative NPV indicates that this product destroys rather than creates economic value for the firm. Conversely, Product Y's profit margin falls below its target profit margin of 10%, but is projected to add economic value to the firm.

The NPV model enables managers ratifying the product development decision to identify cases where the product's target profit margin is insufficient to justify its production (e.g., Product X), and to discover products that increase firm value even though they fail to achieve their target profit margin (e.g., Product Y). During the ratification process, products with a negative NPV may be sent back to the target costing development team to search for further cost reductions. Ultimately, products that do not earn a positive NPV will be rejected. If managers making the ratification decision reject a product, they can use the NPV model to help the development team understand their decision by showing that the product destroys economic value. Conversely, the NPV model can also be used to explain the acceptance of a product with a positive NPV, despite its failure to earn its target profit margin. In this case, this model reveals that the product adds economic value to the firm. Since the NPV model relies on the data provided by the target costing development team, using it to explain the decision to accept or reject a product should help minimize confusion between the operational personnel initiating the proposal and the managers ratifying it.

The target costing development team, with its operational focus, developed the proposals for Products X and Y by benchmarking profit margins from similar products. However, managers who made the ratification decision, evaluated the products based on strategic objectives, such as their potential for increasing stock performance. By relying on the NPV model, managers will only ratify products that are expected to earn a positive NPV, which is consistent with the strategic objective of increasing the firm's market value. As a result, contrary to the development team's expectations, management decided to produce Product Y.

Decision Monitoring

Decision monitoring, which is the second aspect of decision control, involves two types of reviews. Throughout a product's life, managers evaluate the product's performance as well as the individuals in charge of its implementation by periodically comparing actual to planned results. In contrast, the second type of review, a post audit of the product, occurs only at the termination of the product's economic life.

During a product's implementation, operational personnel adjust a firm's manufacturing processes by focusing on a product's short-term (i.e., daily, weekly, and monthly) performance measurements (e.g., defective units, rework, scrap, and yield rates). Conversely, managers responsible for decision control develop an overview of a product's performance by comparing its planned and actual results at periodic intervals (i.e., quarterly and/or annually). This monitoring function enables the decision control managers to review the actions of operational personnel and to evaluate how well they have maintained operational efficiency. By highlighting deviations between planned and actual performance over a period of months, managers monitoring the product's implementation can discover trends and repetitive problems, and separate causes of operational inefficiencies from their symptoms. This information helps identify problematic aspects of the firm's operations and directs management resources toward eliminating inefficiencies in the firm's production processes. At times, the deviations between planned and actual performance result from overly optimistic estimates of the quantity and cost of resources used to manufacture a product. In such cases, periodic monitoring allows the firm's management to revise its plan for subsequent operations using more accurate data.

Table 2 presents data used to monitor the implementation of Product Y. Panels I and II of Table 2 provide the actual and budgeted cost data for the first quarter's production. In Panel I, the second column lists the actual units of Product Y manufactured and the quantity of direct material, labor, and overhead-related resources consumed. The total cost of the inputs used in production, actual cost driver rates, and actual unit cost appear in the remaining three columns, respectively. The actual cost driver rates in the fourth column are computed by dividing the total cost of an input by the quantity of the input consumed. For example, the actual direct material cost driver rate of $5.00 equals the $1,249,500 total cost of direct materials divided by the 250,000 lb. of direct materials used to manufacture Product Y. Similarly, the actual unit cost for each input in the fifth column equals the total cost of each input divided by the actual number of units of Product Y manufactured in the first quarter. Except for engineering, the cost of the firm's inputs is closely tied to Product Y's production. However, the firm incurs the entire year's engineering cost at the beginning of each year. Since manufacturing and sales of Product Y are uniform over time, the first quarter's results include one fourth of the annual engineering cost.

Managers who decided to manufacture Product Y relied on the target costing development team's projected sales of 2,000,000 units of Product Y each year. These annual sales figures translate into expected sales of 500,000 units each quarter. However, as seen in Panel I of Table 2, only 490,000 units were actually sold during the first quarter of production. Furthermore, a comparison of planned to actual unit cost (see Panel V of Table 1 and Panel I of Table 2, respectively) indicates that actual cost exceeded planned cost by \$0.322245 per unit ($=$ \$17.40−\$17.722245). While these deviations from planned performance may seem small, the significance of the first quarter's operations can be understood by forecasting future results based on its sales and cost data. For instance, substituting annual sales of 1,960,000 units, or four times first quarter's sales, and actual unit cost data into the NPV model yields a projected NPV of –\$1,011,517. When managers ratified Product Y, they expected an NPV of \$372,367. However, if the first quarter's results continue, the realized value of Product Y will decline by \$1,383,884 relative to the amount originally expected. By periodically monitoring a product's performance, managers can determine when deviations from expectations occur and ensure that operational personnel involved with the product's implementation take appropriate corrective action.

The original budget for Product Y and the actual operating results for the first quarter appear in Panel II of Table 2. The first quarter's actual operating income after taxes was \$139,120 less than originally budgeted. This difference arose from the lost contribution margin associated with the 10,000 fewer units sold than expected, and inefficiencies in the first quarter's production. The projected contribution margin per unit for Product Y of \$2.20 equals its price of \$19.00 less combined unit- and batch-level costs of \$16.80 (see Panel V of Table 1). Therefore, the 10,000 fewer units sold resulted in lost contribution margin of \$22,000 and a reduction of operating income after taxes of \$17,600. In addition, the cost of the engineering activity, a product-level cost, was originally based on projected output of 500,000 units. Since the firm only manufactured 490,000 units in the first quarter, the actual cost per unit for engineering exceeded expectations by \$0.012245.

To evaluate manufacturing efficiencies and inefficiencies, Panel II of Table 2 includes a flexible budget based on Product Y's actual sales. The flexible budget reflects the revenue and costs that should have been incurred for Product Y's first quarter actual sales of 490,000 units. The difference between the actual revenue and cost and those in the flexible budget measures the deviation of each activity from efficient operations. As shown in the final column, except for revenue and engineering, all of the variances are negative, indicating operating inefficiencies. The assembly activity has the largest variance of –\$107,800, increasing the expected cost of assembly from \$5.00 per unit (see Panel V of Table 1) to \$5.22 per unit (see Panel I of Table 2). While the other activities' variances are substantially smaller than

Table 2. Monitoring of Product Y.

Panel I: First Quarter Results	Quantity	Total Cost	Actual Cost Driver Rate	Actual Unit Cost
Production and Sales (Units)	490,000			
Direct materials (Lbs)	250,000	$ 1,249,500	5.00	$ 2.550000
Direct labor (DLH)	244,000	3,679,900	15.08	7.510000
Assembly (MH)	250,000	2,557,800	10.23	5.220000
Set-up (Hours)	495	303,800	613.74	0.620000
Purchasing (Orders)	5,950	592,900	99.65	1.210000
Engineering (Drawings)*	500	300,000	600.00	0.612245
		$ 8,683,900		$ 17.722245
Panel II: Comparison to Budget	**Original Budget**	**Actual Results**	**Flexible Budget**	**Variance**
Quarterly Demand (Units)	500,000	490,000	490,000	
Revenue	$ 9,500,000	$ 9,310,000	$ 9,310,000	$ -
Direct Materials	$ 1,250,000	$ 1,249,500	$ 1,225,000	$ (24,500)
Direct Labor	3,750,000	3,679,900	3,675,000	(4,900)
Assembly	2,500,000	2,557,800	2,450,000	(107,800)
Set-up	300,000	303,800	294,000	(9,800)
Purchasing	600,000	592,900	588,000	(4,900)
Engineering*	300,000	300,000	300,000	-
Operating Expenses	$ 8,700,000	$ 8,683,900	$ 8,532,000	$ (151,900)
Operating Income Before Taxes	$ 800,000	$ 626,100	$ 778,000	$ 151,900
Tax Expense (20%)	160,000	125,220	155,600	30,380
Operating Income After Taxes	$ 640,000	$ 500,880	$ 622,400	$ 121,520
	Annual Budget	**Actual Results**		
Panel III: Budgeted and Actual NPV	**Years 1-3**	**Year 1**	**Year 2**	**Year 3**
Annual Demand (Units)	2,000,000	1,985,000	1,998,500	2,000,000
Revenue	$ 38,000,000	$ 37,715,000	$ 37,971,500	$ 38,000,000
Operating Expenses	34,800,000	34,806,050	34,864,733	34,831,000
Operating Income Before Taxes	3,200,000	2,908,950	3,106,767	3,169,000
Tax Expense (20%)	640,000	581,790	621,353	633,800
Operating Income After Taxes	$ 2,560,000	$ 2,327,160	$ 2,485,414	$ 2,535,200
Capital Cost (10%)				
Operating Assets		3,228,000	2,152,000	1,076,000
Working Capital		190,000	190,000	190,000
Annual EVA		$ (1,090,840)	$ 143,414	$ 1,269,200
NPV	$ 372,367	$ 80,420		

*The first quarter includes one fourth of the entire year's product-level cost (i.e., engineering) of $1,200,000, which was incurred at the beginning of the year.

assembly's, collectively they increased Product Y's operating cost, which led to a $44,100 decrease in its operating income.

As part of the monitoring activity, managers analyzing Product Y's performance should review the results from Panels I and II of Table 2 with operational personnel who implement the product's marketing and production activities. Questions asked might include why Product Y's sales fell 10,000 units below projections and why costs were $151,900 more than expected. The insights gained from operational personnel about their knowledge of these issues and the corrective actions taken will help managers monitoring Product Y determine whether the situation warrants further attention. As part of the monitoring process, the performance of Product Y will be reviewed at the end of each successive quarter, and annually, using actual and budgeted data similar to that presented in Panels I and II of Table 2. By comparing the current period's results to those of prior periods, the managers monitoring Product Y's operations can assess whether identified problems were addressed. They can also evaluate whether new problems have emerged and how effectively they are being managed.

A final review, or post audit, of Product Y should be performed at the end of its economic life. A post audit involves evaluating a product's performance over its entire economic life to promote organizational learning. Conducting a post audit helps managers identify problems incurred, assess how well they were managed, and better understand the strengths and weaknesses of the firm's operations. A comprehensive review of all aspects of a product from its conception to its termination provides a wealth of insight into the firm's marketing and manufacturing capabilities as well as its limitations. Equally important, a post audit generates information for improving the development and production of future products.

The post audit begins by comparing a product's planned and actual operating performance over its economic life. The second column in Panel III of Table 2 lists the annual budgeted operating income after taxes computed when Product Y was originally ratified. Product Y's actual operating income after taxes for each year appears in the remaining three columns. As seen in Panel III, Product Y never achieved its planned operating income after-tax of $2,560,000, although the firm made progress toward attaining this goal in years two and three.

Another aspect of the post audit process relates to evaluating the ratification decision, which includes comparing a product's projected NPV to its actual NPV. The actual data in Panel III also lists the cost of capital below each year's actual operating income after taxes. In year one, the cost of capital equals Product Y's investment (see Panel III of Table 1) times the cost of capital rate of 10%. Since operating assets are depreciated, the capital cost associated with these assets declines each year. Consequently, the cost of capital in years two and three reflects the book value of assets used to manufacture Product Y at the beginning of the period times the 10% cost of capital rate. However, the cost of capital associated with working capital remains the same each year since this investment relates to a non-depreciable asset.[18] For each year, Product Y's EVA equals the actual operating income after taxes less its total cost of capital. Discounting the EVA for each year to the beginning of period one yields Product Y's actual NPV of $80,420. Each year, the budgeted EVA can be computed by subtracting the total cost of capital for the year listed in Panel III from the annual budgeted operating income after taxes of $2,560,000. This calculation results in a budgeted EVA of –$858,000, $218,000, and $1,294,000 in years one, two, and three, respectively. Discounting each budgeted EVA to the beginning of period one derives the original projected NPV for Product Y computed using the NPV model of $372,367. Even though Product Y did not achieve its entire expected NPV, the post audit reveals that the decision to ratify the product was appropriate.

During the post audit, managers also reexamine a product's quarterly and annual reviews, since they present a comprehensive history of the product's economic life. The marketing and production problems described in these reviews provide managers with information they can use to improve future products. For instance, by analyzing a product's history, managers can assess the reliability of the original sales and cost estimates, which may lead to more accurate forecasts during the product development stage of future products. Besides improved forecasts, such an analysis can also help managers anticipate problems with future products and develop strategies to prevent them from occurring. Moreover, analyzing management's response to the problems documented in a product's reviews can identify areas where additional training of the firm's personnel may be beneficial.

SUMMARY AND CONCLUSIONS

Decision management includes initiation and implementation decisions, while decision control consists of ratification and monitoring. Fama and Jensen (1983) propose that separating decision management from decision control helps to minimize agency cost. They argue that because of this separation, individuals are more likely to act in the best interest of the firm, rather than their self-interest. However, little has been written concerning the application of Fama and Jensen's proposal to managerial accounting.

This article examines the separation of decision management from decision control in the context of target costing. Operational personnel involved in the product initiation stage of target costing invest a significant amount of their time, energy, and creativity in the iterative process of designing a product to achieve its allowable cost. Similarly, the firm's personnel implementing a product designed with target costing have a substantial commitment to meeting the product's expected functionality, quality, and cost parameters. Therefore, operational personnel developing a product have a vested interest in its acceptance, while those implementing the product have a personal interest in its perceived success. The separation of decision control from decision management promotes an independent evaluation of a product with respect to its ratification. Similarly, the monitoring aspect of decision control provides an impartial evaluation of a product's implementation, and helps identify problems and ways to correct them.

The product initiation phase of target costing involves designing a product to meet a profit goal, frequently, based on the profit margin of similar products. However, product ratification includes assessing a product's impact on strategic objectives, such as increasing the firm's market value. Product ratification also requires evaluating the economics of the capital asset investment necessary to manufacture a product. Managers can combine these two aspects of the ratification decision by using the NPV model developed in this article. This model relies on the work of Hartman (2000) and Shrieves and Wachowicz (2001) who demonstrate through mathematical proofs that discounting an investment's EVAs is equivalent to its NPV. Consequently, the NPV model computes a product's economic income based on the accounting data used during the product's development. Incorporating the same data during product ratification and initiation aids in minimizing confusion between managers responsible for the different types of target cost decisions.

This article also describes monitoring a product's performance through two different types of review. First, monitoring that occurs at periodic intervals throughout a product's implementation involves evaluating deviations between a product's planned and actual performance. This analysis highlights issues encountered during the product's production to direct resources toward correcting operational inefficiencies. The second type of monitoring, a post audit, reviews a product's performance at the end of its economic life. A post audit compares a product's expected and realized NPV, and identifies factors that account for the difference. Monitoring a product at periodic intervals during its life and at the termination of its production helps identify patterns, trends, and problematic issues in the firm's initiation, ratification, and implementation processes. More importantly, these two types of review stimulate learning and lead to improvements in the development and implementation of future products.

NOTES

1. EVA is a registered trademark of Stern Stewart and Company.
2. See, for example, Barfield, Raiborn, and Kinney (2003).
3. Once a product's research and development expenditures have been incurred, they become a sunk cost. Consequently, even though the product generates a minimal or negative return, the firm may decide to produce the product based on its expected future revenue and expenses.
4. Technically, external conditions and the market for the firm's product establish its allowable cost, while a product's target cost is determined internally by the firm's design and production capabilities. Sometimes the firm's design and production capabilities are unable to achieve a product's allowable cost. In this situation, the firm must identify the cost reduction that can be attained. The unachievable part of the cost reduction is called the strategic cost-reduction challenge. A product's target cost equals its market price less both the desired profit margin and the strategic cost-reduction challenge. A strategic cost-reduction challenge of zero means a product's allowable and target cost are the same. According to Cooper and Slagmulder (2002), many firms blur the distinction between allowable and target cost. Therefore, throughout the paper, allowable and target cost are used synonymously, similar to their treatment in the target cost literature and their treatment by many firms.
5. As a strategic management accounting practice, target costing requires a cross-functional team effort. In their survey of target cost adopters, Dekker and Smidt (2003) report that while product development and product design are the two departments most involved in the target-costing process, other participants include product planning and finance/accounting.
6. According to Cooper and Slagmulder (2002), firms occasionally break the cardinal rule. For example, "products that create high visibility for the firm, products that introduce the next generation of technology, or products that fill a critical gap in the product line" may be produced even though their expected cost exceeds their target cost (Cooper & Slagmulder, 2002, p. 11).
7. Interestingly, Dekker and Smidt (2003) report that Dutch firms use cost management practices with characteristics similar to target costing, although they rarely call it target costing.
8. Empirical studies of the relationship between EVA and stock market performance relative to accounting income measures are somewhat mixed. Chen and Dodd (1997) reported a higher association between EVA and stock price returns than with accounting and residual income variables. Conversely, Biddle, Bowen, and Wallace (1997) found that earnings were more highly associated with stock price returns than was EVA. The data in both studies used Stern Stewart's publicly available database that includes a small number of standard adjustments to earnings. However, Stern Stewart makes additional adjustments to its clients' incomes to determine their EVA.

Thus, the data used by Chen and Dodd (1997) and Biddle et al. (1997) may not fully reflect the EVA of the firms in their studies.

9. See Lee (2003) for an extended discussion of the cost and benefits of ABC relative to other cost systems.

10. Financial theory suggests that a firm's stock price already captures current and future anticipated positive NPV projects (McConnell & Muscarella, 1985; Brown, Lonie, & Power, 1999). Even so, additional unexpected investments in positive NPV projects will increase a firm's stock market performance when sufficient information about the new investment reaches the market (McConnell & Muscarella, 1985). When a firm's management has lost the market's confidence, announcement of positive NPV projects may not increase the firm's stock market performance (Brown et al., 1999). However, as the market receives information verifying management expectations, the firm's stock market performance should respond accordingly.

11. A product does not create value for the firm until all of its costs, including those imposed externally on the firm, are recovered. Consequently, both EVA and NPV are computed on an after-tax basis.

12. If a firm sells a product in countries with different tax rates, the economics of target costing become more difficult to evaluate. The higher tax rate in one country may reduce a product's target cost to the point that it cannot be manufactured at this cost. Conversely, the lower tax rate in another country can make a product's target cost relatively easy to achieve. Consequently, a product's target cost in each country must be evaluated from a global, rather than individual country, perspective. That is, target cost for the product in each country should be established from a joint analysis of the product's prospective price, sales quantity, and tax rate in each country. For further discussion of multinational tax planning see Scholes, Wolfson, Erickson, Maydew, and Shevlin (2002).

13. In cases where a product's price, unit operating cost, annual demand, effective tax rate, and/or cost of capital rate are not uniform over a product's life, then Eq. (1) or Eq. (2) should be used in lieu of Eq. (3).

14. Frequently, the assets used to manufacture a product are not product specific and have an economic life longer than the product's life. In such cases, the depreciation and cost of capital for these assets should be limited to the periods when the assets are used to manufacture the product. Conversely, if the assets are product specific, their useful life should reflect the life of the product they will produce.

15. Other depreciation methods, such as sum of the year's digits, could also be used to compute a product's target cost. Straight-line depreciation was chosen for its simplicity of exposition in the paper.

16. Corporate finance has a well-developed body of research for estimating a firm's weighted average cost of capital (WACC). To evaluate the cost of capital for individual projects, many firms classify projects into risk categories. The WACC is subjectively increased (decreased) for categories with more (less) risk than that of the firm. A project is assigned to a category based on its risk relative to that of the firm; then, its cash flows are discounted using the category's risk-adjusted cost of capital. Conversely, the capital asset pricing model can be used to determine a project's risk-adjusted cost of capital. For an extended discussion of the WACC, its measurement and related issues, see Brigham and Houston (2001).

17. The annual projected cash inflows for Product Y total $13,320,000 in year one and two and $15,220,000 in year three. Years one and two cash inflow is the sum of Product Y's operating income after taxes, of $2,560,000, plus depreciation expense of $10,760,000. Year three cash flow is the sum of operating income after taxes, depreciation expense of $10,760,000, and the recovery of net working capital of $1,900,000. The initial cash outlay was $32,280,000 for operating assets and $1,900,000 for working capital. The NPV for an initial investment of $34,180,000 and cash inflows of $13,320,000 in years one and two, and cash inflow of $15,220,000 in year three at a cost of capital of 10% equals $372,367. Similar analysis of Product X's operating cash flows leads to an NPV of −$535,778.

18. The difference between the initial investment in working capital and the present value of the funds recovered at the end of the product's life is mathematically equivalent to the present value of an annual capital charge for working capital as computed in Panel III of Table 2. For instance, Product Y requires an initial investment in working capital of $1,900,000, which will be recovered at the end of year three. The economic cost of working capital equals −$472,502 (= −$1,900,000 + $1,427,498). Alternatively, a capital charge of 10% times the working capital investment each year results in an annual cost of $190,000, which when discounted also yields an economic cost for working capital of −$472,502.

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TRUST AND COMMITMENT: INTANGIBLE DRIVERS OF INTERORGANIZATIONAL PERFORMANCE☆

Jane Cote and Claire K. Latham

ABSTRACT

Non-traditional performance indicators have gained broad acceptance in recent years. We continue this discussion and contribute to the knowledge base by employing trust and commitment as two critical intangibles existing between organizations that directly and indirectly influence performance metrics. Each interorganizational contact creates a transactional history that influences cumulative perceptions of trust, that then guide outcome behavior. Using an interdisciplinary foundation, we test a causal model where formal and informal interorganizational relationship structures impact trust and commitment, which then stimulates performance outcomes. The healthcare industry provides the field context where we empirically test our model. A survey was administered to physician practice professionals to measure the theoretical dimensions of the dyad's relationship structure, including antecedents to the mediating variables, trust and commitment, and the resulting outcome constructs.

☆Data availability: The survey administered in this study is available upon request.

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Results demonstrate that relationship dynamics are vital drivers of tangible outcomes. Trust and commitment emerge as variables to be explicitly managed to improve performance.

INTRODUCTION

Virtually all companies rely on some form of interorganizational alliance for efficiency, expertise, or risk sharing (Williamson, 1975). A global economy is accelerating the opportunities for inter-firm arrangements as diverse as outsourcing to jointly managed operations. As outsourcing and other interorganizational partnerships become a larger part of organizations' strategy the interest in the drivers of success become a more relevant avenue for investigation.

Management accounting has increasingly been focused on the causal linkages between inputs and outputs all along the value chain (Ittner & Larcker, 2001). For instance, strong evidence exists that customer metrics drive organizational performance (e.g., Kaplan & Cooper, 1998; Kaplan & Narayanan, 2001; Banker, Potter, & Srinivasan, 2000; Anderson, Fornell, & Lehmann, 1994; Ittner & Larcker, 1998; Smith & Wright, 2004). Customer constructs such as complaints (Banker et al., 2000), customer loyalty and its antecedents; product quality, image, viability, and post sale service (Smith & Wright, 2004) and overall satisfaction defined as quality, price, and expectations (Anderson et al., 1994) have demonstrated links to various profitability indicators. By managing these intangible customer metrics the company can make strategic decisions about the types of customers they need to attract and retain while clearly recognizing the profit impact. Equally important is the recognition that customers demand resources from the firm in the form of various service requests and among customers their demands are heterogeneous (Kaplan & Narayanan, 2001). These results provide the foundation for extending the customer – performance findings to explore the value drivers within interorganizational arrangements. Just as customers consume organizational resources differently, suppliers and other interorganizational partners place differing levels of resource demands on the firm. Similar to the elements that motivate customers to engage in positive interactions with the firm, there are critical attributes in the interorganizational partnership that impact profitability. Therefore, with the rise in such interorganizational arrangements, analysis of the value drivers becomes similarly important to explore. Only when a firm understands "the chain of activities that lead to outputs'' (Simons, 1999, p. 63) can they begin to create an effective control system to strategically structure interorganizational partnerships.

The number of value drivers present within interorganizational relationship is vast and can be idiosyncratic. At the core of interorganizational arrangements are basic drivers of trust and commitment (Cooper & Slagmulder, 2004). Company to company interactions occur at the individual transaction level. Over time, the culmination of these transactions builds a history that leads to a relationship that spans the continuum of success. It is at this subtle, intangible level where the foundation is built that guides the course of inter-firm transactions. Identifying the role of such intangible relationship characteristics in driving value for the organization offers the opportunity to transform unobservable constructs to measurable phenomenon by monitoring the causally linked antecedents (Cooper & Slagmulder, 2004).

Intuitively, trust and commitment are underlying elements in relationship dynamics. Often trust and commitment are such subtle forces that persons involved do not recognize their elements or their impact on the organization until a problem surfaces or financial performance is impaired. At that point the relationship elements are in place and difficult to change. A model that not only measures the antecedents to the development of trust and commitment but also identifies the resulting outcomes, including financial implications, has several advantages. First, it helps bring trust and commitment issues to the forefront where managers can actively begin to anticipate and develop positive interorganizational relationships. Second, control and performance measurement systems can be adapted to incorporate antecedents and consequences of trust and commitment (Birnberg, 2004). Thus, as interorganizational arrangements are becoming more prevalent as efficient means for achieving strategic goals, the need to clearly identify the underlying performance motivators becomes acute. Our research fills this gap by modeling antecedents to trust and commitment with the resulting outcome implications for performance. The causal model is built on the theory that trust and commitment lead to cooperative behaviors that yield efficient and effective outcomes (Cote & Latham, 2004; Cannon, Achrol, & Gundlach, 2000; Morgan & Hunt, 1994). Using the healthcare industry as our setting, we investigate how trust and commitment influence both financial and non-financial performance outcomes.

The health care industry is at cross roads now and many are looking for novel solutions to their seemingly intractable problems. The level of interorganizational trust and commitment is of paramount importance and relationship quality varies dramatically. The dynamics among employer-paid health insurance, physician practices, and patients complicates the efficient delivery of healthcare. Many physician practices are devoting increased resource levels to administer the authorization and receivable activities within their organizations (Sharpe, 1998a, b). To successfully manage in this environment, the practice must be alert to the heterogeneous demands presented by insurers and actively manage each relationship. We propose that the degree of trust and level of commitment are key elements in this equation. At the extreme, where the cost and frustrations peak, physicians are restructuring their medical practices to eliminate the relationship with health insurance companies (Shute, 2002). Terminating the relationship is a major strategic decision because it can severely limit the type and number of patients who can be served under a fee for service model. This termination decision is analogous to a manufacturing setting where management decides to opt for a vertically integrated value chain. If the costs to maintain the horizontal value chain exceed the benefits measured in money, time, or talent, the company will take the costly measures necessary to change the process. In the health care industry, most delivery systems are horizontally integrated and the tensions among the various partners in the delivery chain are ripe and dynamic. It is thus, within this industry that we find a rich context to empirically test our model.

A clear analogy exists that links the physician–insurer partnership to other more traditional channel relationships. Mohr and Nevin (1990) define interorganizational transactions as discrete or relational. When the transactions between organizations are part of an ongoing, integrated, and cooperative social system the two organizations are acting within a distribution channel. In this channel dyad each provides specialized expertise or resources designed to achieve mutual benefit rather than a series of independent transactions (Frazier, 1999). The physician–insurer arrangement is consistent with this conceptualization of interorganizational channel partners. Cote and Latham (2003) specifically address the correspondence between the physician–insurer relationship and the traditional channel dyad. Using both key informant interviews and an analysis of patient level data, they found sufficient mapping between the characteristics of the physician–insurer relationship and the typical channel dyad to conclude that this segment of the healthcare delivery chain functions as a distribution channel. Each bring specialized expertise, with neither able to function optimally within the relationship without mutual cooperation. With the elements of the physician–insurer relationship exhibiting a substantial correspondence with the traditional channel partnerships, the findings in this healthcare setting have the ability to transfer to other interorganizational relationships and other industry settings.

Employing 166 physician practice managers and staff at 29 data collection sites, we tested the construct linkages within the causal model. Trust and commitment are positioned as mediating variables through which the antecedent constructs link to outcome variables. The antecedents to trust and commitment are modeled as legal bonds, termination costs, benefits, communication, and opportunistic behavior are shown to significantly impact the level of trust and commitment in the dyad. Significant relationships are then evident between the two mediating variables, commitment and trust, and all six of the outcome variables: acquiescence, propensity to leave, cooperation, financial consequences, functional conflict, and decision-making uncertainty. These findings support the view that relationship dynamics are vital drivers of tangible outcomes. Trust and commitment emerged in our study as variables to be measured and monitored within performance measurement systems to explicitly manage the impact they have on financial and non-financial results.

The rest of this paper is organized as follows. The second section summarizes relevant prior research, describes the trust and commitment model of relationship quality and provides hypotheses tested. The third section articulates the experimental method, including descriptions of the measurement instrument used. The results are then presented, followed by discussion and future research sections.

LITERATURE REVIEW

Inter-firm relationship dynamics are viewed from two main perspectives. The first is the formal structure (e.g., Cannon et al., 2000; Baiman & Rajan, 2002; Cooper & Slagmulder, 2004), where the contractual agreements define the relationship but where the relational context defines the successful execution of the legal bonds. Most arrangements with external organizational partners are formalized with contracts specifying revenue and cost items having a tangible impact on firm profit. The explicit designation of these items allows managers to develop and set targets more readily, enhancing the ability to reach a positive outcome. However, contracts occasionally break down or generate negative financial implications. Cannon et al. (2000) integrate cooperative norms that guide the social workings of the exchange with legal bonds to assess the impact on performance. They find creating a governance structure that monitors the relational aspects of the exchange leads to performance superior to that achieved with a sole focus on the contractual relationship. Thus, when examining drivers of successful interorganizational arrangements, it is necessary to capture these often subtle, hidden factors that influence relationship economics. Baiman and Rajan (2002) also explore the formal structure and introduce trust as a variable that gains relevance when contracts are incomplete. They demonstrate that in these settings trust affects accounting information system design choices. Trust mitigates the need for costly monitoring systems to insure that one side of the dyad is not exploiting the other. Cooper and Slagmulder (2004) investigate the role that qualitative decision factors play in make or buy decisions. They find that trust serves multiple roles within inter-firm interactions from willingness to acquiesce to demands from either side of the dyad to the development of longer term commitment to mutual performance outcomes. They conclude that trust is a "stronger and more encompassing" dimension driving inter-firm partnerships. These views conclude that the legal contract alone is rarely sufficient to ensure successful outcomes.

The second perspective incorporates the informal or relational aspects of the arrangement (e.g., Morgan & Hunt, 1994). Here the accumulation of individual interactions builds a relationship; the quality of such relationship then defines the ultimate performance of the dyad. Symmetrical trust and commitment reduces uncertainty resulting from opportunistic behavior, minimizing the demand for extensive control procedures (Birnberg, 2004; Morgan & Hunt, 1994). Morgan and Hunt (1994) direct their efforts toward the mechanisms by which productive and effective behaviors lead to high functioning relationships. It is trust and commitment that motivate the dyad participants to work cooperatively and view decisions with a long term lens rather than a short term opportunity to maximize a one-time gain. Other contextual variables can also have an impact on dyad performance. Power, for instance, is a force that coerces behavior. However, power can create unproductive and ineffective processes and outcomes. Hence, Morgan and Hunt (1994) view trust and commitment as the central constructs in a high functioning inter-firm relationship. These two viewpoints, contractual and relational, are merged into the model that describes the critical tangible and intangible links that define the role trust and commitment have in the interorganizational dyad.

Figure 1 illustrates the causal interactions that impact interorganizational relationship quality. It identifies antecedent variables comprised of contracting and normative, tangible and intangible: legal bonds, relationship termination costs, relationship benefits, shared values, and communication.

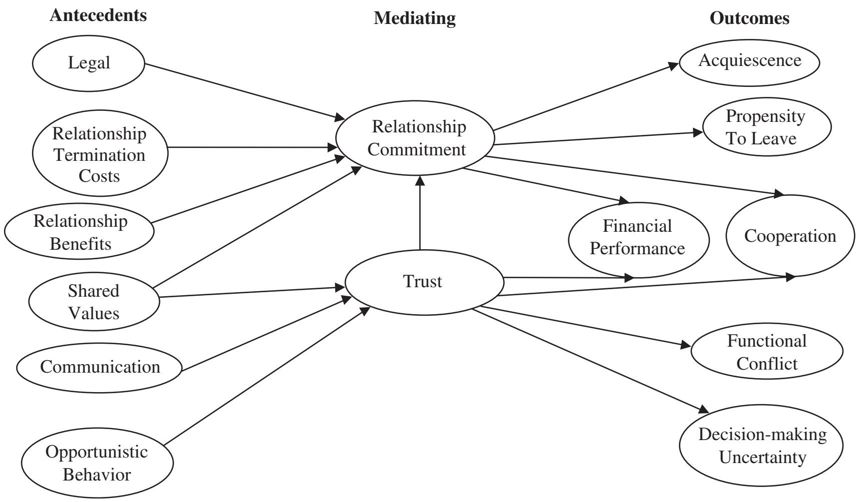


Fig. 1. Trust and Commitment Model of Interorganizational Performance.

These constructs are the building blocks for commitment and trust between organizations (Zineldin & Jonsson, 2000). Attention to building these values is expected to lead to a trusting and committed relationship, which in turn will lead to the outcomes. As Fig. 1 illustrates, trust and commitment are comprised of positive cooperation, acquiescence, intentions to maintain the relationship, and financial benefits, with minimal conflict, and uncertainty. Each construct is defined in more detail below.

Commitment and Trust: Mediating Variables

Morgan and Hunt (1994) posit that the key mediating variables in a relational exchange are commitment and trust. Relationship commitment is defined as "an exchange partner believing that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it; that is, the committed party believes the relationship is worth working on to ensure that it endures indefinitely" (Morgan & Hunt, 1994, p. 22). Relationship trust exists when one exchange partner "has confidence in an exchange partner's reliability and integrity" (Morgan & Hunt, 1994, p. 23). Morgan and Hunt (1994) further note that trust is a determinant of relationship commitment, that is, trust is valued so highly that partners will commit to relationships which possess trust, i.e., higher levels of trust generate greater commitment to the relationship. Further, they theorize that the presence of both commitment and trust is what separates the successful from the failed outcomes. Building commitment and trust to reach successful partnerships requires devoting energies to careful contracting, specific cooperative behaviors, and other efforts that both partners invest. These two constructs are positioned as mediating variables in the model. They serve as the mechanism by which the antecedents influence inter-firm performance (Baron & Kenny, 1986). We now turn to our discussion of these antecedents.

Antecedents

Legal Bonds

Legal bonds or legal contracting refers to the extent to which formal contractual agreements incorporate the expectations and obligations of the exchange partners. A high degree of contract specificity, as it relates to roles and obligations, places constraints on the actions of exchange partners. It is this specificity and attention to detail that typically supports a willingness by partners to invest time in an exchange relationship. Exchange partners who make the effort to work out details in a contract have a greater dedication to the long term success of the partnership (Dwyer, Shurr, & Oh, 1987).

To be successful, physician practices must contract with a broad selection of insurance providers. Each insurer has unique procedures and systems requiring separate legal contracts that detail the terms of the relationship. The contract forms the basis for each interaction requiring substantial investment from both sides to negotiate terms (Cannon et al., 2000; Leone, 2002). It is through this process that the physician practice and insurer define the legal level of commitment. Thus, a higher degree of contract specificity is expected to have a positive influence on relationship commitment.

Relationship Benefits and Termination Costs

Firms that receive superior benefits from their partnership relative to other options will be committed to the relationship. Morgan and Hunt (1994) propose that dyads with more or stronger benefits demonstrate higher levels of relationship commitment. It is then expected that as the benefits to the relationship increase, relationship commitment will be stronger.

Relationship termination costs refer to the expected losses from dissolution and such costs are widely defined in the literature. In essence, relationship termination costs are switching costs. A higher measure of switching costs presents a deterrent to ending the relationship and strengthens the perceived value of committing to the relationship. Hence, relationship termination costs will have a positive correlation with relationship commitment.

Relationship benefits and termination costs become relevant constructs for physicians and insurers. From the physician's perspective, the larger insurers cover a substantial fraction of the patients within their geographical area, necessitating willingness for the physician practice to invest substantial efforts to ensure that the relationship is successful. Likewise, there are often large physician groups that insurers need to be associated with in order to compete within a geographical area. These environmental characteristics create substantial termination costs and relationship benefits that motivate the physician and insurers to develop a long term, committed relationship.

Shared Values

Shared values are "the extent to which partners have beliefs in common about what behaviors, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong" (Morgan & Hunt, 1994, p. 25). Shared values are shown to be a direct precursor to both relationship commitment and trust, that is, exchange partners who share values are more committed to their relationships. Relationships between physicians and insurers often break down or endure substantial friction due to mis-matched values. Expectation gaps concerning procedure authorization, reimbursement, and general patient care are evidence that the physician and insurer do not completely share each others' values in healthcare delivery. When it occurs physician practices often must make repeated oral and written contact to convince insurers to acquiesce to their position. As this conflict is replicated over a series of patients, trust begins to deteriorate and the physician practice begins to assess their level of commitment to the insurer. When values are aligned, both the insurer and physician practice are confident that judgments made by one side will be accepted by the other and the interactions are relatively seamless.

Communication and Opportunistic Behavior

Communication refers to the formal and informal sharing of "meaningful and timely information between firms" (Anderson & Narus, 1990, p. 44). Mohr and Nevin (1990) note that communication is the glue that holds a relationship together. Anderson and Narus (1990) see past communication as a precursor to trust but also that the building of trust over time leads to better communication. Hence, relationship trust is positively influenced by the quality of communication between the organizations.

Opportunistic behavior is "self-interest seeking with guile" (Williamson, 1975, p. 6). Opportunistic behavior is problematic in long term relationships affecting trust concerning future interactions. Where opportunistic behavior exists, partners no longer can trust each other, which leads to decreased relationship commitment. We therefore expect a negative relationship between opportunistic behavior and trust.

Trust in the physician–insurer relationship is influenced both by communication and opportunistic behavior. Communication occurs frequently through procedure authorizations, receivable claims and periodically through practice management advice, processing updates, and office visits. Some insurers provide consistently accurate responses to physician practice inquiries, leading the practice to trust the insurer (Cote & Latham, 2003). Others give conflicting advice, dependent on the insurance representative responding to the inquiry. This destabilizes the relationship, forcing the practice to make multiple inquiries to a single issue and document each interaction precisely. Opportunistic behavior is exemplified in claims processing experiences. Receivable turnover is legally defined, in number of days, by most state insurance commissioners. An insurer must remit payment on a "clean claim" within the statutory period. Clean claims are those with no errors, regardless of the source of the error. If an error is detected, the statutory time period is reset to the beginning. Insurers acting opportunistically will return claims to the physician practice frequently with small errors or errors emanating from their own electronic processing system, thus extending the statutory receivable turnover period. When this happens consistently with an insurer, the physician practice begins to doubt the sincerity of the insurer's behavior.

In summary, trust and commitment are functions of specific efforts both organizations invest in the relationship to improve the value they derive from the arrangement. When a long term association is expected many organizations recognize the benefits that come from developing a strong bond of trust and commitment. For the effort to be worthwhile both must recognize substantial benefits from their joint association and have some common views related to the values they employ in business conduct. Perceptions of opportunism on either side will dampen the potential for trust within the relationship. Alternatively, where switching costs related to developing substitute relationships are substantial, partners will make more concerted efforts to maintain commitment to the existing dyad. Energies devoted to legal contracting and communication then serve to strengthen the commitment and trust bonds. We now turn to the outcomes observed through the presence of trust and commitment in the relationship.

Outcomes

Relationship performance is judged by financial and non-financial outcomes. Strains to the relationship, either due to financial disadvantages or operational conflicts create friction that impairs the arrangement. At the extreme, the relationship terminates. For instance, there is a trend whereby physician practices eliminate their relationships with insurers, creating a practice structure that is analogous to a law firm (Sharpe, 1998a, b; Pascual, 2001; Shute, 2002). Patients pay a retainer for immediate access to the physician. The physician accepts cash for services and patients must seek insurance reimbursement on their own. This represents the extreme case where trust and commitment have dissolved and the physician has refused to acquiesce to insurers' demands and completely left the system. Most physician practices have not resorted to such extremes, yet are still influenced by the model's outcomes.

Acquiescence

Acquiescence is the extent to which a partner adheres to another partner's requests (Morgan & Hunt, 1994). This is an important construct in relationship quality because when organizations are committed to successful relationships, they recognize that the demands made by each other are mutually beneficial.

Propensity to Leave

Commitment creates a motive to continue the relationship. The investments to create the committed relationship, described as the antecedents in the model, directly impact the perceptions that one or both partners will dissolve the relationship in the near future. Partners in relationships expected to terminate in the near term behave differently than those that perceive that both are invested in the relationship for the long term. Thus propensity to leave, resulting from the level of relationship commitment, is an outcome variable with performance implications.

Financial Consequences

Activity based costing has successfully demonstrated that business relationships have heterogeneous effects on profitability (e.g., Kaplan & Narayanan, 2001; Shapiro, Rangan, Moriarty, & Ross, 1987). Intuitively most managers recognize differential financial impacts among their third party interactions and recently many have begun to strategically structure terms with these organizations to enhance the financial benefits (Morton, 2002). Similarly, relationship quality can be expected to have direct and indirect effects on revenues and expenses. Specifically, we propose that the levels of trust and commitment will be positively correlated with financial indicators.

Trust has been previously defined as "confidence in an exchange partner's reliability and integrity" (Morgan & Hunt, 1994, p. 23). With a trusting relationship, the partners do not need to continually verify adherence with agreed upon arrangements and procedures. Hence costly monitoring systems are avoided in favor of simpler procedures to detect innocent errors. Likewise, commitment or "the enduring desire to maintain a valued relationship" (Morgan & Hunt, 1994, p. 22), can create financial consequences. When a longer term relationship is expected, there are incentives for organizations to provide each other with favorable terms. For instance, favorable pricing, delivery, or service terms may be present within committed relationships because the partners are confident that throughout the relationship a variety of benefits will flow in both directions (Walter & Ritter, 2003). Alternatively, when relationship commitment is low fewer incentives exist to offer favorable financial terms or services. This behavior is evident in situations where one exchange partner is considered a backup supplier, contacted only when other more favorable exchange partners are not available (Kaplan & Narayanan, 2001). In these circumstances, managers must either negotiate to improve relationship commitment or they must evaluate the implications for creating an alternative working relationship.

Practice administrators acknowledge revenue and cost heterogeneity among insurers (Cote & Latham, 2003). For instance, approval for a particular medication, termed formulary, must be obtained from each insurance company to assure that it will be a covered expense. Some insurers require extensive paperwork prior to formulary approval, whereas others use a more streamlined approach. Claims approval and accounts receivable collections are other examples where demands from insurance companies vary. Time and paperwork create a measurable financial statement impact for the physician practice. As the level of monitoring and compliance procedures escalates, physician practices must expand their administrative staff to accommodate insurance company demands. Relationship quality as indicated by the levels of trust and commitment built within the relationship are often factors affecting the ease with which such exchanges are accomplished.

Measuring the full cost of an interorganizational partner level can be complicated and is rarely captured by organizations even though it has strategic importance. When attempting to use an intangible value driver to disentangle the effect of constructs such as trust and commitment on costs, the process is even more complex. One-time transactions where trust is confirmed or disconfirmed have negligible impact on expenses. Rather, intangible value drivers have a cumulative and often perceptual impact on profitability. It is only through a history of repeated interactions that a measurable profit impact is detectable. For instance, repeated communication problems take additional time to resolve and when accumulated, may require hiring additional support staff. Perceptions also impact profitability in a subtle but potentially profound way. Even if the partner is not measuring the full cost to support a relationship with an external entity, the perception that they are costing them resources, whether time or money, has implications for the strategy used to monitor them. Walter and Ritter (2003) in their study of German suppliers and their customers confront the challenges of linking trust and commitment to interorganizational financial performance. Without access to individual supplier profitability analyses, they rely upon participant's perceptions regarding profit margins, volume and other non-financial variables to assess the connection that trust and commitment have in creating value for an organization. Perceptions are often judged relative to interactions experienced with other similar entities. For instance, one physician interviewed during our preliminary investigations claimed that an insurer was much more costly than the others due to the amount of time and paperwork they demanded for seemingly routine patient care. This perception of higher cost then impacted contracting and resource allocation decisions. Cote and Latham (2003) in their study of patient level data found insurers place heterogeneous demands on physician practice resources. Insurers names were disguised and ranked based on their historical receivable age and reimbursement patterns. This ranking was identical to the ranking provided by practice managers at the data collection site when asked to identify their perceptions of the relative resource demands from each major insurer in their contracting pool.

Cooperation

Cooperation refers to the exchange parties working together to reach mutual goals (Anderson & Narus, 1990). Cannon et al. (2000) use the term "solidarity" which encompasses "the extent to which parties believe that success comes from working cooperatively together versus competing against one another" (Cannon et al., 2000, p. 183). Though both are outcome variables, Morgan and Hunt (1994) point out that cooperation is proactive in contrast to acquiescence which is reactive. Organizations committed to relationships and trusting of their partners, cooperate to reach mutual goals. Once trust and commitment are established, exchange partners will be more likely to undertake high-risk coordinated efforts (Anderson & Narus, 1990) because they believe that the quality of the relationship mitigates the risks.

Functional Conflict

The resolution of disputes in a friendly or amicable manner is termed functional conflict which is a necessary part of doing business (Anderson & Narus, 1990). Morgan and Hunt (1994) show that trust leads an exchange partner to believe that future conflicts will be functional, rather than destructive. When an organization is confident that issues which arise during the conduct of their arrangement with the other organization will be met with positive efforts to reach a mutual solution, they anticipate tangible benefits.

Uncertainty

Decision-making uncertainty encompasses exchange partners' perceptions concerning relevant, reliable, and predictable information flows within the relationship. The issue relates to whether the exchange partner is receiving enough information, in a timely fashion, which can be then used to confidently reach a decision (Achrol, 1991; Morgan & Hunt, 1994). Cannon et al. (2000) conclude that uncertainty creates information problems in exchange. Morgan and Hunt (1994) support a negative relationship between trust and uncertainty. The trusting partner has more confidence that the exchange partner will not act in an unpredictable manner.

Cooperation, functional conflict, and decision-making uncertainty are ever present in the physician–insurer relationship. As stated earlier, the relationship is symbiotic; each needs to cooperate with the other to provide patient care. Often the physician practice administrators can trace specific issues related to cooperation and conflict back to the level of trust with the insurer (Cote & Latham, 2003). Patient care is complicated, with each patient having unique needs. In a trusting relationship where there is a high degree of confidence that the insurer is reliable and will respond faithfully to patient cases, the physician practice can predict how certain treatment options will be handled. Without trust, there is a degree of randomness in the responses from the insurer, making it difficult for the practice to prepare inquiries to the insurer and anticipate their success.

In summary, prior literature demonstrates how trust and commitment are linked to performance outcomes in interorganizational associations. We present a model that combines findings from the contract and relational literatures to link the antecedents to outcomes through trust and commitment. From a performance measurement perspective, this model provides managers with the framework for diagnosing the root causes of observed performance metrics. This model has implications for many inter-firm relationships. In this study we explore the model from the health care industry vantage. With its extended dependence on a network of interorganizational alliances, the health care industry can illuminate the strength and nuances of this model. Findings in this industry can serve as a guidepost for other industries where the extent of interorganizational interaction may not be as highly structured.

On the basis of the preceding discussion, the following hypotheses are developed.

H1. Interorganizational partners having a higher degree of contract specificity have a greater commitment to the relationship.

H2. Interorganizational partners having a higher measure of relationship termination costs have a greater commitment to the relationship.

H3. Interorganizational partners having a higher measure of relationship benefits have a greater commitment to the relationship.

H4. Interorganizational partners possessing a higher measure of shared values have a greater commitment to the relationship.

H5. Interorganizational partners with a higher measure of shared values have greater relationship trust.

H6. Interorganizational partners with an appropriate degree of formal and informal communication have greater trust.

H7. Interorganizational partners where a higher degree of opportunistic behavior exists have less trust.

H8. Interorganizational partners possessing a higher degree of trust have a greater commitment to the relationship.

H9. Interorganizational partners who have higher measure of relationship commitment are more willing to make relationship-specific adaptations.

H10. Interorganizational partners who have a higher measure of relationship commitment are less likely to end the relationship.

H11. Interorganizational partners who have a higher measure of relationship commitment are more likely to cooperate.

H12. Interorganizational partners who have a higher measure of relationship commitment are more likely to have a relationship with a positive financial impact.

H13. Interorganizational partners who have a higher measure of trust are more likely to have a relationship with a positive financial impact.

H14. Interorganizational partners who have a higher measure of trust are more likely to cooperate.

H15. Interorganizational partners who have a higher measure of trust are more likely to resolve disputes in an amicable manner (functional conflict).

H16. Interorganizational partners who have a higher measure of trust are less likely to have decision-making uncertainty.

RESEARCH METHOD

Survey Administration

Participants were those personnel from physician practices who interact with insurance companies in the course of their work. Most were involved in the billing and authorization functions, but also included physicians, nurses, financial and operations managers. Most participants were met during a regular staff meeting or break period, taking approximately 15–20 min to complete the survey. There were 166 participants with visits to 29 collection sites within the U.S. Pacific Northwest. Respondents were predominately female (89.7%) which represents a typical gender breakdown in the healthcare industry in the personnel positions captured (92% administrative or nonclinical, 8% clinical). On average, survey participants had been employed in the healthcare industry for 14.2 years, in their current position 6.5 years, with their current organization 6.1 years and described themselves as very familiar with insurance company policies, procedures, and practices (6.32 where 7 is most familiar).

A survey instrument was administered to test the extent to which the six antecedents impact the trust and commitment of the physician practice toward health insurance providers as well as how these two constructs then influence the outcome measures. Each participant chose one insurance company that they have substantial experience with in their regular duties. Each participant was then instructed to use the chosen insurer as the referent for their responses. Because one goal is to have responses that represent relationship quality across a broad spectrum, we emphasized that the insurer should be one with which they are most familiar and have a longer term history rather than one they like or dislike the most.

Construct Measurement

The questionnaire consisted of several sections with items using seven points anchored on one of the following scales: (a) "Strongly disagree" (1) and "Strongly agree" (7), (b) "Significantly below expectations" (1) and "Significantly above expectations" (7), (c) "Completely inaccurate description" (1) and "Completely accurate description" (7), (d) "Never confident" (1) and "Completely confident" (7) and (e) "Worse than all other insurers" (1) and "Better than all other insurers"(7). Five items were anchored on a ten-point, 0–100 probability scale. Items employed to measure the various constructs of interest were either adapted from the literature or based on interviews with one representative physician practice management team. The items used are contained in the appendix[1], which also contains the average composite reliabilities of the reflective scales. The average composite reliabilities of the individual measures range from 0.60 to 0.89 indicating the constructs' convergent validity is adequate (Fornell & Larcker, 1981).

Specifically, the measures were developed as follows.

Trust (Mediating Variable)

Reliability and integrity are the key constructs that define trust (Morgan & Hunt, 1994). Similar to the approach in Morgan and Hunt (1994), we assessed trust with five items that measure the respondent's perception of the insurer's honesty, integrity, fairness, consistency, and reliability.

Commitment (Mediating Variable)

Commitment exists when there is the belief that the relationship is worthy of substantial effort to ensure its continuation. Both Morgan and Hunt (1994) and Mowday, Steers, and Porter (1979) employ commitment measures.

From these two scales we developed a four-item measure of commitment that elicits the respondent's perception of the extent to which the physician practice expects to continue the relationship and the level of effort they are willing to exert to make the relationship successful.

Legal Bonds (Antecedent)

Cannon et al. (2000) measured the extent and nature of legal bonds between parties in the supply chain. Their measure was adapted and combined with physician practice management features to develop a scale that measures legal bonds from the perspective of respondent's perception of their fairness and flexibility or adaptability in a two-item measure.

Relationship Termination Costs (Antecedent)

Termination costs are analogous to switching costs. If a physician practice terminates a relationship with an insurer, they may lose patients as well as expend substantial effort to develop alternative insurer arrangements. Termination costs were identified through interviews with physician practice management staff. The four-item measure addressed the respondent's perception of lost income that would accrue if the relationship was terminated, the alternative insurers available and the level of investment physician practices have committed to facilitate a working relationship with the insurer.

Relationship Benefits (Antecedent)

Similar to relationship termination costs, relationship benefits were determined through interviews with physician practice management. Morgan and Hunt (1994) demonstrated the need to measure context specific benefits to activate a meaningful link to commitment. The benefits to the physician practice that comprise the seven-item measure of this construct are breadth of coverage, claims processing, flexibility, technical support, continuing education, formulary, and referring capabilities. Subjects were asked to evaluate the working relationship with the insurer relative to their expectations.

Shared Values (Antecedent)

To assess shared values we followed a procedure used by Morgan and Hunt (1994). We developed value statements from our practice management interviews that reflect the primary values of a typical physician practice. Concern for the patient and ethics were the values included in the measure. We then asked participants to record both their agreement with these values and then record their perception of the insurer's belief in these values. Both were scored on the seven-point Likert-type scale and the measure was a difference score where zero means they share the same values, positive score implies participant has places higher values on these characteristics and a negative score indicates the insurer places higher value on these characteristics.

Communication (Antecedent)
Communication is expected to influence trust. As past communications accumulate, the parties begin to develop a level trust in each other. Adapting measures from Morgan and Hunt (1994), Mohr and Nevin (1990), and Anderson and Narus (1990) our four-item measure of communication elicited the respondent's view of the extent to which information sharing occurs and rapport has been built.

Opportunistic Behavior (Antecedent)
Opportunistic behavior, or ''self-interest seeking with guile'' (Williamson, 1975, p. 6), occurs when one party takes actions that puts the other party at a disadvantage. Both Morgan and Hunt (1994), and Anderson and Narus (1990) measure opportunistic behavior within interorganizational relationships. Four items measured the respondent's perception of the extent to which the insurer alters facts, makes unfulfilled promises, distorts information and exaggerates their needs.

Financial Consequences (Outcome)
A series of interviews with physician practice managers was instrumental in developing the measure of financial statement impact, which is comprised of nine items. Factors such as claim processing speed, ease, and percentage of disputed claims were considered important measures of cost. Time was another factor that drives the costs necessary to work with an insurer. Monitoring or checking up on submitted claims, complaints from patients, and flexibility to accommodate patients with complex medical cases all create demands on staff and/or physician time. These time demands have a cumulative effect that adds administrative staff (Cote & Latham, 2003). Similar to Kumar, Stern, and Achrol (1992) this construct was measured relative to other insurers with whom they have established relationships.

Acquiescence (Outcome)
Acquiescence, or the willingness to comply with other's requests, is a forward looking measure. We measured it using a ten-point probability scale to assess perceptions concerning conformity with requests from the insurer.

Procedures and advice are the primary components of acquiescence measured in this study.

Propensity to Leave (Outcome)
Expectations regarding continuation of the relationship are measured similarly to Lusch and Brown (1996). We elicited this propensity with three items that explore expectations regarding whether the relationship is a long-term alliance and whether contract renewal is virtually automatic.

Cooperation (Outcome)
Three items defined our measure of cooperation. Adapted from both Heide and John (1992) and Anderson and Narus (1990), we assessed whether the practice respondents view problems as being solved jointly, whether there is commitment to improvements that benefit the relationship as a whole, or whether reciprocal favors exist.

Functional Conflict (Outcome)
To measure functional conflict we assessed respondent's perceptions of the extent to which conflict exists in the relationship (Kumar et al., 1992). Three items were used to measure this construct.

Decision-Making Uncertainty (Outcome)
Decision-making uncertainty measures whether the physician practice has sufficient information to make routine decisions in a manner acceptable to both parties. Using data from our interviews, we created this measure to assess respondent's views of the extent to which participants were confident in their ability to make future decisions. Routine decisions such as medical procedure coverage, processing a complex claim, reimbursement timing, and problem resolution were included in this four-item measure.

RESULTS

Structural Equation Model Analysis

We use structural equation modeling (SEM) (using EQS$^{\mathrm{TM}}$ 6.0 SEM software), with maximum likelihood estimation technique, to test the structural model presented in Fig. 1 and our specific hypotheses. The SEM process centers on two stages, validating the measurement model using confirmatory factor analysis and fitting the structural model through path analysis with latent variables. It permits us to examine the full model simultaneously, as opposed to one path at a time, as well as to examine the hypothesized causal relations among the six antecedents, trust and commitment, and six performance metrics. In addition to the benefit of testing the model overall rather than coefficients individually, other advantages of SEM are greater flexibility of assumptions than multiple regression, the use of confirmatory factor analysis to reduce measurement error and the ability to model mediating variables. Our findings are presented in Table 1 and Fig. 2. Fig. 2 illustrates the model and identifies the results of the structural equation analysis. It provides the path coefficients for each causal link and the R^2 coefficient for each mediating and outcome construct. Table 1 presents the construct correlation matrix to provide an alternative method for evaluating the causal associations.

Various fit indices may be used to evaluate descriptively whether the estimated model is not different than the hypothesized model (Carmines & McIver, 1981). Table 2 presents the fit statistics. The overall model has an adequate goodness of fit index (Comparative Fit Index (CFI)) of 0.898 (Bollen IFI = 0.900), given the complexity of the model and the substantial number of constructs, indicators and paths (Williams & Holahan, 1994; Bollen, 1989). An alternative measure, χ^2, indicates the difference between the estimated and observed correlation matrix. A low χ^2 (high P-value) indicates there is no difference, that is, the specified model recaptures the observed correlation matrix completely. Conversely, a high χ^2 and low P-value, as is evident here ($\chi^2 = 512.0857$, P-value $= 0.000$), suggests there is a statistical difference between the observed and estimated correlation matrix indicating the model is not perfectly capturing the observed correlation matrix. Because of statistical power, however, a low χ^2 is achieved infrequently.[2] When N is large and there exists a greater potential for problems with the traditional χ^2 test, the use of the ratio of the χ^2 estimator divided by its degrees of freedom as a measure of fit is appropriate (Bollen, 1989). Bollen (1989) presents support for an adequate fit as a value less than 3.[3] Our model achieves an acceptable 1.695.

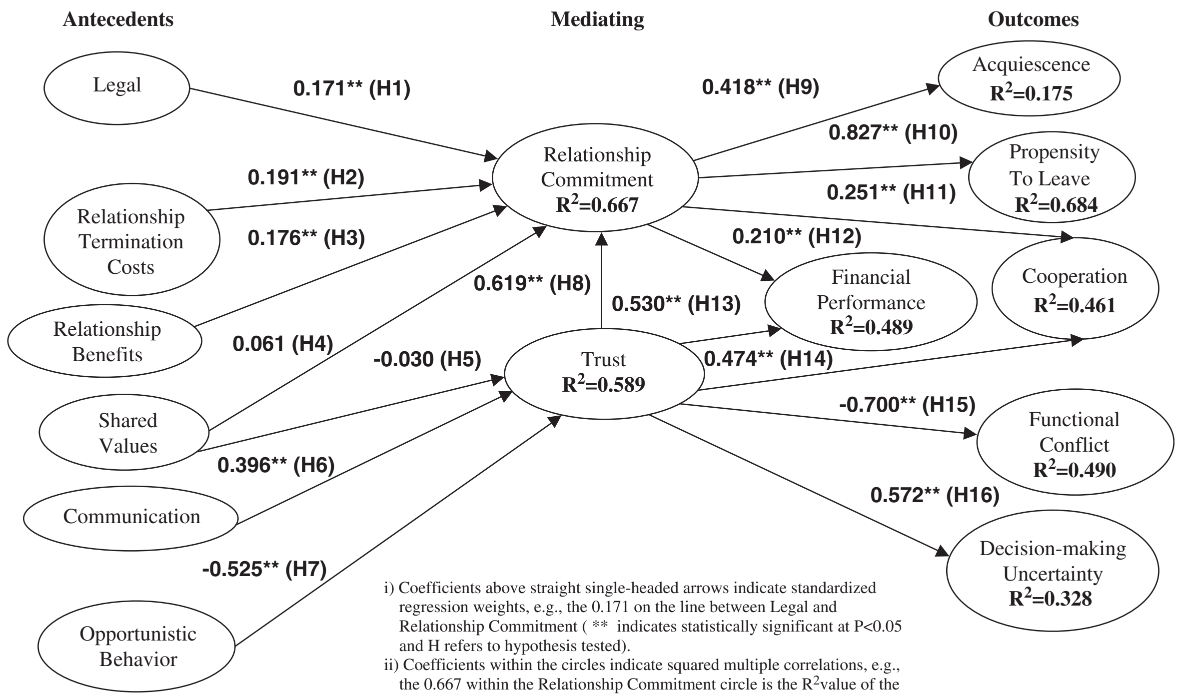
Tests of the Causal Hypotheses

Breckler (1990) emphasizes the key importance of evaluating the fit of individual equations within the model in addition to testing the global fit. All of the individual path coefficients are significant at $P < 0.05$ except for those paths involving shared values. The results for strength of the individual antecedents leading to our mediating variables, trust and commitment, are

Table 1. Correlation Matrix.

	Legal	Termination Costs	Benefits	Shared Values	Communication	Opportunistic Behavior	Commitment	Trust	Financial Performance	Acquiescence	Propensity to Leave	Cooperation	Functional Conflict	Decision Making Uncertainty
Legal	1													
Termination costs	0.040													
	(0.519)	1												
Benefits	0.482	0.168												
	(5.574)**	(2.128)**	1											
Shared values	−0.200	0.176	−0.197											
	(−2.522)**	(2.229)**	(−2.477)**	1										
Communication	0.298	0.097	0.502	−0.121										
	(3.665)**	(1.241)	(5.749)**	(−1.542)	1									
Opportunistic	−0.242	0.095	−0.475	0.125	−0.359									
behavior	(−3.041)**	(1.171)	(−6.264)**	(1.556)	(−4.598)**	1								
Commitment	0.526	0.229	0.682	−0.061	0.593	−0.528								
	(6.875)**	(2.794)**	(9.504)**	(−0.732)	(7.937)**	(−8.123)**	1							
Trust	0.531	−0.031	0.724	−0.152	0.554	−0.644	0.761							
	(7.186)**	(−0.390)	(10.618)**	(−1.911)	(7.553)**	(−12.605)**	(18.559)**	1						
Financial	0.507	−0.046	0.681	−0.094	0.438	−0.312	0.609	0.695						
performance	(5.809)**	(−0.586)	(7.234)**	(−1.199)	(5.156)**	(−3.958)**	(8.211)**	(10.052)**	1					
Acquiescence	0.381	0.075	0.230	0.002	0.197	−0.127	0.393	0.302	0.313					
	(4.202)**	(0.799)	(2.481)**	(0.024)	(2.121)**	(−1.313)	(4.380)**	(3.343)**	(3.416)**	1				
Propensity to	0.451	0.100	0.574	−0.069	0.420	−0.500	0.827	0.639	0.538	0.477				
leave	(5.727)**	(1.209)	(7.595)**	(−0.832)	(5.290)**	(−7.411)**	(21.646)**	(11.706)**	(7.028)**	(5.599)**	1			
Cooperation	0.441	0.113	0.525	−0.044	0.571	−0.470	0.602	0.640	0.439	0.289	0.551			
	(5.179)**	(1.443)	(5.968)**	(−0.569)	(6.369)**	(−6.179)**	(8.101)**	(9.033)**	(5.162)**	(3.135)**	(7.231)**	1		
Functional	−0.412	0.051	−0.549	0.073	−0.473	0.524	−0.585	−0.659	−0.558	−0.352	−0.626	−0.646		
conflict	(−4.898)**	(0.651)	(−6.181)**	(0.936)	(−5.490)**	(7.001)**	(−7.816)**	(−9.376)**	(−6.261)**	(−3.858)**	(−8.451)**	(−6.971)**	1	
Decision–	0.382	0.118	0.573	0.031	0.472	−0.387	0.563	0.533	0.453	0.368	0.495	0.535	−0.567	
making uncertainty	(4.585)**	(1.500)	(6.388)**	(0.395)	(5.487)**	(−4.987)**	(7.461)**	(7.215)**	(5.300)**	(4.042)**	(6.374)**	(6.059)**	(−6.332)**	1

**Indicates statistically significant at $P<0.05$.



i) Coefficients above straight single-headed arrows indicate standardized regression weights, e.g., the 0.171 on the line between Legal and Relationship Commitment (** indicates statistically significant at $P<0.05$ and H refers to hypothesis tested).
ii) Coefficients within the circles indicate squared multiple correlations, e.g., the 0.667 within the Relationship Commitment circle is the R^2value of the regression of Relationship Commitment on the four antecedents: Legal, Relationship Termination Costs, Relationship Benefits and Shared Values.
iii) Correlations among the antecedent variables were modeled but are not shown.

Fig. 2. Path Model Results (using EQS™ Display Standards).

Table 2. Structural Equation Model Fit Statistics.

Comparative fit index (CFI)	0.898
Bollen index (IFI)	0.900
χ^2	512.0857
P-value	0.0000
Degrees of freedom (d.f.)	302
χ^2/d.f.	1.695

also presented in Fig. 2. A trust model comprised of communication, opportunistic behavior and shared values has a R^2 of 0.589 implying that 58.9% of the variance in the level of trust expressed by participants can be explained by the three antecedent variables. The primary drivers of the level of trust the participants expressed for insurance providers are opportunistic behavior from a negative perspective and communication. A commitment model, comprised of trust, legal bonds, relationship termination costs, relationship benefits, and shared values is statistically significant with an R^2 of 0.667 or 66.7% of the variance explained. The strongest association exists between trust and commitment.

As hypothesized there are significant relationships evident between the two mediating variables, commitment and trust, and all six of the outcome variables, acquiescence, propensity to leave, cooperation, financial consequences, functional conflict, and decision-making uncertainty. Commitment has the strongest influence on propensity to leave (0.827), which captures an entity's interest to remain in a relationship ($R^2 = 0.684$). A higher level of commitment also supports greater acquiescence (0.418) or agreement for the well-being of the relationship, improved financial consequences (0.210) and increased cooperation (0.251). All of the path coefficients leading from trust exceed 0.45 with the strongest impact being on functional conflict (−0.700) and reducing the uncertainty in decision-making (0.572). Similar to commitment, as predicted, trust positively influences cooperation (0.474) and enhances financial consequences (0.530).

Further analysis of the insignificant relationships between shared values and trust and shared values and commitment reveal a potential measurement issue. Descriptive statistics on shared values indicate a lack of variance in the construct (average = 5.93, minimum = 4, maximum = 7, standard deviation = 0.63). The correlation matrix (Table 1) supports a lack of relationship between shared values and any of the other constructs.

Overall, the results taken together suggest strong support for H1 through H3 and H6 through H16 and a lack of support for H4 and H5. Key to our primary research question, commitment and trust are mediating variables, which specify the determinants of performance outcomes. This finding is consistent with the proposition that a high level of trust and commitment within the interorganizational alliance is rewarded.

DISCUSSION

This study investigates the antecedents to trust and commitment and in turn the impact that trust and commitment has on the performance of interorganizational relationships. With the increasing reliance on partnering and outsourcing, understanding how successful relationships between organizations can be developed and performance assessed is critical to their long run sustainability. The physician practice – insurance company relationship is the source for our data to test the model developed in this paper. This is a relationship that is highly controversial, with varying levels of success. Such outcome variability makes this context relevant for model development and testing, as well as important to the healthcare industry.

We tested a complex model that hypothesized four antecedents to commitment, three antecedents to trust, and six outcome measures. Even with several constructs and a complex causal expectation, the data were supportive of the model. Of the 16 hypotheses, all but two were supported. Only one of the constructs, shared values, was not a significant antecedent to the mediating variables. The model has substantial explanatory power, as do most of the individual causal paths. Taken together, the model presents convincing evidence that performance within interorganizational relationships is highly dependent on the building of trust and commitment between the dyad.

The shared values construct was not supported by the data. Interviews with key healthcare personnel indicated that it is a driver within the relationships. Therefore, we look to measurement explanations to explain the lack of support. Shared values was operationalized similar to the method in Morgan and Hunt (1994). Subjects responded to several values statements by expressing both the strength of their beliefs and then expressing how strongly the insurer believed in these values. A difference score was generated that indicated the extent of agreement between the physician practice employee and the insurance provider on each value statement. A review of the individual observations found that many subjects had trouble evaluating the insurer's beliefs. Future research needs to create an alternative method to measure shared values that captures the belief structure of both sides of the interorganizational alliance.

One unique finding is the influence that trust and commitment have on financial consequences. Where many managers might understand that trust and commitment make a relationship more pleasant, that attribute alone is often unlikely to direct attention to the issue. Demonstrating that trust and commitment also impact profitability creates motivations for managers to actively develop strong relationship bonds with partners or contractors.

Most managers implicitly recognize the relationship dynamics inherent in interorganizational arrangements, but without an understanding of the antecedents and outcomes or empirical evidence it is difficult for them to structure a coherent plan to improve trust and commitment with external partners. The implications that trust and commitment have on the dyad are subtle and cumulative. They build through individual transactions and interactions. It is only when events accumulate that relationship quality emerges as a tangible force affecting performance. At that point in time it is quite difficult to alter the relationship dynamics. Our study provides a foundation for managing the relationship. All too often a contract is established and both parties assume the relationship will succeed based on the pre-arranged terms. However, especially in settings where all contingencies cannot be specified in advance, the contract alone will not ensure a high functioning relationship (Cannon et al., 2000; Cooper & Slagmulder, 2004). Our contribution has been to provide evidence that trust and commitment are key elements affected by the alliance structure and that drive consequent outcomes. This evidence has the capacity to raise relationship dynamics from managers' subconscious to a measurable, interconnected level. When recognized as essential, positive actions can be proactively initiated to improve commitment and trust, and ultimately the organization's financial performance rather than reacting to negative consequences. It is evident that a strong contract in conjunction with active relationship management is necessary to achieve optimal interorganizational effectiveness.

FUTURE RESEARCH

This research blends the disciplines of accounting, healthcare issues, relationship marketing, and organizational behavior. We believe that our willingness to draw from these disparate disciplines to address interorganizational performance represents a significant contribution to the knowledge base. The next phase of research should emphasize both measurement and structural enhancements.

As in most research settings, a number of decisions were made that could potentially limit the generalizability of these findings. Common method bias (e.g., Podsakoff, MacKenzie, Podaskoff & Lee, 2003; Cote & Buckley, 1987) challenges all construct measurement efforts to develop valid measures. Careful consideration was taken to minimize exposure to common method bias, from the design to analysis stages. However, since all studies contain complicated tradeoffs, some risks inherent in construct development and measurement are unavoidable. In addition, this study was limited to one industry in one geographical region. To the extent that the interorganizational issues under study are industrially or geographically unique, the ability to generalize from these findings to new contexts may be affected. With replication in a variety of settings the full impact that trust and commitment have on organizational performance between inter-firm partners can be wholly represented.

Structurally, future research should search for constructs that enhance the comprehensiveness of this model. For instance, power within the relationship was modeled implicitly in this study. Future research may incorporate one of the many definitions of power (Frazier, 1999) to explicitly assess its impact on interorganizational performance. The opposite side of the interorganizational partnership, the insurance company in this case, needs to be examined to assess the strength of the constructs from differing value chain partners. The distribution channel literature underscores the importance of investigating both sides of an interorganizational alliance as a means of identifying and understanding both compatibilities and incompatibilities between partners (Morgan & Hunt, 1994). This will provide a comprehensive representation of the elements both exchange partners expect in a healthy, high functioning relationship.

NOTES

1. The survey instrument is available upon request.
2. Bentler and Chou (1987) note that in large samples, "even the best model may not fit, since the sample-size multiplier that transforms the fit function into a chi-square variate will multiply a small lack of fit into a large statistic" (97). Breckler also states that the χ^2 test is sensitive to small differences between observed and estimated data in large samples (1990).
3. Carmines and McIver (1981) suggest a ratio as high as 5 is acceptable.

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APPENDIX: CONSTRUCT MEASURES

Trust (reflective indicators, average composite reliability: 0.89)

1. The level of trust with this insurer is
2. This insurer is honest.
3. This insurer can be counted on to do what is right.
4. This insurer has high integrity.
5. This insurer treats us fairly.

Relationship Commitment (reflective indicators, average composite reliability: 0.79)

1. The relationship deserves maximum effort to maintain.
2. The relationship is something we are very committed to.
3. The relationship is one we expect to continue indefinitely.
4. We are willing to put in a great deal of effort, beyond that normally expected.

Legal Bonds (formative indicators, a summated scale was used)

1. The contracts with this insurer are fair to both parties.
2. Our formal contracts are responsive to unusual and infrequent circumstances.

Relationship Termination Costs (formative indicators, a summated scale was used)

1. We have made significant investments in software and training dedicated to this insurer.

2. This insurer has some unusual standards and practices, which have required adaptation.
3. We have invested a lot of time and effort to learn the ins and outs of this insurer's systems.
4. If our relationship with this insurer were terminated, we would suffer a significant loss in income.

Relationship Benefits (formative indicators, a summated scale was used)
Evaluate the working relationship with insurer on the following
1. Coverage of medical procedures.
2. Claims processing.
3. Flexibility to accommodate patients with complex medical cases.
4. Technical support.
5. Continuing medical education for providers and staff.
6. Referring specialists and facilities.
7. Formulary (i.e., medications covered).

Shared Values (formative indicators, a summated scale was used)
With respect to the following statements, please indicate the degree to which you agree with them and you believe that this insurer agrees with them
1. The primary concern is for the patient.
2. Under no circumstances will unethical behaviors be tolerated.

Communication (formative indicators, a summated scale was used)
1. Any information that might help the other party will be provided to them.
2. Exchange of information in this relationship takes place frequently.
3. Parties will provide proprietary information if it can help the other party.
4. We keep each other informed about events or changes that may affect the other party.

Opportunistic Behavior (reflective indicators, average composite reliability: 0.86)
1. Sometimes this insurer alters the facts slightly.
2. Sometimes this insurer promises to do things without actually doing them later.
3. Sometimes this insurer distorts information to us in order to protect their interests.

4. Sometimes this insurer exaggerates their needs in order to get what they want from us.

Financial Consequences (formative indicators, a summated scale was used)
Relative to other insurers, please rate this insurer on the following cost and revenue dimensions

1. Demands for physician and/or staff time.
2. Ease of processing claims.
3. Costs to process claims.
4. Speed at which they remit payment.
5. Percentage of disputed claims.
6. Percentage of reimbursement relative to billed charges.
7. The need to monitor or check up on the insurer.
8. Complaints from patients about this insurer.
9. Process for credentialing a new physician.

Acquiescence (reflective indicators, average composite reliability: 0.60)

1. In the future, we will likely conform to this insurer's accepted procedures.
2. We intend to adopt future practice management advice offered by this insurer.

Propensity to Leave (reflective indicators, average composite reliability: 0.74)

1. We expect our relationship with this insurer to continue a long time.
2. Contract renewal with this insurer is virtually automatic.
3. Our relationship with this insurer is a long term alliance.

Cooperation (formative indicators, a summated scale was used)

1. Problems that arise in the course of this relationship are treated by the parties as joint, rather than individual responsibilities.
2. The parties are committed to improvements that may benefit the relationship as a whole, and not only to the individual parties.
3. This insurer helps us out in whatever ways we ask.

Functional Conflict (formative indicators, a summated scale was used)

1. The relationship with this insurer can be best described as tense.
2. Significant disagreements occur within this relationship.
3. We frequently clash on issues relating to our practice management systems.

Decision-Making Uncertainty (formative indicators, a summated scale was used)

With this insurer, how confident are you in your ability to make future decisions regarding

1. What medical procedures are covered.
2. The procedures for processing a complex claim.
3. When payment will be received regarding a processed claim.
4. Who to talk to when you have a question concerning a claim 1.

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