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Antecedents to management accounting change: a structural equation approach

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Abstract

This paper reports on a survey of manufacturing companies, and uses structural equation modeling to examine the relationships between the changing competitive environment, and a range of organizational variables as antecedents to management accounting change. The results indicate that an increasingly competitive environment has resulted in an increased focus on differentiation strategies. This, in turn, has influenced changes in organizational design, advanced manufacturing technology and advanced management accounting practices. These three changes have led to a greater reliance on non-financial accounting information which has led to improved organizational performance.

Introduction

Throughout the 1990s, the growing level of global competition intensified the challenges for managers who need to consider more effective ways of achieving competitive advantage and improving organizational performance. One means of achieving this is through the adoption of clearly articulated strategies, flexible organizational structures and innovative accounting systems. A common theme in normative management accounting research is that changes in an organization's external environment will lead to change in an organization's management accounting system (Atkinson et al., 1997; Nanni, Dixon, & Vollman, 1992). This is based on the argument that managers need specific forms of management accounting information that support their decision needs within increasingly uncertain environments, and to assist them to monitor progress against strategies. The need for an appropriate fit between the environment and organizational systems is an underlying assumption of much of the empirical contingency-style management accounting research (see for example, Chenhall & Langfield-Smith, 1998a,1998b; Gul, 1991; Perera, Harrison, & Poole, 1997), as is the need for management accounting systems to change to support managers' new information requirements. However, prior empirical research in management accounting has examined primarily the various relationships between the environment, organizational variables, and management accounting systems at a point in time. There has been limited empirical research examining the nature of the changes in management accounting systems and organizational variables made in response to environmental changes, and whether or not these changes improve organizational performance.

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This study uses a survey method and utilizes structural equation modeling to identify whether changes that have occurred within the external environment of manufacturing organizations have led to change in the type of management accounting information provided and used for decision-making. More specifically, this study investigates whether changes in the organizational environment have led to changes in the organizations' strategy, organizational design, advanced manufacturing technology and management accounting practices. These changes in turn are hypothesized to influence the type of management accounting information used by managers, which may lead to improved organizational performance. The remainder of this paper is organized as follows. Section 2 summarizes the relevant prior literature, and presents research hypotheses. The research method and development of the survey is explained in Section 3. Section 4 contains the analysis of the data, and this is followed by a discussion of the results and conclusion.

Literature review and hypothesis development

Effects of changes in the competitive environment

In this section, the literature that examines the relationships between changes in the competitive environment, and changes in strategy, organization design and technology is reviewed, and hypotheses presented.

Changes in the environment and strategy

Since the 1980s, there has been significant change in the external environment faced by firms in all sectors of the economy. This includes more active competitors, increasingly demanding customers, and the availability of information processing technologies (Hiromoto, 1991; Innes & Mitchell, 1990; Shields, 1997). Such changes have occurred as a result of market and financial deregulation, and increasingly companies compete in a single global market. Increasing globalization has resulted in intense and aggressive international competition, increased customer demands including diversified customer needs, and shorter product life cycles (Dent, 1996; Shields, 1997).

The strategy an organization adopts constitutes the logic underlying its interactions with its environment. It is well established that an organization's strategy is a response to its environment, and that the appropriate matching of strategy and the environment can enhance performance (Burns & Stalker, 1961; Porter, 1980). Several empirical studies have examined the linkage between environment and strategy. For example, Fuschs, Mifflin, Miller, and Whitney (2000) found that successful firms aligned key elements of strategy with the environment. Chong and Chong (1997) found a positive association between perceived environmental uncertainty and strategy, and Miller (1988) found a relationship between an unpredictable and dynamic environment and an innovation strategy.

As the environment becomes dominated by increasingly more demanding customers and as competitors respond to customer demands in increasingly sophisticated ways, a firm may place greater emphasis on developing a differentiation strategy that emphasizes more customer-oriented aspects such as quality, flexibility, innovative products and dependability of supply (Perera et al., 1997; Sim & Killough, 1998). Therefore, the following hypothesis is proposed:

H_{1a}. Firms facing a more competitive environment will change towards a differentiation strategy.

Changes in the environment and organization design

Under conditions of environmental change where markets have become more competitive, particularly with an increased level of high quality and competitively priced products, firms may respond by reorganizing their work processes, and adopting structures that have a stronger customer orientation (Keidel, 1994; Miller, 1988; Parthasarthy & Sethi, 1993). In particular, a variety of team-based structures have emerged, including self-managed work teams, and cross-functional project teams (Cohen & Bailey, 1997). Self-managing work teams are increasingly relied on in manufacturing organisations (Anderson, Hesford, & Young, 2002). These teams are continuing work units responsible for producing products, often from the initial purchase of materials, through all stages of the production process, to the final product. Employees are empowered to make a variety of decisions that were once the domain of supervisors and managers, and team members are multi-skilled. These decisions can cover the areas of production quality, supplier and customer liaison, personnel management, production planning and conflict resolution. Cross-functional teams are one-time team structures that are formed for a specific purpose, such as developing a new product, or improving work processes. Team members are drawn from different functional areas of the business which allows a variety of different skills, knowledge, expertise and perspectives to be brought to the project. These teams have the potential to generate new ideas or derive novel solutions, which may be essential to competing in dynamic competitive environments (Anderson et al., 2002). Thus, higher quality and more timely and creative outcomes can be expected from such teams, as their capacity to undertake multiple activities simultaneously provides an effective response to time-based competition (Brown & Eisenhardt, 1995; Cohen & Bailey, 1997).

The adoption of teams is associated with flatter hierarchies and the increased empowerment of lower-level managers and employees (Chenhall & Langfield-Smith, 1998b; Elliot, 1991; Otley, 1994; Rimmer, Macneil, Chenhall, Langfield-Smith, & Watts, 1996; Shields, 1997). To ensure fast and innovative responses in complex and dynamic environments, there has been a move away from hierarchical controls and centralized decision making, towards the allocating of more responsibility to lower levels of the firm. It has been argued that the use of team-based structures in complex environments enables organizations not only to improve their speed and flexibility of response, but also to improve the quality of that response (Cohen, 1993; Lawler, 1993). Therefore, the following hypothesis is proposed:

H_{1b}. A more competitive environment will result in changes in organizational design, with greater use of team-based structures.

Changes in the environment and technology

An increasingly competitive environment can lead to firms adopting innovative products and production techniques to provide increased flexibility, and to satisfy customer demands (Foster & Gupta, 1994; Otley, 1994). In order to compete in these highly competitive markets, many organizations have made considerable investments in advanced manufacturing technology, such as computer-aided design, computer-integrated manufacturing and just-in-time systems. The use of these technologies has resulted not only in increased quality, but also in the ability to provide differentiated products or services to satisfy specific market segments or even individual customers (Elliot, 1991; Gosse, 1993; Otley, 1994).

The increased flexibility provided by advanced manufacturing technology has made it more attractive to increase the breadth of the product line, as making more frequent changeovers and producing in smaller batches allows customer preferences to be satisfied, without having to incur high inventory storage costs (Milgrom & Roberts, 1995). Advanced manufacturing technologies enable companies to compete on the basis of quality, productivity and flexibility, as well as on cost, and have transformed the manner in which production takes place even in relatively small companies (Bhimani, 1994; Bruggeman & Slagmulder, 1995; Parthasarthy & Sethi, 1992; Pfeffer, 1994). Thus, the following hypothesis is proposed:

H_{1c}. A more competitive environment will result in increased use of advanced manufacturing technology.

Effects of changes in strategy

In this section, the relationships between changes in strategy and changes in organization design, technology and advanced management accounting practices are presented. Three hypotheses are developed.

Changes in strategy and organization design

The increased emphasis on a differentiation strategy may require operational employees to adopt a stronger customer orientation, and one way of encouraging employees to take ownership of such a strategy is through the introduction of team-based structures. In production teams, workers are encouraged to pool their knowledge of the production process and initiate innovative approaches to improve productivity and quality, and to reduce production lead time (Banker, Potter, & Schroeder, 1993). Teams provide the basis for a stronger customer focus and allow the structuring of work around processes rather than functions, which has direct implications for engaging in process improvement activities which may improve an organization's speed, flexibility and quality of response (Scott & Tiessen, 1999; Rimmer et al., 1996). Therefore, the following hypothesis is proposed:

H_{2a}. A change towards a differentiation strategy will result in changes in organization design, with greater use of team-based structures.

Changes in strategy and technology

A proper link between strategy and manufacturing operations is a key to developing sustainable competitive advantage (Porter, 1996). One way in which manufacturing organizations can respond to increasing customer demands of quality, flexibility and dependability of supply is through the implementation of advanced manufacturing technology. Schroeder and Congden (2000), in a study of small to medium-sized manufacturers, found the most financially successful firms were those which demonstrated a tight alignment between strategy and technology, while Kotha and Swamidass (2000) found that for firms competing on the basis of quality, customer service, delivery reliability, product features and flexibility, investment in advanced manufacturing technology resulted in superior growth. A positive association between an emphasis on differentiation strategies and investments in advanced manufacturing technologies was also found in a study of UK firms (Burcher & Lee, 2000). Thus, the following hypothesis is proposed:

H_{2b}. A change towards a differentiation strategy will result in increased use of advanced manufacturing technology.

Changes in strategy and advanced management accounting practices

In pursuing competitive advantage, organizations may implement manufacturing processes and administrative functions that support their particular strategic priorities. For example, both Chenhall and Langfield-Smith (1998b) and Callahan and Gabriel (1998) found greater use of advanced management accounting practices, such as quality improvement programs, benchmarking and activity-based management, in firms that placed a strong emphasis on product differentiation strategies, and this ultimately resulted in high performance.

Advanced management accounting practices can assist employees to more easily focus on achieving differentiation priorities, such as quality, delivery and customer service, compared to more traditional financially based accounting practices, as they highlight the need to satisfy customer requirements. For example, target costing allows managers to focus on low cost while simultaneously maintaining customer expectations in areas of quality and functionality. Also, activity-based management focuses on maintaining or enhancing customer value, not just controlling costs. Thus, the following hypothesis is proposed:

H_{2c}. A change towards a differentiation strategy will result in the increased use of advanced management accounting practices.

Effects of changes in technology

This section reviews the literature examining the relationships between changes in the use of advanced manufacturing technology, and changes in organization design and advanced management accounting practices.

Changes in technology and organization design

Adopting new technologies may require changes in organizational structures and work practices to better suit the capabilities of that technology (Rimmer et al., 1996). Traditional manufacturing plants tend to be laid out by machine or process function. Line personnel, separated from their coworkers by inventory, become specialized by repeatedly processing large batches of similar materials, and inventories are pushed through the system with quality inspections conducted by quality control personnel occurring at the end of the production. In contrast, the successful implementation of new technology often requires the blending of technological and social skills, which can best be achieved through adoption of work-based teams or production cells. These new structures emphasize products and customers rather than mass production. A team may manage the complete processing of products, with each employee performing several functions. Batches are small, there is little work-in-process inventory, teams become responsible for production and quality, and sometimes liaise directly with suppliers and customers (Banker et al., 1993; Rimmer et al., 1996). Therefore, the following hypothesis is proposed:

H_{3a}. The increased use of advanced manufacturing technology will result in a change in organization design, with greater use of team-based structures.

Changes in technology and advanced management accounting practices

With the introduction of new technologies in manufacturing operations, the structure of manufacturing costs has changed. Technologies such as computer-integrated manufacturing and just-in-time systems emphasize that variable direct labor and inventory are vanishing from the factory. Speed of operation is not determined by how fast an operator can work, but by the type of automation and manufacturing system used (Dhavale, 1996). Consequently, traditional cost control systems which focus on variance analysis, aggregating costs and accounting for inventory, do not effectively identify resources consumed, or help managers manage those resources. In addition, they may distort the realities of manufacturing performance with new technological processes (Bruggeman & Slagmulder, 1995; Gosse, 1993; Kaplan, 1994).

Advanced management accounting practices, such as activity-based management, life cycle costing and target costing, appear to be gaining an increasing foothold in the modern world (Granlund & Lukka, 1998). They provide an approach to resource management that supports a customer focus. For example, benchmarking provides an important way of sensitizing the organization to external performance standards, thus overcoming the inward focus of cost variance analysis (Chenhall & Langfield-Smith, 1998a; Elnathan, Lin, & Young, 1996). Quality improvement programs have evolved as a philosophy that stresses the notion of continuously improving manufacturing processes by eliminating waste, improving quality, developing people skills and at the same time reducing costs (Sim & Killough, 1998). The following hypothesis is proposed:

H_{3b}. The increased use of advanced manufacturing technology will result in the increased use of advanced management accounting practices.

Influence of organizational changes on non-financial management accounting information

In this section, the literature that examines the relationships between changes in organizational variables, namely advanced management accounting practices, strategy, organization design and technology, and changes in reliance on non-financial management accounting information will be reviewed.

Changes in advanced management accounting practices and non-financial MAI

There is strong empirical support for the association between advanced management accounting practices and the increased use of non-financial performance measures. Chenhall and Langfield-Smith (1998b) found that firms which emphasized product differentiation strategies benefited from the use of advanced management accounting practices and reliance on non-financial information. Further, Abernethy and Lillis (1995), Banker et al. (1993), Perera et al. (1997) and Sim and Killough (1998) found a positive association between the emphasis placed on various forms of advanced management practices in an environment of manufacturing flexibility, and the use of non-financial measures such as defect rates, on-time delivery and machine utilization. Therefore, the following hypothesis is proposed:

H_{4a}. The increased use of advanced management accounting practices will result in greater reliance on non-financial MAI.

Changes in strategy and non-financial MAI

An organization's ability to survive and function successfully in an environment of intense competition depends partially on the availability of information upon which its managers can act (Bhimani, 1993). Therefore, accounting information should be designed to facilitate informed judgments and decisions that support the chosen strategy.

The development of appropriate management accounting information requires that the strategy be articulated so that goals and objectives are defined with sufficient precision to be measurable. For example, if quality or innovation is central to a firm's competitive strategy, then it is vital that the firm's accounting system is able to measure events representing these factors. Measures that focus on customer satisfaction, manufacturing excellence, market leadership, quality, reliability, responsiveness, and technological leadership, innovation and human resources need to be considered (Eccles, 1991; Fisher, 1992). The failure to include these measures in a formal management accounting system may well hamper an organization's ability to achieve various differentiation strategies of customer satisfaction, quality, speed, learning and process improvement (Sim & Killough, 1998).

A change towards a differentiation strategy requires a shift from cost and efficiency-based performance measures to ones which measure specific non-financial aspects of strategy, such as quality, service, flexibility and dependability (Cooper, Kaplan, Maisel, Morrissey, & Oehm, 1992; Samson, Langfield-Smith, & McBride, 1991). This leads to the hypothesis:

H_{4b}. A change towards a differentiation strategy will result in greater reliance on non-financial MAI.

Changes in organization design and non-financial MAI

A critical aspect of adopting team operations is the process of empowerment. Teams cannot simply be delegated responsibilities. Empowerment places both authority and responsibility at low levels in an organization; it implies that employees are willing to take responsibility for their own actions, and use their initiative to locate and solve problems to ensure that organizational goals are met, particularly in relation to customer service (Ichniowski, Shaw, & Prennushi, 1997; Otley, 1994; Rimmer et al., 1996). Changing the organization design, including the use of teams and employee empowerment, will result in changed employer and employee expectations, including increased access to relevant information (Scott & Tiessen, 1999).

The role of management accounting in this changed organization structure is not simply to deliver cost data, but to provide a service that empowers team members to make the best decisions in light of current conditions (Gordon & Miller, 1976; Nanni et al., 1992). As more decision making responsibility is passed to 'lower' levels of the organization, there is an increased need for easily accessible and relevant information at these levels, as well as relevant information for top management to evaluate the operations of the firm and direct strategy (Banker et al., 1993). Non-financial performance measures can form an integral part of the information base necessary for team success (Scott & Tiessen, 1999). Therefore, the following hypothesis is proposed:

H_{4c}. A change in organization design, with greater use of team-based structures, will result in greater reliance on non-financial MAI.

Changes in technology and non-financial MAI

It has been argued that reliance on non-financial information is dependent on the level of adoption of advanced manufacturing technology (Perera et al., 1997). If substantial changes take place in the manufacturing processes, the management accounting system must also change if it is to provide relevant information for managerial decisions and control (Foster & Horngren, 1988; Kaplan, 1986; Nanni et al., 1992).

Financially oriented accounting measurement systems imperfectly reflect, and often with considerable lags, the increase in manufacturing efficiency and effectiveness that occurs when firms pursue total quality control, just-in-time inventory systems, and computer integrated manufacturing processes. These systems, with their emphasis on short-term profits fail to capture the benefits that arise from decreased new product launch times, reduced throughput and lead times and the improved flexibility which modern manufacturing technology has made possible (Kaplan, 1986). Poorly designed or outdated accounting and control systems can distort the realities of manufacturing performance. Furthermore, such systems can place out of reach most of the promised benefits of new methods because the performance of individuals, production processes, and firms in high technology environments are not being assessed and evaluated appropriately (Kaplan, 1984; Young & Selto, 1991). Such technological changes require fundamental changes to performance measures (Bhimani, 1993; Drury & Tayles, 1995). More timely, relevant and comprehensible information is perceived as improving managerial decisions in areas such as cost reduction, cost control, product quality and performance assessment. For example, to evaluate the effectiveness of the flexible manufacturing systems to deliver customer value, measures such as cycle time, delivery performance, and the ability of manufacturing to vary product characteristics or develop new products would be more appropriate to track performance, than traditional cost metrics (Abernethy & Lillis, 1995; Bhimani, 1993). Thus, the following hypothesis is proposed:

H_{4d}. The increased use of advanced manufacturing technology will result in greater reliance on non-financial MAI.

Change in non-financial MAI and organizational performance

It has been argued that reliance on financial performance measures alone will not necessarily produce improved financial results, as financial measures only indicate the outcomes of past activities which may be no guide to improving future performance. Non-financial measures, however, can reflect the drivers of future financial performance. It follows, therefore, that performance measures that exclude important aspects of manufacturing operations will not direct managers to areas of critical concern (Nanni et al., 1992).

However, although predictive ability is claimed to be one of the benefits of non-financial measures (Atkinson et al., 1997), it appears that managers are not always sure that their efforts are rewarded with improvements in the financial bottom line (Fisher, 1992). While the majority of prior research supports a positive relationship between the increased reliance on non-financial information and organizational performance, the exact nature of the relationship is ambiguous.

Mia and Clarke (1999) found an indirect association between the intensity of market competition and business unit performance through the use of management accounting information. Davila (2000) and Chong and Chong (1997) established that a greater use of non-financial information for business units following a customer-focused or prospector-type strategy, had a positive impact on performance. Managers in these cases tended to place greater reliance on non-financial information on the assumption that good performance in non-financial areas would drive good financial performance. On the other hand, Perera et al. (1997) found no association between the use of non-financial measures and perceived performance in an organization with a ‘customer-focused’ manufacturing strategy.

Improved performance has resulted in firms that use flexible manufacturing, and which also place greater reliance on non-financial manufacturing measures (Abernethy & Lillis, 1995; Sim & Killough, 1998). Improved performance has also occurred when teams have been provided with comprehensive performance measures, that is, a combination of financial and non-financial measures (Scott & Tiessen, 1999). Ittner and Larcker (1995) and Sim and Killough (1998) both found a significant positive interaction between TQM practices, management accounting information and performance. On the other hand, Banker, Potter and Srinivasan (2000) and Ittner and Larker (1998) found that particular non-financial measures were positively associated with future, rather than current, revenues and profit. It is possible, however, that organizational strategy, the type of technology, and the structural and environmental factors confronting the organization could also affect the use and performance consequences of reliance on non-financial performance measures (Daft & Lengel, 1986; Ittner & Larcker, 1998). Also, improvements in non-financial measures will not result in improved profits if management has selected the wrong critical success factors. If, for instance, performance measures are based on quality, but quality is not of value to the customer, the strategy will not lead to improved financial performance. A strategy of innovation will fail unless it addresses an environment that values novelty and is accompanied by an organizational structure that can produce it. Similarly, a matching of only organizational design and environment with each other will be inadequate if either conflicts with the selected strategy (Miller, 1982; Pelham, 1999).

Therefore, the use of non-financial performance measures may be just one factor in a management accounting information system that must be considered with all other variables within the organization. Successful companies must not only track financial performance and operating efficiency, but must also pay close attention to customer satisfaction and human resources, and there must be an agreement on strategy and clarity of communication (Lingle & Schiemann, 1996). Information is now recognized as one of the most powerful tools that can substantially influence the wealth of corporations (Mangaliso, 1995). Thus, in response to the changed environment, the challenge for any management accounting system is to provide up-to-date information to help managers reach informed economic decisions, and to motivate users to aim and strive for organizational change (Horngren, 1995; Stokes & Lawrimore, 1989). Failure to rely on appropriate accounting information may contribute to ineffective resource management and a gradual decline in organizational performance. This leads to the final hypothesis.

H_5. A change in MAI, with greater reliance on non-financial management accounting information, will result in improved organizational performance.

The hypotheses are illustrated in Fig. 1.

Method

This section contains two parts. First, there is a description of the sample used to test the hypotheses. Second, the development of the survey instrument and the measurement of the variables are described.

Sample selection

A self-administered questionnaire was sent to the general managers of 700 manufacturing organizations randomly selected from the *Kompass Australia* (1999) database. A stratified sampling approach was used. This involved dividing the sample into five groups based on the number of employees (a proxy for size), and selecting firms proportional to the number of companies in each group. The firms selected were business units of larger firms, or companies in their own right. The initial posting of the survey instrument also included, (a) a letter, addressed personally to the general manager of each business unit, explaining the purpose of the study; a tear-off section allowing respondents to provide their name and address for a copy of the survey results, while ensuring anonymity, (b) a reply-paid envelope for the return of the survey, and (c) a separate reply-paid envelope for the return of the tear-off section. Three weeks after the initial posting, a reminder letter was sent to all managers who had not returned the tear-off section. Two weeks later, each manager who could not be identified as having responded was phoned and encouraged to complete the questionnaire. Additional questionnaires were forwarded to those who had misplaced the original material.

A total of 155 responses (22%) were received. Of these, 14 were unusable, mainly due to missing data on organizational performance. This resulted in 141 useable responses, a response rate of 20%. The remaining sample firms had average sales of $128.2 million and average assets of $88.59 million. The majority of firms in the sample were stand-alone companies (59% of the sample) or divisions of larger companies (37%). The respondents had been with their firm an average of 11.3 years. Most described themselves either as managers (61%) or managing directors (23%).

The useable response rate of 20% is clearly lower than anticipated. It provides a sample size

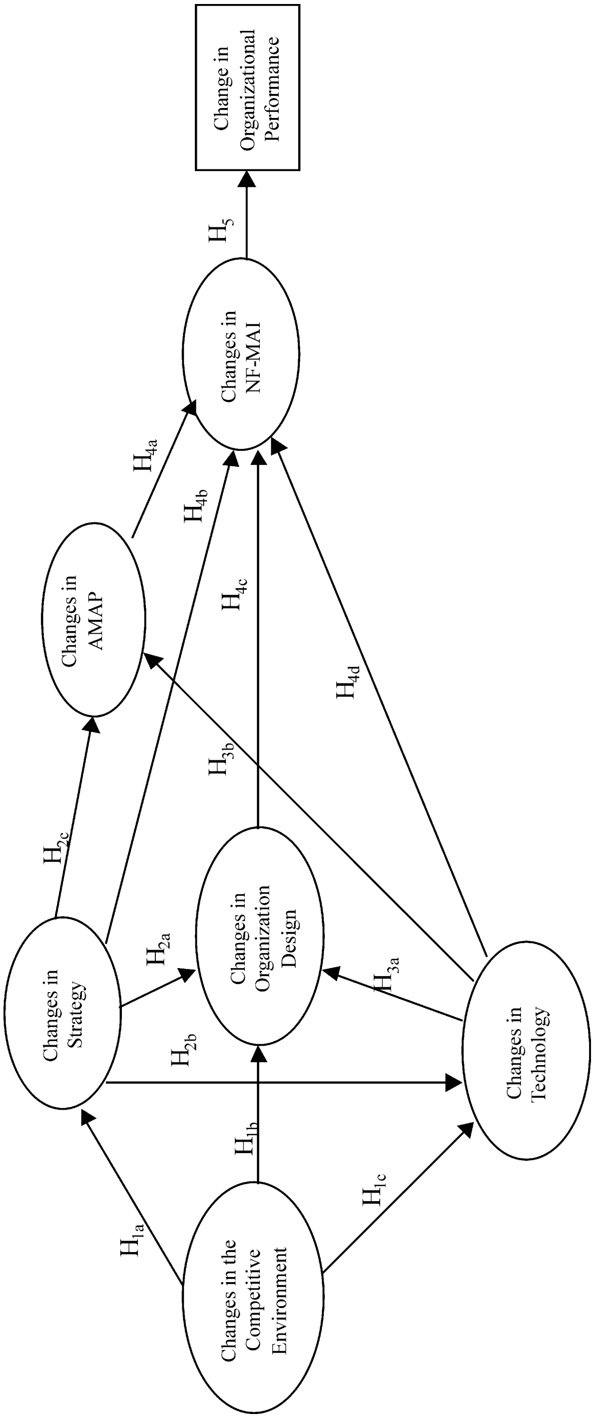

Fig. 1. Hypothesized model.

which is just large enough to undertake the structural equation analysis (discussed in a later section), but the potential for non-response bias does arise. The mean responses for questionnaires received prior to the reminder phone call were compared to those received after the phone call, to test if responses differed between the two groups. No significant differences were identified, providing some support for the absence of a non-response bias. However, this test is not conclusive. Follow-up calls to late and non-respondents revealed that some managers had no time to complete the questionnaire, while other managers stated that they had recently received a large number of questionnaires and their firm had adopted a policy of not completing postal surveys. The low response rate is clearly a limitation of this study.[1]

Survey design and variable measurement

The questionnaire was pre-tested by a small group of academics and managers, prior to postage. This resulted in changes to some of the wording and the presentation of the questionnaire. The survey instrument consisted of demographic data, including sales revenue, book value of assets and employee numbers, and questions that measured each of the variables of interest. In most cases, the measures were adapted from prior research. All variables (except organizational performance) were measured on an 11-point scale, to capture decreased change (−5 to −1), no change (0) and increased change (+1 to +5), over the past 3 years. Where relevant, respondents had the opportunity to indicate if the various practices or items had never been used or adopted (indicated as N/A). For analysis, scores were coded '0' for N/A while the remaining responses were coded 1–11. Therefore, the point of 'no change' was coded '6'.

The measure of environmental change was based on the instrument used by Tan and Litschert (1994), developed from Khandwalla (1977). As with other questions in this survey, managers' perceptions were relied on to measure environmental change. Managers' perceptions were considered appropriate in this situation, compared to the use of more objective measures for several reasons. First, it is managers' perceptions of the environment which are of interest, as it is these perceptions that will influence decisions with respect to the choice of strategy and changes in other organizational and management accounting variables. Second, it is difficult to measure objectively variables such as the extent of change in the environment, or change in strategic emphasis (Duncan, 1972; Khandwalla, 1972; Lawrence & Lorsch, 1967). Finally, it has been argued that individuals have sufficient understanding of their decision process to be able to give relatively reliable information (Chenhall & Morris, 1986; Shortell & Zajac, 1990). The measure of change in the environment addressed changes in competitors' actions with respect to eight areas: prices and products; customers' expectations in regard to price, quality and delivery; suppliers' actions in respect to price, quality, delivery and availability; availability of new manufacturing technology; regulations such as changes in tariff policies; local economic factors such as market and economic growth; international factors such as the world economy, imports and foreign exchange; and development of new products or services in the industry.[2] Respondents were asked to indicate the extent to which they believed the competitive environment of their business unit had changed over the past 3 years for each of these eight areas. The anchors of the scale were 'significantly less competitive' (scored −5) to 'significantly more competitive' (scored +5).

The measure of change in the use of advanced manufacturing technology consisted of nine items taken from recent management accounting literature

[1] Dillman (2000) provides several measures for reducing nonresponse bias in postal questionnaire studies. These include the use of response-friendly questionnaires (including the design of the letter, the length of the survey, the order of the questions), using of multiple contacts, including a pre-paid return envelope, personalisation of correspondence, and prepaid incentives. While most aspects of Dillman's "tailored design method" were applied in the design of this study, on reflection, an increase in the number of contacts made with managers and the use of prepaid incentives may have increased the response rate.

[2] These items are similar to those used by Gul and Chia (1994), Govindarajan (1984), and Kren and Kerr (1993).

(see, for example, Kotha & Swamidass, 2000; Rimmer et al., 1996). These items were just-in-time purchasing, just-in-time production, total quality management, flexible manufacturing systems, computer integrated manufacturing, computer aided design, computer aided manufacturing, materials requirements planning and manufacturing resource planning. Respondents were asked to indicate the extent to which their business unit's use of the eight technologies had changed over the past three years, from 'used significantly less' (scored −5) to 'used significantly more' (scored +5).

The strategy measure focused on the extent to which each business unit had changed its strategic emphasis over a range of differentiation aspects, during the past 3 years. The nine items (listed in Table A3 in the Appendix) all measured aspects of differentiation, and were derived from instruments used by Chenhall and Langfield-Smith (1998b), Parthasarthy and Sethi (1993) and Perera et al. (1997). Each element was rated on an 11-point Likert scale ranging from 'emphasized significantly less' (scored −5) to 'emphasized significantly more' (scored +5).

Change in organizational design was adapted from measures developed by Chenhall and Langfield-Smith (1998b) and Miller, DeMeyer and Nakane (1992). Respondents were asked to indicate the extent to which their use of a range of ten organizational design practices had changed over the past 3 years. These items were work-based teams, manufacturing cells, cross-functional teams, multi-skilling of the workforce, management training, worker training, employee empowerment, flattening of the formal organizational structure, establishing a participative culture and reorganizing manufacturing processes. The 11-point Likert scale ranged from 'used significantly less' (scored −5) to 'used significantly more' (scored +5).

The measure for change in advanced management accounting practices required respondents to indicate the extent to which their use of a range of nine contemporary management accounting practices had changed over the past three years. The items were activity-based costing, activity-based management, target costing, value chain analysis, benchmarking, product life-cycle analysis, product profitability analysis, customer profitability analysis and quality improvement programs. The items were derived from a measure developed by Chenhall and Langfield-Smith (1998b). The 11-point Likert scale ranged from 'used significantly less' (scored −5) to 'used significantly more' (scored +5).

Changes in non-financial management accounting information included a list of 19 items based on items used by Abernethy and Lillis (1995) and Stivers, Covin, Hall, and Smalt (1998). Items included on-time delivery, customer satisfaction, ongoing supplier evaluations, rate of new product introductions, and measures of set-up times. (A full list is provided in Table A6 in the Appendix.) Respondents were asked to indicate the extent to which their reliance on the items of information for decision making had changed over the past three years, on a scale ranging from 'considerably less reliance' (scored −5) to 'considerably more reliance' (scored +5).

The organizational performance variable was measured using the two-part measure developed by Govindarajan (1988) and Govindarajan and Fisher (1990). The first part of the measure asked respondents to compare the change in their business unit's performance over the past three years, relative to their competitors, over ten financial and non-financial dimensions of performance. These items were return on investment, profit, cash flow from operations, cost control, development of new products, sales volume, market share, market development, personnel development and political-public affairs. An 11-point Likert scale ranged from 'significantly lower performance than competitors' (scored −5) to 'significantly higher performance than competitors' (scored +5). The second part of the measure required respondents to assess the same ten dimensions in terms of their importance to the business unit, on a 5-point Likert scale ranging from 'no importance' (scored 1) to 'extremely important' (scored 5). Final scores for each dimension were determined by multiplying the respective 'performance' and 'importance' scores. A single performance score for each firm was calculated as the weighted average of all 10 dimensions.

Statistical analysis and results

This section includes details of the statistical analysis undertaken using structural equation modeling (SEM), hypotheses testing and presentation of the results. SEM was the preferred method of analysis in this study as it allows the analysis of multiple relationships simultaneously, provides measures of overall model fit, as well as explaining the significance of each of the relationships between the variables (Kline, 1998). The ability to model multiple relationships is an advantage of latent variable SEM over multiple regression and path analysis. In addition, unlike regression analysis and path analysis, SEM will account for the effects of measurement error in multi-item variables.

Measurement models

Structural equation modeling (SEM) was used to analyze the data using a two-stage process recommended by Schumaker and Lomax (1996). In the first stage, each latent variable was modeled as a separate measurement model. A measurement model relates observed variables to their associated latent variable. In this case, the latent variables were changes in the competitive environment (environment), changes in the use of advanced manufacturing technology (technology), changes in emphasis on differentiation strategy (strategy), changes in the use of organizational design practices (organization design), changes in the use of advanced management accounting practice (AMAP) and change in reliance on non-financial management accounting information (NF-MAI). The second stage involved constructing the structural model by specifying the relationships between the latent variables. In this section, the first stage will be described.

Formulating measurement models for each variable involved using AMOS 4 to conduct confirmatory factor analysis for each set of items.[3] Covariances were included between error terms in each measurement model where suggested by AMOS, but only where such covariances were justified theoretically.[4] Details of the fit indices for each measurement model are shown in Table 1.

Model fit is defined by Hair, Anderson, Tatham and Black (1998), as the "degree to which the actual/observed input matrix is predicted by the estimated model". There is no single measure of fit for structural equation models, so it is good practice to include a range of fit indices. Chi-square and the Goodness-of-Fit (GFI) index measures overall model fit. A non-significant chi-square indicates that the data fit the model, while the GFI index ranges from 0 (poor fit) to 1 (perfect fit) with an acceptable minimum of 0.90 (Hu & Bentler, 1999). The GFI is considered analogous to the R^2 value reported in multiple regression models (Hoyle & Panter, 1995; Tanaka, 1993). Model comparison was evaluated using the Tucker–Lewis Index (TLI) (Tucker & Lewis, 1973) and the Comparative Fit Index (CFI) (Bentler, 1990). A value greater than 0.90 for the TLI and 0.95 for the CFI reflects a good model fit. The Adjusted Goodness-of-Fit (AGFI) index and the Akaike Information Criterion (AIC) were used to measure model parsimony. The AGFI ranges from 0 (poor fit) to 1 (perfect fit) with a cutoff of 0.90 indicating a good fit, while the AIC should be less than for the saturated model. This measure assesses whether or not the model fit has been achieved by "over fitting" the data with too many coefficients (Hair et al., 1998). In Table 1, in all but one case, the fit indices for each measurement model were better than the recommended criteria. In the case of NF-MAI, the fit was acceptable for all but two measures: the chi-square was significant ($P=0.021$) and the AGFI was 0.885. However, in the light of the other very favorable fit measures, the measurement models can all be regarded as exhibiting good fit.

A number of items were deleted as part of the development of the measurement models. As the strategy item 'provide unique product features' had a negative factor score weight, this was deleted from the strategy variable (Loehlin, 1998).

[3] In SEM, confirmatory factor analysis, rather than exploratory factor analysis is used as the identification of the factors is specified by theory, not by the data (Hair et al., 1998).

[4] The inclusion of non-zero covariances between error terms has been used in prior management accounting research when semantic (or theoretical) relationships exist between items (see, for example, Shields, Deng & Kato, 2000; Jaworski & Young, 1992).

Table 1
Model fit for measurement models

Variable	χ^2	df	*P*	GFI	TLI	CFI	AGFI	AIC (saturated model)
Environment	18.92	18	0.397	0.968	0.993	0.995	0.936	54.92 (72.00)
Technology	30.18	23	0.144	0.954	0.982	0.989	0.910	74.19 (90.00)
Strategy	25.24	17	0.089	0.958	0.958	0.975	0.911	63.24 (72.00)
Organization design	28.42	23	0.201	0.957	0.976	0.984	0.916	72.42 (90.00)
AMAP	36.81	33	0.297	0.953	0.988	0.991	0.921	80.81 (110.00)
NF-MAI	62.59	42	0.021	0.927	0.940	0.954	0.885	110.59 (132.00)

The item 'reorganizing manufacturing processes' was removed from the organization design variable, as it had a squared multiple correlation of 0.04, indicating that the item explained less than 5% of the latent variable. Due to the large number of items in the NF-MAI variable, the number of parameters to be estimated was too large in relation to the sample size, resulting in an initial poor fit (Kline, 1998).[5] Further analysis was performed by dividing the items into two variables, to reduce the number of parameters to be estimated for each variable. However, this analysis revealed the items did not comprise more than one distinct variable. Therefore, to decrease the number of free parameters and improve the stability of the measurement model, seven items with low squared multiple correlations (<0.2) were removed from the model. Following the removal of these items, 'cycle from order to delivery' had a negative factor weight so was also removed. (The list of items removed is reported in footnote 9 in the Appendix.) The 11 remaining items all had a critical ratio significant at $P \leqslant 0.001$. The descriptive statistics for all items included in each of the final variables are provided in the Appendix.

The structural model

The second stage of the analysis involved constructing the structural model, by specifying the relationships between the latent variables and organizational performance, in line with the hypotheses.[6] Scores for each latent variable were calculated by averaging the items remaining in each variable following the confirmatory factor analysis. As discussed earlier, organizational performance was calculated as the average of the change in performance multiplied by the degree of importance of each item (Govindarajan & Fisher, 1990). Table 2 lists the descriptive statistics for each variable in the study, including reliability measures (Cronbach's alpha), which ranged from 0.74 to 0.85. These all exceed the minimum value of 0.70, which is usually considered acceptable (Nunnally, 1978). Thus, the items within each variable are highly correlated with one another and therefore reliable predictors of that latent variable (Hair et al., 1998). The high reliability measures also provide confidence that the items in each variable were measuring a single construct. Table 3 contains a correlation matrix, which reveals that none of the variables are too highly correlated with each other.

Analysis of the theoretical model (as indicated in Fig. 1) indicated an acceptable model fit for a number of fit indices, with a marginally significant

[5] Kline (1998) suggests the ratio of subjects to free parameters should be 10:1, while Hair et al. (1998) suggest a minimum of 5:1. With 19 items in the construct, each with an error term, and one parameter fixed at '1′, there were 39 free parameters to be estimated. Ideally, this would require a minimum of 195 respondents in the data set, whereas the data set contained only 141 responses.

[6] The recommended minimum sample size for SEM is governed by two criteria. First, the minimum sample required to provide valid fit indices is said to be between 100 and 200 (Hair et al., 1998). Second, the minimum degrees of freedom required to ensure a stable SEM analysis has been suggested as either 5:1 (Hair et al., 1998) or 10.1 (Kline, 1998). In this model there were 19 free parameters, which would require a sample size of between 95 and 190. As a precaution against the small sample size of 141, the structural model was tested using two smaller component models and the full data set. The significant paths in these two models were identical to those found when the full model was run.

Table 2
Descriptive statistics for final variables

Variable	Theoretical range	Actual range	Mean	Standard deviation	Cronbach's alpha
Change in environment	1–11	4.25–10.00	7.76	1.14	0.74
Change in technology	1–11	4.00–11.00	7.84	1.17	0.85
Change in strategy	1–11	5.25–11.00	8.23	1.19	0.77
Change in organization design	1–11	6.00–10.67	7.99	1.13	0.80
Change in AMAP	1–11	6.00–10.70	7.66	1.00	0.82
Change in NF-MAI	1–11	5.82–10.45	7.59	0.99	0.85
Performance	1–55	11.80–46.40	27.11	7.31	N/A

Table 3
Correlation coefficients ($n=141$)

	Environment	Strategy	Technology	Organization design	AMAP	NF-MAI	Performance
Environment	1.000						
Strategy	0.349**	1.000					
Technology	0.264**	0.600**	1.000				
Organization design	0.250**	0.527**	0.355**	1.000			
AMAP	0.223**	0.608**	0.465**	0.566**	1.000		
NF-MAI	0.283**	0.644**	0.525**	0.733**	0.698**	1.000	
Performance	0.280**	0.539**	0.339**	0.462**	0.529**	0.577**	1.000

**$P<0.01$.

chi-square of 15.39 (df = 8, $p<0.052$), and all other fit indices either within or close to acceptable levels (GFI = 0.968; AGFI = 0.890; CFI = 0.983; TLI = 0.955; AIC = 55.39 (saturated model 56.000)). There were, however, a number of insignificant paths which needed to be deleted from the model. Those paths were between environment and organization design, environment and technology, technology and organization design, technology and AMAP, and strategy and NF-MAI. The outcome of these deletions was an improvement in model fit [$\chi^2=18.99$, df = 13, $p=0.123$; GFI = 0.964; TLI = 0.978; CFI = 0.986; AGFI = 0.923; AIC = 48.99 (saturated model 56.00)].

The final structural model is presented in Fig. 2. Table 4 provides a summary of the regression coefficients for each path in the model.

The results

The fit measures in the final model indicate a good model fit, with seven paths significant at $P \leqslant 0.001$, and one path significant at $P \leqslant 0.1$. The insignificant Chi-square for the model of 18.99 (df = 13, $P=0.123$) and the GFI (0.964) both indicate good overall fit. The comparative fit measures all indicate good model fit (TLI = 0.978, CFI = 0.986), as do the model parsimony measures (AGFI = 0.923, AIC = 48.99, saturated model = 56.00). Each of these fit measures exceeds the accepted minimums.

While hypothesis 1a is supported, no significant relationship was found between changes in the environment and changes in organizational design or changes in technology. Therefore, hypotheses 1b and 1c are rejected. The second group of hypotheses proposing a change towards a differentiation strategy would result in a change in organizational design with greater use of team-based structures, a greater use of advanced manufacturing technology and the greater use of AMAP are both supported. However, no significant relationships were found between the increased use of advanced manufacturing technology and changes in either organization design or AMAP, therefore hypotheses 3a and 3b are both rejected.

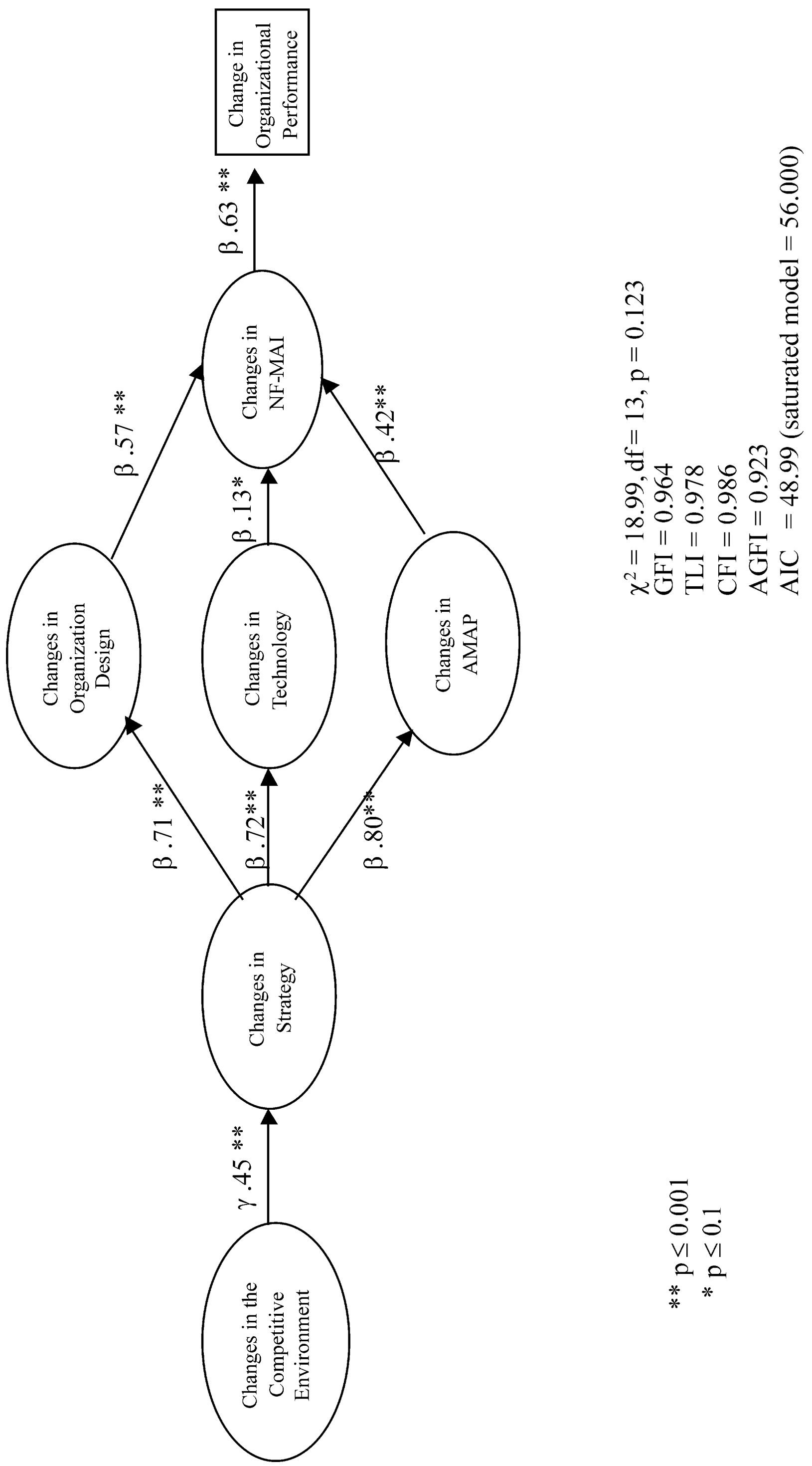

Fig. 2. Final model.

Table 4
Regression coefficients in the final model

Path	Standardized estimate (γ)	Standard error	Critical ratio
Environment – Strategy	0.449	0.109	4.384
Strategy – Organization design	0.712	0.085	8.123
Strategy – Technology	0.718	0.086	8.553
Strategy – AMAP	0.797	0.072	9.680
AMAP—NF-MAI	0.416	0.081	5.071
Organization design – NF-MAI	0.568	0.071	7.060
Technology – NF-MAI	0.129	0.062	1.739
NF-MAI – Performance	0.632	0.593	8.650

Hypotheses 4a–d examined the relationships between changes in the organizational variables and the resulting changed reliance on non-financial MAI. Hypotheses 4a, 4c and 4d are all supported, however the relationship between strategy and NF-MAI was not significant, resulting in the rejection of hypothesis 4b.

In the final model, there is a significant relationship ($\beta = 0.63$, $P \leqslant 0.001$) between changes in non-financial MAI and performance, and therefore H_5 is supported. A summary of the findings relating to the hypotheses is shown in Table 5.

Thus, a review of the final model reveals an interesting picture of the various direct and indirect relationships between the variables of interest. Rather than the hypothesized changes in the competitive environment having a direct effect on organizational variables, the effect is indirect through strategy. Also, rather than an increased emphasis on differentiation strategy influencing the increased reliance on non-financial MAI, the influence is indirect, through changes in organizational design, advanced manufacturing technology and AMAP. These findings will be discussed in greater detail in the following section.

Discussion

Having examined the outcomes of the testing of the data and the hypotheses in the previous section, this section provides a more detailed examination of the findings of this study, to provide further insights into the relationships between the variables that have been examined. In undertaking this examination, the break-down of the components of each of the variables, as provided in the tables in the Appendix, will be drawn on, as well as the data provided in the main tables of this paper.

The findings from this study confirm that there has been a significant increase in the competitiveness of the external environment faced by Australian manufacturing organizations over the past three years (mean = 7.76, in Table 2). The areas of greatest increase in competitiveness relate to the actions of competitors (mean of 8.35 in Table A1), customers with their increased expectations in relation to quality and price (mean = 8.32), and the need to develop new products (7.92). While tariff protection has been reducing in Australia since the early 1990s, continuing tariff reductions, together with concern for local economic growth, are still significant factors affecting the manufacturing industry. Therefore, to compete effectively, manufacturers need to take actions, or put in place systems to become innovative and improve quality, while being competitive on price.

Clearly, among the firms surveyed, each of the various aspects of differentiation were considered to have changed significantly over the past three years (see Table A3). In particular, the emphasis on on-time and dependable delivery, high quality products and effective after sales service, point to the increasing importance of companies adopting stronger differentiation strategies to compete in the increasingly globalized external environment. Within the structural model, the relationship between changes in the environment and changes towards a differentiation strategy was particularly strong ($\gamma = 0.45$, $P \leqslant 0.001$), reflecting environmental change as a driver of strategic change. This is consistent with prior empirical findings of Perera et al. (1997) and Sim and Killough (1998).

However, the structural model indicates no significant direct relationships between changes in the environment and the hypothesized changes in either organization design or technology. Rather it appears it is the greater emphasis on differentiation strategies that is driving many other organizational and accounting changes. The impact of environmental change on these variables is indirect.

Table 5
Summary of hypothesis testing

	Hypothesis	Support/reject
H_{1a}	Firms facing a more competitive environment will change towards a differentiation strategy.	Supported
H_{1b}	A more competitive environment will result in changes in organization design, with greater use of team-based structures.	Rejected
H_{1c}	A more competitive environment will result in increased use of advanced manufacturing technology.	Rejected
H_{2a}	A change towards a differentiation strategy will result in changes in organization design, with greater use of team-based structures.	Supported
H_{2b}	A change towards a differentiation strategy will result in increased use of advanced manufacturing technology.	Supported
H_{2c}	A change towards a differentiation strategy will result in the increased use of advanced management accounting practices.	Supported
H_{3a}	The increased use of advanced manufacturing technology will result in a change in organization design, with greater use of team-based structures.	Rejected
H_{3b}	The increased use of advanced manufacturing technology will result in the increased use of advanced management accounting practices.	Rejected
H_{4a}	The increased use of advanced management accounting practices will result in greater reliance on non-financial MAI.	Supported
H_{4b}	The change towards a differentiation strategy will result in greater reliance on non-financial MAI.	Rejected
H_{4c}	A change in organization design, with greater use of team-based structures, will result in greater reliance on non-financial MAI.	Supported
H_{4d}	The increased use of advanced manufacturing technology will result in greater reliance on non-financial MAI.	Supported
H_5	A change in MAI, with greater reliance on non-financial accounting information, will result in improved organizational performance.	Supported

A significant relationship was found between changes in strategy and the increased use of team-based structures ($\beta = 0.71$, $P \leqslant 0.001$). The elements of structure that had changed significantly over the past three years included multi-skilling of the workforce, worker training and the use of cross-structural teams (see Table A4). Thus, as suggested by Rimmer et al. (1996) and Scott and Tiessen (1999), organizations may change their structure in response to a greater emphasis on a differentiation strategy, and the introduction of team-based structures enables employees to adopt a stronger customer orientation focusing on quality, service, flexibility and dependability.

A significant relationship was also found between changes in strategy and changes in the use of advanced manufacturing technology ($\beta = 0.72$, $P \leqslant 0.001$). This supports the research of Bruggeman and Slagmulder (1995), Kotha and Swamidass (2000) and others who found that many organizations have invested in advanced manufacturing technologies to allow them to compete on the basis of quality, productivity and flexibility, in highly competitive markets. Nevertheless, while a substantial number of firms have increased their use of some technologies, particularly computer-aided design, total quality management, just-in-time production, and just-in-time purchasing (see Table A2), it should be noted that a large number of firms made no use of some of the individual advanced manufacturing technologies. For example, 94 or 95 out of the 141 responding firms used flexible manufacturing systems, computer-aided manufacturing systems and computer integrated manufacturing. At first glance this may seem to indicate a high percentage of non-users. However, there would be some organizations where some technologies may not be appropriate, whereas other firms may make great use of only a few technologies, and therefore may not need to utilize all others. The hypothesized relationships between changes in advanced manufacturing technology leading to changes in organization design or AMAP were not significant.

Further, increased emphasis on differentiation strategies was significantly related to the increased use of advanced management accounting practices ($\beta = 0.80$, $P \leqslant 0.001$). This supports the findings of prior research that has found that practices such as quality improvement programs and benchmarking can support firms pursuing differentiation strategies (see, for example, Callahan & Gabriel, 1998;

Chenhall & Langfield-Smith, 1998b). The detailed data in Table A5 indicates that the AMAPs that were increasingly used to the greatest extent by respondents were quality improvement programs, product profitability analysis, benchmarking and customer profitability analysis. As with advanced manufacturing technology, not all respondents were making increased use of all AMAPs. This is to be expected as some AMAPs clearly are substitutable for each other. Also, resource constraints may limit the extent of use of multiple techniques within the one firm.

Among the range of non-financial information that was examined, those that firms had most increased their reliance on over the past 3 years were on-time delivery, customer satisfaction, material scrap loss, product defects and supplier evaluations (Table A6). It should be noted that a large number of respondents were increasing their reliance on all non-financial measures. Interestingly, the measures that were closest to "no change" were measures of employee turnover and employee satisfaction, as well as set-up times. In the case of the employee measures we could speculate that firms already placed sufficient emphasis on such measures, and increased focus was not required. Alternatively, for management decision making, increased focus on employee measures may be of limited utility, compared to measures of delivery and customer satisfaction, which can be more closely linked to differentiation strategies.

While there were three significant paths leading to increased reliance on non-financial MAI, it was the change in organization design (the move towards the adoption of team-based structures) that had the major impact ($\beta = 0.57$, $P \leqslant 0.001$). This supports the suggestions by Banker et al. (1993) and Scott and Tiessen (1999) that as decision-making responsibility is passed to lower levels of the organization, there is an increased need for relevant information to support operations and decision making at these levels. Indeed, several of the non-financial measures that would be relevant to self-managed teams were among the highest relied on by respondents—on-time delivery, material scrap loss and product defects. Also, non-financial measures relevant to managers in enhancing team development were also highly scored—employee education/training and team performance measures. AMAP also had a significant influence on NF-MAI ($\beta = 0.42$, $P \leqslant 0.001$), as did advanced manufacturing technology ($\beta = 0.13$, $P \leqslant 0.1$).

It has been suggested that organizations pursuing a differentiation strategy need performance measures supporting that strategy (Cooper et al., 1992; Samson et al., 1991). However, the results of this study indicate that the relationship between the greater emphasis on differentiation strategies and greater reliance on NF-MAI is an indirect, rather than direct one. While responding firms have placed greater reliance on information which may support differentiation strategies, this information is also relevant to supporting team structures, providing feedback on advanced manufacturing technology and advanced management accounting practices. Therefore, although the correlation matrix in Table 3 indicates a significant relationship between strategy and NF-MAI ($r = 0.644$) when the relationships between all variables are included in a single model, that particular direct relationship becomes insignificant in the presence of the other variables. Hence, it appears that strategy is driving changes in organization design, technology and AMAP, and it is these organizational changes that are driving the changes in reliance on non-financial information.

The final issue was whether these organizational changes have any impact on overall organization performance. As discussed in a previous section, the findings of empirical research that studies the link between the use of non-financial performance measures and improved organizational performance varies. Some of this variation could be a function of the measures used to evaluate performance. For example, Banker et al. (2000) and Ittner and Larcker (1998) found a positive association between the use of particular non-financial MAI and future, rather than current organizational performance, when measuring financial performance only. Thus, a lag effect was included in the relationships between MAI and financial performance. The results of this study, however, indicate that organizational performance is significantly associated with an increased reliance on NF-MAI ($\beta = 0.63$, $P \leqslant 0.001$).

The organizational performance measure used in this study was a composite measure of financial and non-financial performance, weighted by respondents. It focused on performance over the past 3 years relative to competitors. A question to consider is whether the 3-year time frame is sufficient to incorporate any lags between changes in organizational systems, changes in management accounting systems and organizational performance. This could be the focus for future empirical research.

Conclusion

There is evidence over the past few decades that the external environment faced by firms in all sectors of the economy has become increasingly competitive. Consequently, there have been calls for changes in the way organizations operate. In particular, there have been calls for changes in the nature of management accounting systems.

This study set out to examine the changes that have occurred as a result of external environmental changes. The results indicate that successful organizations are changing towards strategies that place greater emphasis on customer service and product innovation. These strategies encourage the increased use of advanced manufacturing technologies which allows the organization to more economically meet customer preferences as well as improving product quality. A differentiation strategy also leads to an increased use of team-based structures, providing a basis for a stronger customer focus, and also the greater use of advanced management accounting techniques designed to support a customer focus. Each of these initiatives leads to a greater reliance on the management accounting system through the provision of a range of non-financial performance measures.

The results of this study indicate that the changed environment has not had a direct impact on the use of team-based structures, as suggested by Miller (1982), or the use of advanced manufacturing technology. Further, there are no direct relationships linking organization design, technology, and advanced management accounting practices. The change in these organizational factors appears to be a response solely to the change in strategic emphasis.

As hypothesized, a move towards the greater use of team-based structures, greater use of advanced manufacturing technology, and the greater use of advanced management accounting practices have all significantly influenced a greater reliance on non-financial management accounting information. Consistent with Ittner and Larcker (1997) and Daft and Lengel (1986) when all of these factors fit together, organizations have experienced improved organizational performance, compared to their competitors.

In this study, structural equation modeling was used to analyze relationships between the variables of interest. This provided several advantages compared to the more commonly used techniques in management accounting, such as regression analysis. First, it allowed many relationships to be considered within a single analysis. This exposed insignificant relationships that would not have been revealed by a more selective correlation or regression analysis. Second, it allowed for error variances associated with multi-item constructs to be incorporated into the model. This provides a means for the inaccuracies associated with the imprecise measurement of multi-item variables to be included specifically. Third, it allowed measures of fit to be determined. Finally, the use of structural equation modeling in this analysis recognized that strategy, technology, organization design, and management accounting practices do not impact independently either on the reliance on non-financial management accounting information, or on organizational performance. Rather, the method acknowledges that each of these organizational factors work concurrently to influence other organizational factors, as well as non-financial MAI and performance.

As always there are limitations to this study that should be considered. The analysis involves only a relatively small proportion of all manufacturing organizations in Australia, and there may be some non-response bias. A stratified sampling strategy was used in the study to maximize the generalizability of results. However, the low response rate needs to be taken in account, and may impact on generalizability. Further, the usable sample size was 141 companies, which is regarded as an adequate, but not generous size for a stable SEM analysis. Clearly a greater number of responses would have provided more confidence in the outcomes of the analysis.

While the survey measured organizational change by means of managers' perceptions over a 3-year period, greater insight into the drivers of change could be gained by more detailed focused surveys, or longitudinal studies of particular organizations. Such studies would also capture the time lag between various organizational changes. For example, it may take organizations more than 3 years to make substantial changes in investments in advanced manufacturing technology, or change their use of advanced management accounting practices, in response to changes in the competitive environment.

An additional limitation of this research is the assumption of unidirectional relationships between the variables. It is possible, however, that some relationships are in the opposite direction, or even reciprocal. For example, it may be that the greater use of team-based structures has allowed a greater emphasis on particular customer-oriented differentiation strategies such as customizing products to customer needs, rather than the opposite relationship specified in the model. Similarly, while a greater emphasis on differentiation strategies has been associated with the increased use of advanced manufacturing technologies, it may in fact be the capabilities of the technology which is allowing firms to provide a greater customer focus. Moreover, a factor not considered with this modeling technique is that the relationships between the variables may not be linear, or that the relationships exhibit linearity only within a limited relevant range. These types of relationships could be evaluated with a case study approach, or through additional survey studies that utilize more complex quantitative analysis.

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Appendix

Descriptive statistics for items in final variables

Table A1. Competitive environment

Survey item	N^a	Mean	S.D.
Competitors	141	8.35	2.14
Customers/ buyers	141	8.32	2.32
Product Innovation	141	7.92	1.38
Regulatory	141	7.89	1.40
Local economy	141	7.83	2.07
Technological	141	7.54	1.81
International	141	7.15	1.89
Suppliers	141	7.06	2.17

Table A2. Advanced manufacturing technology

Survey item	N^a	Mean	S.D.
Computer aided design	114	8.08	1.68
Just-in-time production	114	7.97	1.62
Total quality management	129	7.85	1.61
Just-in-time purchasing	114	7.83	1.62
Manufacturing resource planning	106	7.83	1.73
Computer integrated manufacturing	95	7.82	1.53
Materials requirements planning	108	7.81	1.57
Computer aided manufacturing	94	7.79	1.60
Flexible manufacturing systems	94	7.49	1.60

Table A3. Strategy[7]

Survey item	N^a	Mean	S.D.
Provide on-time delivery	141	8.75	1.65
Make dependable delivery promises	141	8.55	1.71
Provide high quality products	141	8.52	1.66
Provide effective after-sales service and support	135	8.24	1.68
Make changes in design and introduce new products quickly	127	8.10	1.82
Customize products and services to customer needs	132	8.08	1.76
Product availability (broad distribution)	129	7.75	1.58
Make rapid volume/product mix changes	125	7.77	1.71

[7] The item 'provide unique product features' was deleted from the measurement model.

Table A4. Organization design[8]

Survey item	N^a	Mean	S.D.
Multi-skilling of workforce	139	8.47	1.63
Worker training	141	8.38	1.50
Cross-functional teams	114	8.10	1.55
Establishing participative culture	136	8.10	1.70
Management training	138	7.96	1.62
Flattening of formal organizational structures	138	7.96	1.93
Work-based teams	129	7.78	1.69
Employee empowerment	133	7.75	1.57
Manufacturing cells	95	7.40	1.72

Table A5. Advanced management accounting practice

Survey item	N^a	Mean	S.D.
Quality improvement programs	134	8.11	1.63
Product profitability analysis	131	7.98	1.48
Benchmarking	120	7.97	1.32
Customer profitability analysis	115	7.90	1.58
Shareholder value analysis/EVA	87	7.60	1.69
Target costing	95	7.45	1.41
Activity-based costing	104	7.37	1.52
Activity-based management	99	7.24	1.33
Value chain analysis	83	7.18	1.37
Product life-cycle analysis	96	6.94	1.38

Table A6. Non-financial MAI[9]

Survey item	N^a	Mean	S.D.
On-time delivery	137	8.26	1.66
Customer satisfaction	131	7.82	1.58
Material scrap loss	126	7.79	1.57
Product defects	133	7.77	1.59
Supplier evaluations	132	7.70	1.44
Market share	133	7.66	1.61
Employee education/ training	136	7.51	1.41
Team performance	126	7.50	1.41
Set-up times	115	7.42	1.49
Employee satisfaction	129	7.32	1.42
Employee turnover	125	6.80	1.29

[8] The item 'reorganizing existing manufacturing (e.g. re-engineering business processes, reorganizing/reconditioning plant)' was deleted from the measurement model.

[9] Items removed from the final measurement model include: customer complaints, cycle time from order to delivery, machine utilization and downtime, rate of introduction of new products, measures of ability to vary product characteristics, market growth, number of warranty claims and employee safety.

[a] *N* includes only firms where the item was used.

References

Abernethy, M. A., & Lillis, A. M. (1995). The impact of manufacturing flexibility on management control system design. *Accounting, Organizations and Society*, *20*, 241–258.

Anderson, S. A., Hesford, J. W., & Young, S. M. (2002). Factors influencing the performance of activity-based costing teams: a field study of ABC model development time in the automotive industry. *Organizations and Society*, *27*, 195–212.

Atkinson, A. A., Balakrishnan, R., Booth, P., Cote, J. M., Groot, T., Malmi, T., Roberts, H., Uliana, E., & Wu, A. (1997). New directions in management accounting research. *Journal of Management Accounting Research*, *9*, 79–108.

Banker, R. D., Potter, G., & Schroeder, R. G. (1993). Reporting manufacturing performance measures to workers: an empirical study. *Journal of Management Accounting Research*, *5*, 33–55.

Banker, R. D., Potter, G., & Srinivasan, D. (2000). Empirical investigation of an incentive plan that includes nonfinancial performance measures. *The Accounting Review*, *75*, 65–92.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.

Bhimani, A. (1993). Performance measures in UK manufacturing companies: the state of play. *Management Accounting, December*, 20–22.

Bhimani, A. (1994). Monitoring performance measures in UK manufacturing companies. *Management Accounting*, *January*, 34–36, 54.

Brown, S. L., & Eisenhardt, K. M. (1995). Product development: past research, present findings and future directions. *Academy of Management Review*, *20*(2), 343–378.

Bruggeman, W., & Slagmulder, R. (1995). The impact of technological change on management accounting. *Management Accounting Research*, *6*, 241–252.

Burcher, P. G., & Lee, G. L. (2000). Competitiveness strategies and AMT investment decisions. *Integrated Manufacturing Systems*, *11*(5), 340–347.

Burns, T., & Stalker, G. M. (1961). *The management of innovation*. London: Tavistock.

Callahan, C. M., & Gabriel, E. A. (1998). Information in imperfectly competitive markets: a theoretical and empirical investigation. *Contemporary Accounting Research*, *15*(4), 419–455.

Chenhall, R. H., & Langfield-Smith, K. (1998a). Adoption and benefits of management accounting practices: an Australian study. *Management Accounting Research*, *9*(1), 1–19.

Chenhall, R. H., & Langfield-Smith, K. (1998b). The relationship between strategic priorities, management techniques and management accounting: an empirical investigation using a systems approach. *Accounting, Organizations and Society*, *23*(3), 243–264.

Chenhall, R. H., & Morris, D. (1986). The impact of structure, environment, and interdependence on the perceived usefulness of management accounting systems. *The Accounting Review*, *61*, 16–35.

Chong, V. K., & Chong, K. M. (1997). Strategic choices, environmental uncertainty and SBU performance: a note on the intervening role of management accounting systems. *Accounting and Business Research*, *27*(4), 268–276.

Cohen, S. G. (1993). New approaches to teams and teamwork. In J. R. Galbraith, & E. E. Lawler (Eds.), *Organizing for the future* (pp. 194–226). San Francisco, CA: Josey-Bass.

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: group effectiveness research from the shop floor to the executive suite. *Journal of Management*, *23*(3), 239–252.

Cooper, R., Kaplan, R. S., Maisel, L. S., Morrissey, E., & Oehm, R. M. (1992). *Implementing activity-based cost management—moving from analysis to action*. Montvale, NJ: Institute of Management Accountants.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science*, *32*, 554–571.

Davila, T. (2000). An empirical study of the drivers of management control systems' design in new product development. *Accounting, Organizations and Society*, *25*, 383–409.

Dent, J. F. (1996). Global competition: challenges for management accounting and control. *Management Accounting Research*, *7*, 247–269.

Dhavale, D. G. (1996). Problems with existing manufacturing performance measures. *Journal of Cost Management*, *Winter*, 50–55.

Dillman, D. A. (2000). *Mail and internet surveys* (2nd ed.). New York: John Wiley and Sons.

Drury, C., & Tayles, M. (1995). Issues arising from surveys of management accounting practice. *Management Accounting Research*, 267–280.

Duncan, R. G. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, *17*(2), 313–327.

Eccles, R. G. (1991). The performance measurement manifesto. *Harvard Business Review*, *Jan–Feb*, 131–137.

Elliot, R. K. (1991). The third wave breaks on the shores of accounting. *Accounting Horizons*, *June*, 61–85.

Elnathan, D., Lin, T. W., & Young, S. M. (1996). Benchmarking and management accounting: a framework for research. *Journal of Management Accounting Research*, *8*, 37–54.

Fisher, J. (1992). Use of nonfinancial performance measures. *Journal of Cost Management*, *Spring*, 31–38.

Foster, G., & Gupta, M. (1994). Marketing, cost management and management accounting. *Journal of Management Accounting Research*, *6*, 43–77.

Foster, G., & Horngren, C. T. (1988). Cost accounting and cost management in a JIT environment. *Cost Management*, *Winter*, 4–14.

Fuschs, P. H., Mifflin, K. E., Miller, D., & Whitney, J. O. (2000). Strategic integration: competing in the age of capabilities. *California Management Review*, *Spring*, 118–147.

Gordon, L. A., & Miller, D. (1976). A contingency framework for the design of accounting information systems. *Accounting, Organizations and Society*, *1*, 59–69.

Gosse, D. I. (1993). Cost accounting's role in computer-integrated manufacturing. *Journal of Management Accounting Research*, *Fall*, 159–179.

Govindarajan, V. (1984). Appropriateness of accounting data in performance evaluation: an empirical examination of environmental uncertainty as an intervening variable. *Accounting, Organizations and Society*, *9*(2), 125–135.

Govindarajan, V. (1988). A contingency approach to strategy implementation at the business-unit level: integrating administrative mechanisms with strategy. *Academy of Management Journal*, *31*(4), 828–853.

Govindarajan, V., & Fisher, J. (1990). Strategy, control systems, and resource sharing: effects on business-unit performance. *Academy of Management Journal*, *33*(2), 259–285.

Granlund, M., & Lukka, K. (1998). It's a small world of management accounting practices. *Journal of Management Accounting Research*, *10*, 153–179.

Gul, F. A. (1991). The effects of management accounting systems and environmental uncertainty on small business managers' performance. *Accounting and Business Research*, *22*, 85 57-61.

Gul, F. A., & Chia, Y. M. (1994). The effects of management accounting systems, perceived environmental uncertainty and decentralization on managerial performance: a test of three-way interaction. *Accounting, Organizations and Society*, *19*(4/5), 413–426.

Hair, J. F. Jr., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River, NJ: Prentice-Hall International.

Hiromoto, T. (1991). Restoring the relevance of management accounting. *Journal of Management Accounting Research*, *Fall*, 1–15.

Horngren, C. T. (1995). Management accounting: this century and beyond. *Management Accounting Research*, *6*, 281–286.

Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: concepts, issues, and applications*. Thousand Oaks, CA: Sage Publications.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55.

Ichniowski, C., Shaw, K., & Prennushi, G. (1997). The effects of human resource management practices on productivity: a study of steel finishing lines. *The American Economic Review*, *87*, 291–314.

Innes, J., & Mitchell, F. (1990). The process of change in management accounting: some field study evidence. *Management Accounting Research*, *1*, 3–19.

Ittner, C. D., & Larcker, D. F. (1995). Total quality management and the choice of information and reward systems. *Journal of Accounting Research*, *33*(Supplement), 1–34.

Ittner, C. D., & Larcker, D. F. (1997). Quality strategy, strategic control systems, and organizational performance. *Accounting, Organizations and Society*, *22*, 293–314.

Ittner, C. D., & Larcker, D. F. (1998). Innovations in performance measurement: trends and research implications. *Journal of Management Accounting Research*, *10*, 205–238.

Jaworski, B. J., & Young, S. M. (1992). Dysfunctional behavior and management control: an empirical study of marketing managers. *Accounting, Organizations and Society*, *17*(1), 17–35.

Kaplan, R. S. (1984). Yesterday's accounting undermines production. *Harvard Business Review*, *July/August*, 95–101.

Kaplan, R. S. (1986). Accounting lag: the obsolescence of cost accounting systems. *California Management Review*, *28*(2), 174–199.

Kaplan, R. S. (1994). Management accounting 1984–1994: development of new practice and theory. *Management Accounting Research*, *5*, 247–260.

Keidel, R. W. (1994). Rethinking organizational design. *Academy of Management Executive*, *8*(4), 12–17.

Khandwalla, P. N. (1972). The effect of different types of competition on the use of management controls. *Journal of Accounting Research*, 275–285.

Khandwalla, P. N. (1977). *The design of organizations*. New York: Harcourt-Brace-Jovanovich.

Kline, R. B. (1998). *Principles and practice of structural equation modeling*. New York: The Guilford Press.

Kotha, S., & Swamidass, P. M. (2000). Strategy, advanced manufacturing technology and performance: empirical evidence from U.S. manufacturing firms. *Journal of Operations Management*, *18*(3), 257–277.

Kren, L., & Kerr, J. L. (1993). The effect of behaviour monitoring and uncertainty on the use of performance-contingent compensation. *Accounting and Business Research*, *23*, 159–168.

Lawler, E. E. (1993). Creating the high-involvement organization. In J. R. Galbraith, & E. E. Lawler (Eds.), *Organizing for the future* (pp. 172–193). San Francisco, CA: Josey-Bass.

Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and environment*. Boston, MA: Harvard University Press.

Lingle, J. H., & Schiemann, W. A. (1996). From Balanced scorecard to strategic gauges: is measurement worth it?. *Management Review*, *March*, 56–61.

Loehlin, J. C. (1998). *Latent variable models: an introduction to factor, path, and structural analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Mangaliso, M. P. (1995). The strategic usefulness of management information as perceived by middle managers. *Journal of Management*, *21*(2), 231–250.

Mia, L., & Clarke, B. (1999). Market competition, management accounting systems and business unit performance. *Management Accounting Research*, *10*, 137–158.

Milgrom, P., & Roberts, J. (1995). Complementarities and fit: strategy, structure, and organizational change in manufacturing. *Journal of Accounting and Economics*, *19*, 179–208.

Miller, D. (1982). Evolution and revolution: a quantum view of structural change in organizations. *Journal of Management Studies*, *19*(2), 131–151.

Miller, D. (1988). Relating Porter's business strategies to environment and structure: analysis and performance implications. *Academy of Management Journal*, *31*(2), 280–308.

Miller, J. G., De Meyer, A., & Nakane, J. (1992). *Benchmarking global manufacturing—understanding international suppliers, customers and competitors*. Homewood, IL: Irwin.

Nanni, A. J., Dixon, J. R., & Vollman, T. E. (1992). Integrated performance measurement: management accounting to support the new manufacturing realities. *Journal of Management Accounting Research*, 1–19.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Otley, D. T. (1994). Management control in contemporary organizations: towards a wider framework. *Management Accounting Research*, *5*, 289–299.

Parthasarthy, R., & Sethi, S. P. (1992). The impact of flexible automation on business strategy and organizational structure. *Academy of Management Review*, *17*(1), 86–111.

Parthasarthy, R., & Sethi, S. P. (1993). Relating strategy and structure to flexible automation: a test of fit and performance implications. *Strategic Management Journal*, *14*, 529–549.

Pelham, A. M. (1999). Influence of environment, strategy, and market orientation on performance in small manufacturing firms. *Journal of Business Research*, *45*, 33–46.

Perera, S., Harrison, G., & Poole, M. (1997). Customer-focused manufacturing strategy and the use of operations-based nonfinancial performance measures: a research note. *Accounting, Organizations and Society*, *22*, 557–572.

Pfeffer, J. (1994). *Competitive advantage through people: unleashing the power of the work force*. Boston, MA: Harvard Business School Press.

Porter, M. E. (1980). *Competitive strategy: techniques for analyzing industries and competitors*. New York: Free Press.

Porter, M. E. (1996). What is strategy? *Harvard Business Review*, *74*(6), 61–78.

Rimmer, M., Macneil, J., Chenhall, R., Langfield-Smith, K., & Watts, L. (1996). *Reinventing competitiveness: achieving best practice in Australia*. Melbourne: Pitman Publishing.

Samson, D. A., Langfield-Smith, K., & McBride, P. (1991). The alignment of management accounting with manufacturing priorities: a strategic perspective. *Australian Accounting Review*, *1*(1), 29–40.

Schroeder, D. M., & Congden, S. W. (2000). Aligning competitive strategies, manufacturing technology, and shop floor skills. *Production and Inventory Management Journal*, *41*(4), 40–47.

Schumacker, R. E., & Lomax, R. G. (1996). *A beginner's guide to structural equation modeling*. NJ: Lawrence Erlbaum Associates.

Scott, T. W., & Tiessen, P. (1999). Performance measurement and managerial teams. *Accounting, Organizations and Society*, *24*, 263–285.

Shields, M. D. (1997). Research in management accounting by North Americans in the 1990s. *Journal of Management Accounting Research*, *9*, 3–61.

Shields, M. D., Deng, F. J., & Kato, Y. (2000). The design and effects of control systems: test of direct- and indirect-effects models. *Accounting, Organizations and Society*, *15*, 185–202.

Shortell, S. M., & Zajac, E. J. (1990). Perceptual and archival measures of Miles and Snow's strategic types: a comprehensive assessment of reliability and validity. *Academy of Management Journal*, *33*(4), 817–832.

Sim, K. L., & Killough, L. N. (1998). The performance effects of complementarities between manufacturing practices and management accounting systems. *Journal of Management Accounting Research*, *10*, 325–346.

Stivers, B. P., Covin, T. J., Hall, N. G., & Smalt, S. W. (1998). How nonfinancial performance measures are used. *Management Accounting, February*, 44–49.

Stokes, C. R., & Lawrimore, K. W. (1989). Selling a new cost accounting system. *Journal of Cost Management*, *3*(3), 29–34.

Tan, J. J., & Litschert, R. J. (1994). Environment-strategy relationship and its performance implications: an empirical study of the Chinese electronics industry. *Strategic Management Journal*, *15*, 1–20.

Tanaka, J. S. (1993). Multifaceted conceptions of fit in structural equation models. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 10–39). Newbury Park, CA: Sage Publications.

Tucker, L. R., & Lewis, C. (1973). The reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*, 1–10.

Young, S. M., & Selto, F. H. (1991). New manufacturing practices and cost management: a review of the literature and directions for research. *Journal of Accounting Literature*, *10*, 265–298.