

*Full Length Research Paper*

# The influence of perceived environmental uncertainty, firm size, and strategy on multiple performance measures usage

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Accepted 16 August, 2010

The balanced scorecard (BSC) is regarded as the most popular performance measurement system in providing a superior combination of financial and non-financial performance measures. This study empirically investigates the influence of perceived environmental uncertainty, firm size, and business strategy on the use of multiple performance measures among 120 Malaysian manufacturing firms. The balanced scorecard's four dimensions were used to operationalise the multiple performance measures. Data used in this study was obtained from mailed questionnaires sent to the top managers of randomly selected manufacturing firms. The results suggest that perceived environmental uncertainty negatively influences the extent of use of financial and internal processes measures, while prospector strategy positively influences the extent of use of innovation and learning and overall balanced scorecard (BSC) measures. The results also reveal that analyzer strategy has a significant and positive impact on the use of time-focused customer measures, while firm size has a significant and positive impact on the use of innovation and learning measures.

**Key words:** Performance measures, balanced scorecard, strategy, firm size, perceived environmental uncertainty.

## INTRODUCTION

Performance measurement system plays an important role in the efficient and effective management of organizations, yet it remains critical and much debated issue (Kennerly and Neely, 2002). Many factors have attracted the attention of academicians, practitioners and researchers to performance measurement issue. These factors have been discussed extensively in the literature of management accounting systems, management control systems and performance measurement systems (for example, Nanni and Dixon, 1992; Lynch and Cross, 1995; Neely, 1999; Otley, 1999). Among them are: (1) Traditional management control system seems to overlook the elements of non-financial measures, strategies and operations; (2) Traditional performance measurement system tends to rely heavily on the use of accounting-based or financial performance measures; (3) Increasing pressure from domestic and global competitors; (4) High demands for quality and reliable products from customers; (5) High expectation from

stakeholders; (6) Usage of new and advanced manufacturing technology; (7) The changing nature of work; (8) Usage of specific improvement initiatives, national and international awards; (9) Changing organizational roles; (10) The power of information technology. Due to the above factors, traditional performance measurement system does not seem to adequately reflect the effectiveness of companies operating in today's rapidly changing, dynamic, and competitive environment. As a result, many researchers have introduced several new performance measurement systems or models in order to cater for today's needs. The most popular performance measurement system today seems to be the balanced scorecard (BSC) developed by Kaplan and Norton in 1992. The balanced scorecard (BSC) has received worldwide recognition as a performance measurement tool which is essentially multi-dimensional in nature that links measures to organizational strategy (Kaplan and Norton, 1996). The balanced scorecard (BSC) "translates an

organization's mission and strategy into a comprehensive set of performance measures that provides the framework for a strategic measurement and management system" (Kaplan and Norton, 1996).

The balanced scorecard (BSC) seems to be prominent in accounting research when several researchers have initiated to study balanced scorecard (BSC) empirically (Hoque and James, 2000; Maiga and Jacobs, 2003). As Atkinson et al. (1997) noted, "The balanced scorecard is among the most significant developments in management accounting and thus, deserves intense research attention". In light of this development, this study was conducted to advance understanding of the influence of contextual variables (in this case, perceived environmental uncertainty, firm size, and business strategy) on the use of multiple performance measures which were operationalised using the balanced scorecard (BSC) framework.

The remainder of this paper will proceed as follows. The next section discusses the theoretical linkages between PEU, firm size, Miles and Snow's (1978) strategies and the use of performance measures to formulate the three sets of hypotheses. The third section presents the research method, sample, and variable measurement. The fourth section discusses the results. The final section provides a discussion on the findings and conclusions.

## **THEORETICAL DEVELOPMENT AND HYPOTHESES GENERATION**

### **Operationalization of multiple performance measures using the balanced scorecard (BSC) framework**

There is considerable empirical support for the use of multiple performance measures or performance measurement diversity in the literature (for example, Abernethy and Lillis, 1995; Banker et al., 2000; Ittner and Larcker, 1998; Hoque and James, 2000; Bryant et al., 2004; Van der Stede et al., 2006). For example, in a study of 128 manufacturing firms in both U. S. and Europe, Van der Stede et al. (2006) found that firms with more extensive performance measurement systems, especially ones that include objective and subjective non-financial measures, have higher performance. Bryant et al. (2004) reported that when firms implement a performance measurement system that contains both financial and non-financial measures, they will benefit more than the firms that rely solely on financial measures. Banker et al. (2000) also found that when non-financial measures are included in the compensation contract, managers more closely aligned their effort to those measures, resulting in increased performance. Specifically on BSC measures, Hoque and James (2000) found support for the main effect of overall BSC measures usage on firm performance.

The balanced scorecard (BSC) is essentially a performance measurement system which forms part of

management accounting control system. For the purpose of this study, multiple performance measures were operationalized using the BSC framework. According to Kaplan and Norton (1992, 1996, 2001) multiple performance measures reflect the organization's changing business environment as well as the achievement of its goals. They further argued that the BSC provides a new framework for describing value-creating strategies that link tangible and intangible assets. Basically, the BSC comprises a combination of multidimensional performance measures which include financial, customer, internal business processes and innovation and learning perspectives (Kaplan and Norton, 1996; 2001). However, in the earlier version of the BSC framework, Kaplan and Norton (1992) had used innovation and learning instead of innovation and learning perspective. Thus, this study used innovation and learning rather than learning and growth perspective as the former is more relevant to the current study. This approach is also consistent with the studies by Hoque and James (2000), Hoque et al. (2001) and Olson and Slater (2002). Therefore, the term balanced scorecard (BSC) measures are used throughout this paper to represent the multiple performance measures.

### **Linkage between perceived environmental uncertainty and performance measures**

Prior researchers such as Lawrence and Lorsch (1967); Duncan (1972) and Govindarajan (1984), view environment as a source of information where the decision-makers' perceptions of this information could lead them to make changes in organizational processes. With regard to environmental uncertainty, Miliken (1987) developed a general definition of environmental uncertainty, stating it as "an individual's perceived inability to predict (an organization's environment) accurately" because of a "lack of information" or "an ability to discriminate between relevant and irrelevant data." This definition is consistent with the conceptualization of perceived environmental uncertainty suggested by Duncan (1972) and Miles and Snow (1978) earlier. From Duncan (1972), environmental uncertainty is a result of three conditions: (1) a lack of information concerning the environmental factors associated with a particular organizational decision making situation; (2) an ability to accurately assign probabilities with regard to how environmental factors will affect the success or failure of a decision unit in performing its functions; and (3) a lack of information regarding the costs associated with an incorrect decision or action. Similarly, Miles and Snow (1978) noted that managerial perceptions of perceived environmental uncertainty are determined by "the predictability of conditions in the organization's environment". Predictability is viewed as the ability of an organization to know what the external environment is going to be like in the future (Steers, 1977). The greater the uncertainty, the lesser the

predictability.

From the management accounting and control literature, environment is one of the factors that determine the management accounting and control systems design used by an organization (Ezzamel, 1990; Gordon and Miller, 1976). In fact, the external control model suggests that environment is the dominant influence on organizational actions (Romanelli and Tushman, 1986) and it is multidimensional with multiple and various effects on organizational characteristics (Keats and Hitt, 1988). For example, the level of environmental uncertainty plays a role in determining whether the organization needs a centralized and objective control system or a subjective control system (Waterhouse and Tiessen, 1978). Waterhouse and Tiessen (1978) noted that, under condition of high environmental uncertainty, the organization would adopt subjective control system, while under predictable environment the organization would adopt the centralized and objective control system. Moreover, as degree of environmental uncertainty (dynamism and hostility) increases, organization needs to incorporate more non-financial data into its accounting information system and adopt a fairly sophisticated control system (Gordon and Miller, 1976; Khandwalla, 1972). In addition, perceived environmental uncertainty is found to be positively associated with budget characteristics (Ezzamel, 1990). Environmental uncertainty is also a contingent factor which affects the choice of the performance evaluation style (Govindarajan, 1984).

Perceived of product competition (competition is one element of environmental uncertainty) is reported to be positively correlated with the use of controls (Khandwalla, 1972 and 1973). Khandwalla argued that product competition requires a greater use of sophisticated controls than distributive and price competition since it tends to create a rather complex, decentralized, differentiated and technocratic organizational form. He further argued that the need for differentiation and creativity is essential in responding to the threats and opportunities of a competitive environment should the companies want to survive. Khandwalla's proposition is consistent with Lawrence and Lorsch (1967) that as an organization becomes differentiated, the need for sophisticated controls also increases.

Empirical studies by Gordon and Narayanan (1984); Chenhall and Morris (1986); Brownell (1987) and subsequently, Mia (1993); Gul and Chia (1994) and Chong and Chong (1997), found that perceived environmental uncertainty is associated with the characteristics of the management accounting information. Gordon and Narayanan (1984), for example, reported that higher perceived environmental is positively associated with the higher importance of external, non-financial, and ex ante type information. Information characterized as external, non-financial, and ex ante (relates to future events) in nature is contrasted with those of traditional information which is internal, financial, and ex post (relates to past

events) in nature (Gordon and Narayanan, 1984). Likewise, findings from Brownell's (1987) study indicate that reliance on accounting performance measures (RAPM) is low under high environment uncertainty but high under low environmental uncertainty.

Following Gordon and Narayanan (1984), study by Chenhall and Morris (1986) indicates a significant relationship between the perceived usefulness of broad scope and timely information and perceived environmental uncertainty. Broad scope information refers to information related to the external environment, non-financial measurement, and future-oriented events (Chenhall and Morris, 1986). Related studies such as Mia (1993), Gul and Chia (1994), Chong and Chong (1997) apparently support the arguments for the relationship between broad scope information and perceived environmental uncertainty. Similarly, Chapman (1997) argued that performance evaluation under conditions of uncertainty is inappropriate when accounting information is incomplete because the process of quantification of accounting information will likely be harder in the more rapidly changing situation. Furthermore, Lynch and Cross (1995) and Hoque et al. (2001) argued that organizations facing higher competition are likely to use multiple performance measures. In view of the above reported findings, thus, it can be concluded that in high perceived environmental uncertainty, information needed for planning, controlling, decision making and performance evaluation and measures should go beyond the accounting and financial information.

Following the above evidence, it seems reasonable to hypothesize that as perceived environmental uncertainty (PEU) increases, the extent of balanced scorecard (BSC) measures usage, particularly, the non-financial perspectives of customer and innovation and learning measures, increases, but the extent of financial and internal business process measures usage decreases. Thus, this study posits that there will be a positive relationship between the degree of PEU and the extent of usage of customer and innovation and learning measures and a negative relationship between the degree of PEU and the extent of financial and internal business process measures usage. Specifically on the positive relationship between the degree of PEU and the extent of customer and innovation and learning measures usage, argument from Miles and Snow (1978) can lend support when they concluded that externally-oriented functions such as market research and product development received emphasis with high PEU. Findings from a study by Hitt et al. (1982) also provide marginal support for this relationship.

With regard to the PEU and internal business process relationship, the direction is posited to be negative. Although, internal business process measures are mainly non-financial, they are actually measuring efficiency of the operating process and thus, are internally focused. Therefore, internal business process measures do not reflect the broad scope type of information as suggested

by Chenhall and Morris (1986). Argument from Miles and Snow (1978) seems to support this relationship when they viewed those internally-oriented functions such as production or operations would be dominant under conditions of low PEU. As such, similar to financial measures, it is reasonable to posit that there will be a negative relationship between degree of PEU and the extent of usage of internal business process measures. It should be noted here, however, that there is a study on manufacturing flexibility (one element of internal process) that indicated that there is a positive relationship between perceived environmental uncertainty and manufacturing flexibility (Swamidass and Newell, 1987). Further, besides looking at the individual perspective of the balanced scorecard (BSC) measures, this study also looks at the overall balanced scorecard measures in relating it with perceived environmental uncertainty.

In sum, prior studies have shown that there are some associations between PEU and performance measures. Hence, the following set of hypotheses was developed:

**H<sub>1</sub>:** The degree of PEU is associated with the extent of multiple performance measures usage.

**H<sub>1a</sub>:** The higher the degree of PEU, the lower is the extent of financial measures usage.

**H<sub>1b</sub>:** The higher the degree of PEU, the greater is the extent of customer measures usage.

**H<sub>1c</sub>:** The higher the degree of PEU, the lower is the extent of internal business process measures usage.

**H<sub>1d</sub>:** The higher the degree of PEU, the greater is the extent of innovation and learning measures usage.

**H<sub>1e</sub>:** The higher the degree of PEU, the greater is the extent of overall BSC measures usage.

### **Linkage between firm size and performance measures**

Firm size represents a contingent factor that falls into the category of industry characteristics. Smith et al. (1989) noted that organization size has long been an important macro variable in the organizational literature. Minzberg (1979) stated that organization size can be measured by the number of employees, the amount of sales, the size of the budget, the size of the capital investment, and other factors. According to Woodward (1965), the best indication of "bigness" is the size of the management group. Firm size are commonly measured by gross sales or gross value of assets (Ketinger et al., 1994), number of employees (Aiken et al., 1980; Dewar and Dutton, 1986; Govindarajan, 1984; Hoque and James, 2000; Merchant, 1981), and sales turnover (Hoque et al., 2001). Since balanced scorecard (BSC) can be considered as an important innovation in performance measurement system, prior studies on the relationship between firm size and innovation can lend support to the linkage between firm size and balanced scorecard measures

usage. According to Moch and Morse (1977), size is likely to have direct effects on adoption of innovations whereby adoption of innovation occurs more frequently in large, specialized, functionally-differentiated and decentralized organizations. Also, Blau and McKinley (1979) and Dewar and Dutton (1986) found a positive relationship between firm size and innovation. However, Hage (1980) and Aiken et al. (1980) reported a negative relationship and a non-significant relationship respectively with regard to the relationship between size and innovation.

Prior studies that examined the effects of organization size on the design of accounting control systems and on the budget characteristics include Merchant (1981), Ezzamel (1990), Libby and Waterhouse (1996), Gosselin (1997), Guilding (1999), Hoque and James (2000) and Hoque et al. (2001).

Merchant (1981) put strong support for the organization's size, measured by number of employees, being strongly related to the choice of organizational control strategies. He noted that larger firms with more diverse and more decentralized tend to implement a more administratively-oriented control strategy and greater budgeting sophistication. On the other hand, he indicated that the use of an interpersonal control strategy found in smaller, less diverse, and more centralized firms. A recent study by Hoque and James (2000) found that larger organization size, measured by number of employees, is positively associated with the overall usage of balanced scorecard measures. Also, Guilding (1999) provided strong support for the view that size is positively related to greater use of, and greater perceived helpfulness in, customer-focused accounting. Furthermore, firm size is also an important determinant for sustainability and performance (Ketinger et al., 1994). Ketinger et al. (1994) pointed out that large firms are usually associated with more access to resources, economies of scale, and value chain alliances.

However, studies by Ezzamel (1990); Libby and Waterhouse (1996); Gosselin (1997) and Hoque et al. (2001) show conflicting findings. The results of Ezzamel's (1990) study found no support for the association of organization size as measured by the number of employees with budget characteristics, given the importance of organization size in explaining variations in the budget characteristics as reported in the literature. Also, Libby and Waterhouse (1996) reported that change in management accounting and control system is not associated with larger organizations. Similarly, size does not influence the adoption of an activity management approach (Gosselin, 1997). Meanwhile, business unit size as measured by sales revenue appears not to be an important predictor of the balanced scorecard (BSC) usage as reported in the study of Hoque et al. (2001).

From the foregoing discussion, although, there are arguments for size not being positively associated with the use of performance measures, the expectation is that:

**H<sub>2</sub>:** Firm size is positively associated with the extent of multiple performance measures usage.

**H<sub>2a</sub>:** Firm size is positively associated with the extent of financial measures usage

**H<sub>2b</sub>:** Firm size is positively associated with the extent of customer measures usage.

**H<sub>2c</sub>:** Firm size is positively associated with the extent of internal business process measures usage.

**H<sub>2d</sub>:** Firm size is positively associated with the extent of innovation and learning measures usage.

**H<sub>2e</sub>:** Firm size is positively associated with the extent of overall BSC measures usage.

### ***Linkage between business strategy and performance measures***

The literature on strategic management suggests that strategy may be an important variable in the design of information systems. Therefore, as the balanced scorecard (BSC) provides the information in terms of performance measures, it is necessary to consider the contingency relationship of strategy and the performance measures. Kaplan and Norton (1996) noted that "all balanced scorecards use certain generic measures which reflect the common goals of many strategies, as well as similar structures across industries and companies." Hence, the balanced scorecard (BSC) framework can provide a useful tool in translating strategic requirements of any type of strategies into suitable and relevant performance measures. Strategy is considered as central contingent variable in management control systems since it can heavily influence the choice of performance measures to be used, and that accounting control systems should be designed by taking into consideration the business strategy of the firm (Miller and Friesen, 1982; Govindarajan and Gupta, 1985; Simons, 1987, 1990).

Several studies have shown that performance measures play a key role in a strategy implementation where they have found that there are associations between the choice of performance measures and the type of strategy pursued. For example, studies by Abernethy and Lilis (1995) and Perera et al. (1997) show that firms with manufacturing flexibility strategy and customer-focused manufacturing strategy tend to use more of non-financial performance measures and less of cost efficiency-based performance measures. Meanwhile, a study by Ittner et al. (1997) discovered that non-financial measures have a positive relationship with innovation-oriented strategy, quality-oriented strategy, regulatory requirement and competitive pressures. More recently, Van der Stede et al. (2006) found that firms that emphasize quality in manufacturing use more of both objective and subjective non-financial measures.

The current study adopted the Miles and Snow's (1978) typology to represent the strategy variables. Their four

types of strategies are: prospector, defender, analyzer, and reactor. There are at least four reasons why it was chosen. First, the capacity of an organization to innovate is the key dimension of this typology (Gosselin, 1997); therefore, this typology is appropriate for examining its relationship with the balanced scorecard measure as the latter is considered as a new innovation in measuring performance. Second, this typology is considered holistic when it integrates the range of relationships between the strategy, structure, and processes (Venkatraman, 1989), thus, it provides the basis to develop a theoretical framework useful for identifying the characteristics of balanced scorecard measures that are suitable for different strategic types. Third, it is well-documented and representative of the current strategy content of literature (Simons, 1987), well empirically tested, and well accepted and internally consistent (Gosselin, 1997). Fourth, this typology seems to share similar attributes and characteristics to other strategy archetypes, as it is considered in several studies, such as differentiation and low-cost strategies (Porter, 1980), entrepreneurial and conservative strategies (Miller and Friesen's, 1982), and build and harvest strategies (Govindarajan, 1985).

The primary dimension underlying Miles and Snow typology is the organization's rate of product-market change. Prospectors are characterized by their dynamism in seeking market opportunities, their capability to develop and produce new products to meet customers' needs, their investment in large amounts of financial resources related to research and development, and their enhancement in team work. In addition, Miles and Snow proposed that prospectors that operate in more dynamic environments tend to focus on new product-market innovations and as such tend to de-emphasize control systems based on financial measures. Prospectors are considered pioneer in their product-market innovation and are flexible as well as proactive in their environmental interactions. Moreover, organizations of the prospector type are being 'first-in' new product and market areas, their product-market domain is broad and subject to periodical redefinition, and they responds rapidly to early signs of opportunity.

Studies by Thomas et al. (1991), Hambrick (1983), Snow and Hrebiniak (1980) and Connant et al. (1990) seem to provide a general and common conclusion that prospector strategy tends to be associated more with Research and Development expenditure, new product introduction, and marketing efforts compared to analyzer strategy and defender strategy. These findings confirm Miles and Snow's proposition that 'the prospectors' prime capability is that of finding and exploiting new product and market opportunities' (Miles and Snow, 1978).

Meanwhile, Shortell and Zajac (1990) argued that prospectors would give their greatest attention to market research because they must continually scan their external environment to locate and exploit new product-market opportunities. More recently, Olson and Slater

(2002) found that prospectors evaluate performance in terms of effectiveness which comprises measures such as new product success, percentage of revenues derived from new products or new customers, market development, and sales or market share growth.

Defenders have a strategy which is the polar opposite from prospectors. They operate within a narrow product-market domain characterized by high production volume and low product diversity, and compete aggressively on price, quality, and customer service. Opposite from prospectors, defenders that operate in more stable environments, tend to focus on cost control and not innovations. They undertake relatively less product-market innovation, emphasize on efficiency and stability, and have ability to maintain and protect a secure niche for relatively long periods.

Walker and Ruekert (1987) noted that the defender's focus on low cost requires close attention to operational details, including the relentless pursuit of cost economies and productivity improvements through standardization of components and processes, routinization of procedures and the integration of functional activities across business units. Slater and Narver (1993) discovered that relative cost found to be significantly associated with profitability performance of defenders. Earlier, Hambrick (1983) found that defenders seem to focus on measures related to cost control, price cutting, capacity utilization, and production efficiency.

Analyzers have a unique combination of the prospector and defender types (also known as hybrid prospector-defender), operating in both stable and changing environment and tend to focus on both innovations and cost efficiency. They exhibit less product-market innovation than prospectors but more flexible than defenders. They maintain stability in their core activities by maintaining a stable limited line of products and services, but are quickly to copy others' innovations in their non-core activities. Organizations of analyzers grow and innovate, but they are frequently 'second-in' and seldom 'first-in'. According to Miles and Snow (1978), information needs of analyzers will be some combination of those identified for prospectors and defenders.

Snow and Hrebiniak (1980) argued that analyzers, because of their tendency to imitate successful product and market innovations of prospectors, would tend to emphasize selling and have a distinctive competence in marketing/selling. Subsequently, McDaniel and Kolari (1987) found that marketing officers of prospector and analyzer banks viewed new product development, promotional, and marketing research activities as being more important to organizational strategy than do marketing officers of defender banks. Meanwhile, Slater and Narver (1993) found that market and customer orientation is also essential to the success (profitability) of both prospectors and analyzers. While, McDaniel and Kolari (1987) found no significant difference between prospectors' and analyzers emphasis on new product development, Shortell and Zajac (1990) found no significant differences

in the actual number of new services offered by health care organizations adopting prospector and analyzer strategy.

Reactor is regarded as the weakest type of strategy. Reactors are unstable type of organizations with lack of consistency in strategy, technology, and structure, lack of aggressiveness, and are unable to respond effectively to environmental change. In this study, the researcher leaves out the reactor strategy and only focuses on the prospector, defender, and analyzer strategies.

Based on the foregoing arguments, the following set of hypotheses was formulated:

**H<sub>3</sub>**: The extent to which a firm emphasizes a given business strategy is associated with the extent to which it uses appropriate performance measures.

**H<sub>3a</sub>**: The extent to which a firm emphasizes prospector strategy is (a) negatively associated with the extent to which it uses financial and internal business processes measures, and (b) positively associated with the extent to which it uses customer and innovation and learning measures.

**H<sub>3b</sub>**: The extent to which a firm emphasizes analyzer strategy is positively associated with the extent to which it uses financial, customer, internal business processes, and innovation and learning measures.

**H<sub>3c</sub>**: The extent to which a firm emphasizes defender strategy is (a) positively associated with the extent to which it uses financial and internal business processes, and (b) negatively associated with the extent to which it uses customer and innovation and learning measures.

**H<sub>3d</sub>**: The extent to which a firm emphasizes prospector strategy is positively associated with the extent to which it uses overall BSC measures

**H<sub>3e</sub>**: The extent to which a firm emphasizes analyzer strategy is positively associated with the extent to which it uses overall BSC measures.

**H<sub>3f</sub>**: The extent to which a firm emphasizes defender strategy is negatively associated with the extent to which it uses overall BSC measures.

## RESEARCH METHODS

### Population and sample

The study was based on data collected using mail questionnaires sent to the top managers of manufacturing firms. Directory of Federation of Malaysian Manufacturers (FMM) year 2003 was made as the population frame where a total of about 2,400 companies were listed. A total of 975 companies from various sectors located throughout the Peninsular Malaysia were identified from the directory. Only firms with at least 25 employees and annual sales turnover of at least RM10 million were selected as to have enough firms representing small and large firms. Of 975 questionnaires sent out, a total of 133 questionnaires were returned. However, 13 of these were returned either completely unanswered or partly answered. Thus, the remaining 120 responses were used in the data analysis of this study, making a usable response rate of 12.3%.

Electrical and electronics product manufacturing; iron, steel, and metal product manufacturing; food and beverage manufacturing; and rubber and plastic product manufacturing represent primary business activities of the 120 responding firms. Approximately, 82.3% of the firms have annual sales turnover greater than RM21 million. Bulk of firms has a total number of employees of 400 or less and those with greater than 400 employees making up about 30.8% of the firms.

About 44.7% of the firms manufacture less than 5 products and around 84% have been in operation for more than 10 years. Nearly 47% of the respondents held the position in the upper management level (CEO, managing director, general manager, and director), with the remaining 53% divided between marketing manager, resource/personnel manager, senior manager, financial controller/accountant and others.

### Variable measurement

#### Perceived environmental uncertainty (PEU)

In this study, the variable environmental uncertainty was named perceived environmental uncertainty to recognize the fact that environmental uncertainty is assessed using perceptual measures. Perceptual measures for environmental uncertainty were used rather than objective measures as only through managerial perception environmental becomes known to the organizations (Downey and Slocum, 1975; Lawrence and Lorsch, 1967). To Lawrence and Lorsch (1967), environmental uncertainty is considered to be a perception (subjective interpretation) of key decision makers, while Starbuck (1976) regarded environmental uncertainty as a perceptual phenomenon which is a property of organization administrators. Bourgeois (1985), in his study, had used perceptual data in measuring environmental uncertainty where his results indicated that perceived environmental uncertainty is low when the environmental state is stable and it is high when the environmental state is volatile.

PEU was measured using a 28-item instrument. Of the 28 items, 22 items were adapted from Miles and Snow (1978) and the remaining 6 items adapted from Gordon and Narayanan (1984). Different items from different authors were chosen in order to provide comprehensive and precise questions related to environmental uncertainty. Some of the items in the questionnaire were modified into a new format and were not taken as they are in the original instruments. The 28 items were supposed to measure the respondents' perceptions on the predictability of various aspects of their organisation's suppliers, competitors, customers, financial/capital markets, government regulatories, labour unions, and economics, politics, and technology.

However, in the data analysis, labour unions section was excluded as not many Malaysian manufacturing firms have labor unions. All of the items were measured on a seven-point Likert-type scale (varying from "highly predictable" to "highly unpredictable"). The aggregate mean of the seven components served as the overall perceived environmental uncertainty score for a firm. The Cronbach alpha coefficient was 0.88, exceeding the lower limit of acceptability which is usually considered to be 0.70 (Nunnally, 1978). Reliability measures and descriptive statistics are shown in Table 2.

#### Firm size

Firm size was measured by the number of employees as obtained from the FMM directory. Number of employees is one of the more common methods of measuring organizational size (Smith et al., 1989). Firm size was measured as the log of total number of

employees (Carpenter and Fredrickson, 2001).

### Business strategy

Strategy was measured based on Miles and Snow's (1978) strategic typology. A newly developed multi-item scale rather than the paragraph description approach was used in this study for operationalizing the miles and snow strategic typology. This study adopts a new multi-item scale developed by Parnell (1997), based on the work of Conant, Mokwa and Varadarajan (1990). Each respondent was required to indicate whether he or she agrees or disagrees with 48 statements concerning their organization by using a seven-point Likert scale ranging from "1 = Strongly disagree" to "7 = Strongly agree". The terms "Prospector", "Analyzer", "Defender", and "Reactor" were omitted from the questions as to reveal that not one of the types necessarily represents good or poor strategy.

### Multiple performance measures

Multiple performance measures were assessed using 29 items. Twenty items were taken from Hoque, Mia and Alam (2001), which is originally adopted from Kaplan and Norton (1992). The remaining nine items are self-constructed. The respondents were asked to indicate the extent of their use of each performance measure using a seven-point Likert-type scale ranging from one (not at all) to seven (to a greater extent).

A principal components analysis (PCA) with varimax rotation was performed for all 29 measures to determine whether or not they fall within the balanced scorecard's four dimensions. After several runs of factor analysis, there were only 17 measures left eventually and a total of 12 items were deleted from the analysis due to cross-loadings and insignificant factor loadings. This procedure finally identified five factors with eigenvalues greater than 1 that explained a total of 71.9% of the variance. Table 1 presents the factor loading for each of the performance measures. The first factor was labeled product-focused customer. It consists of four measures related to percentage of shipments returned, number of overdue deliveries, number of warranty claims, and number of customer complaints. The second factor includes four measures pertaining to manufacturing lead time or cycle time, ratio of good output to total output, labour efficiency variance, and flexibility. Thus, it was named internal processes. The third factor was labeled innovation and learning as it is composed of three measures relating to time-to-market new products, number of new product launches, and number of new patents. Factor 4 is made of a group of measures that are typically financial, thus was named financial. There are three measures under this factor: sales revenue, sales growth, and operating income. Factor 5 is a group of measures relating to on-time delivery, customer response time, and survey of customer satisfaction. Thus, this factor was labeled time-focused customer. For the purpose of getting a full understanding of the issue, both overall and individual dimension were considered in the data analysis. This approach is consistent with Hoque's et al. (2001) study.

## RESULTS

To describe all continuous variables used in this study, the descriptive statistics as shown in Table 2 provides summary statistics such as mean, minimum, maximum, and standard deviation. The results show that the mean responses on the variables are scattered around the

**Table 1.** Results of factor analysis for multiple performance measures.

Factor	Items	Factor loadings	Eigenvalues	Percentage of variance explained
1	<b>Product-focused customer</b>		5.58	17.95
	% of shipments returned	0.840		
	Number of overdue deliveries	0.839		
	Number of warranty claims	0.817		
	Number of customer complaints	0.777		
2	<b>Internal processes</b>		2.24	14.53
	Manufacturing lead time/cycle time	0.836		
	Ratio of good output to total output	0.830		
	Labour efficiency variance	0.659		
	Flexibility	0.540		
3	<b>Innovation and learning</b>		1.84	14.44
	Time-to-market new products	0.875		
	Number of new product launches	0.849		
	Number of new patents	0.815		
4	<b>Financial</b>		1.42	12.77
	Sales revenue	0.910		
	Sales growth	0.840		
	Operating income	0.640		
5	<b>Time-focused customer</b>		1.15	12.20
	On-time delivery	0.840		
	Customer response time	0.811		
	Survey of customer satisfaction	0.654		

**Table 2.** Descriptive statistics.

	Minimum	Maximum	Mean	Std. deviation
Firm size (no. of employees)	3.22	8.22	5.50	0.91
PEU	1.76	5.24	3.51	0.66
Financial measures	3.67	7.00	5.98	0.78
Internal processes measures	2.00	7.00	5.30	1.10
Innovation measures	1.00	7.00	3.99	1.57
Product-focused customer	1.00	7.00	5.03	1.53
Time-focused customer	2.33	7.00	5.73	0.89
Overall BSC measures	3.18	7.00	5.20	0.82
Prospector strategy	3.25	6.83	5.35	0.85
Analyzer strategy	4.00	6.92	5.75	0.60
Defender strategy	3.50	6.25	4.76	0.55

range of 3.00 and 6.00, with standard deviation of between 0.55 and 1.57. Perceived environmental uncertainty seems to be perceived as rather low by the respondent as indicated by low mean and low standard deviation.

Low perceived environmental uncertainty scores may

be subject to the perceptual limitations that affect the measures of perceived environmental uncertainty and thus, limit the results of the study. In this case, it could be due to the perceptions that, if an environment is changing in predictable ways, there is low environmental uncertainty, even though there may be actually



**Table 3.** Correlation coefficients, means, and standard deviations of variables.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. PEU	1.00											
2. Firm size	-0.22*	1.00										
<b>Business strategy</b>												
3. Prospector	-0.17	0.14	1.00									
4. Analyzer	-0.20*	0.09	0.76**	1.00								
5. Defender	-0.06	-0.08	0.25**	0.32**	1.00							
<b>BSC measures</b>												
6. Financial	-0.15	0.01	0.07	0.08	-0.09	1.00						
7. Product-focused customer	-0.13	0.16	0.14	0.12	-0.11	0.24**	1.00					
8. Time-focused customer	-0.07	0.03	0.43**	0.51**	0.10	0.30**	0.36**	1.00				
9. Internal processes	-0.23*	0.14	0.29**	0.31**	0.00	0.28**	0.54**	0.50**	1.00			
10. Innovation	0.01	0.21*	0.42**	0.27**	0.18	0.05	0.26**	0.27**	0.38**	1.00		
11. Overall BSC measures	-0.16	0.19*	0.39**	0.36**	0.02	0.44**	0.85**	0.66**	0.79**	0.62**	1.00	

\*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

substantial environmental volatility. Among the business strategies, prospector receives the highest variation in scores although, its mean is slightly lower than analyzer strategy, while defender strategy is the lowest among them.

As indicated by the mean scores, it appears that the respondents placed the highest score on the usage of financial measures (mean = 5.98), followed by time-focused customer measures (mean = 5.73), internal processes measures (mean = 5.30), product-focused customer measures (mean = 5.03) and innovation and learning measures (mean = 3.99). These results are quite similar to prior surveys (Ittner and Larcker, 1998; Anand et al., 2005).

Table 3 displays a correlation matrix using the Pearson product-moment coefficient for all variables. Correlation analysis was used to describe the strength and direction of the linear relationship between variables. Results in Table 3 indicate that many variables are able to show significant bivariate relationship with each other. Perceived environmental uncertainty (PEU) shows a significant negative correlation with firm size ( $r = -0.22$ ,  $p < 0.05$ ), analyzer strategy ( $r = -0.20$ ,  $p < 0.05$ ), and internal processes ( $r = -0.23$ ,  $p < .05$ ).

Firm size shows a significant positive correlation only with innovation ( $r = 0.21$ ,  $p < 0.05$ ) and overall BSC measures ( $r = .19$ ,  $p < .05$ ). It can be seen that except for financial and product-focused customer measures, all other three dimensions of multiple performance measures, namely, time-focused customer, internal processes, innovation and learning as well as the overall BSC measures are also significantly positively correlated with prospector strategy at  $r = 0.43$  ( $p < 0.01$ ),  $r = 0.29$  ( $p < .01$ ),  $r = 0.42$  ( $p < 0.01$ ), and  $r = 0.39$  ( $p < 0.01$ ) respectively. Similarly, there is a strong positive

correlation between analyzer strategy and time-focused customer measure ( $r = 0.51$ ,  $p < 0.01$ ), between analyzer strategy and internal processes measure ( $r = 0.31$ ,  $p < 0.01$ ), analyzer strategy and innovation and learning measure ( $r = 0.27$ ,  $p < 0.01$ ), and between analyzer strategy and overall balanced scorecard (BSC) measure ( $r = 0.36$ ,  $p < 0.01$ ).

Majority of multiple performance measure dimensions (the dependent variables) are significantly correlated with each other, suggesting that multicollinearity is likely to exist. However, according to Pallant (2001),  $r = .90$  and above indicating that variables are highly correlated. From Table 3, none of the correlation coefficients is greater than .90. Also, after performing tolerance and variation inflation factor (VIF) tests, none of these tests detected multicollinearity among the variables ( $VIF < 10$ , Hair et al., 1998). Thus, it can be reasonably concluded that there is no potential major problem for regression analysis. The correlations between all the five dimensions are expected as they are linked by the cause-and-effect relationships.

Although, the cause-and-effect is difficult to prove, but the strong association among these dimensions suggests the existence of such relationship. The results show that innovation measure is significantly correlated with internal processes measure ( $r = .38$ ), internal processes measure is significantly correlated with product-focused customer measure ( $r = .54$ ), and product-focused customer measure is significantly correlated with financial perspective ( $r = .24$ ).

One interpretation of these significant correlations is that improvement in the innovation activities may be accompanied by improvements in internal processes and customer satisfaction and in turn lead to improvement in the financial performance.

**Table 4.** Regression analyses.

Parameter	Financial		Product-focused customer		Time-focused customer		Internal processes		Innovation		Overall BSC measures	
	$\beta$	t	$\beta$	t	$\beta$	t	$\beta$	t	$\beta$	t	$\beta$	t
PEU	-0.180	-1.824**	-0.078	-0.792	0.017	0.201	-0.163	-1.746**	0.094	1.037	-0.062	-0.685
Firm size	-0.053	-0.545	0.115	1.180	-0.033	-0.390	0.666	0.507	0.190	2.094*	0.119	1.330
Prospector	0.095	0.640	0.118	0.806	0.200	1.563	1.254	0.213	0.409	2.946*	0.280	2.075*
Analyzer	0.029	0.188	0.048	0.317	0.389	2.964*	1.304	0.195	-0.066	-0.462	0.160	1.151
Defender	-0.097	-0.969	-0.120	-1.201	-0.48	-0.558	-0.521	0.604	0.102	1.106	0.060	-0.659
R square		0.051		0.063		0.290		.168		.198		0.207
F-value		1.145		1.421		8.677*		4.187*		5.179*		5.519*

\*  $P < 0.05$ ; \*\*  $p < 0.10$ .

### Hypotheses tests

To test the three sets of hypotheses, a multiple regression analysis was performed for each dependent variable. Multiple performance measures comprising five dimensions represent the dependent variables. Table 4 shows the results of the regression analyses.

Results in Table 4 show that, when financial serves as the dependent variable, overall model is not significant and explains only 5.1% of the variance. However, a closer look at the t-values indicate that perceived environmental uncertainty (PEU) gives a negative significant influence on the use of financial measure ( $t = -1.824$ ,  $p < 0.10$ ). Therefore, this result is consistent with and supports the sub-hypothesis H1a stating that the higher the degree of PEU, the lower is the extent of financial measures usage. However, the rest of sub-hypotheses from the first set hypotheses are not supported.

When product-focused customer measure is the dependent variable, none of the independent variables significantly influences the use of product-focused customer measure and the overall model is also not significant. When time-focused customer measure represents the dependent variable, even though only analyzer strategy shows a significant positive contribution towards the use of time-focused customer measure ( $t = 2.964$ ,  $P < 0.01$ ), the overall model is significant and explains 29% of the variance ( $F = 8.677$ ,  $p < .05$ ). Therefore, sub-hypothesis H3b receives marginal support.

Further, results in Table 4 show that the five variables, namely, PEU, firm size, prospector, analyzer, and defender are able to explain 16.8% of the variations in the use of internal processes measure ( $F = 4.187$ ,  $p < 0.05$ ). However, an examination of the individual contribution of each of these variables indicates that only PEU has a negative significant impact on the use of internal processes measure. Thus, hypothesis H1c is supported by the regression analysis.

When innovation and learning measure serves as the dependent variable, the results of the regression analyses in Table 4 show that the overall model contributes significantly ( $F = 5.179$ ,  $p < .05$ ) and is able to explain 19.8% of the variance in innovation and learning measure. Details results indicate that there are significant positive relationships between firm size and the use of innovation measure and between prospector strategy and the use of innovation and learning measure. Thus, H<sub>2d</sub> is fully supported while H<sub>3a</sub> is partially supported.

Further, results in Table 4 indicates that the overall model contributes significantly ( $F = 5.519$ ,  $p < .05$ ) and predicts 20.7% of the variance in overall balanced scorecard (BSC) measure. Again, prospector strategy shows a positive significant contribution towards the use of overall BSC measure ( $t = 2.075$ ,  $p < .05$ ). However, other independent variables do not give significant impacts on the use of overall BSC measure. Therefore, H<sub>2e</sub> is marginally supported.

### DISCUSSION AND CONCLUSIONS

The results relating to the first set of hypotheses show that the level of perceived environmental uncertainty (PEU) is significantly associated only with the use of financial and internal processes measures. These results can reasonably explain the importance of perceived environmental uncertainty as a proxy for variables external to the organization in explaining variations in the choice of and extent of performance measures as reported in previous studies (Gordon and Miller, 1976; Gordon and Narayanan, 1984; Chenhall and Morris, 1986).

The results imply that under conditions of low PEU, usage of performance measures tended to be placed more on financial and internal processes measures (such as operating income, sales revenues, manufacturing lead

time, and labour efficiency variance).

The negative relationship of PEU with financial measures usage is compatible with the finding of Brownell (1987) indicating that reliance on accounting performance measures (RAPM) is low under high environment uncertainty but high under low environment uncertainty. Similarly, the result still bears some congruence with the earlier study of Govindarajan (1984) who found support for the proposition that superiors of business units which face lower environmental uncertainty rely heavily on financial data in performance evaluation.

The results show that PEU has significant negative relationship with the usage of internal processes measures, thus are consistent with the prediction. The internal processes measures are considered as non-financial, narrow scope, and efficiency-related type of information.

Although this result does not bear congruence with that of Gordon and Narayanan (1984) who found that non-financial information is positively associated with perceived environmental uncertainty, the result is in congruence with the view that although internal business process measures are non-financial measures, they measure the efficiency of operation. According to Miles and Snow (1978), the efficiency measures should be primarily internally-oriented in nature and would be dominant under conditions of low perceived environmental uncertainty.

Thus, it suggests that in low environmental uncertainty as generally indicated in this study, firms would focus on production planning and controlling as well as improving manufacturing and operational processes as these internal aspects may not be affected so much by the external environment. This could infer that internal stability is desirable as it allows standardization and increased operating efficiencies (Thompson, 1967).

The results found marginal support for the relationship between firm size and the extent of multiple performance measures usage. There is a positive significant relationship between firm size and the extent of use of innovation measures. This indicates that greater innovation measures usage is associated with larger firm size. This finding in one way or another supports the arguments that innovation is associated with larger organization (Moch and Morse, 1977) and that size can be associated with capital resources (Hicks, 1997).

The only significant relationships found from the regression analysis are: relationship between prospector strategy and the extent of use of innovation measures and the relationship between prospector strategy and the usage of overall balanced scorecard (BSC) measures, and relationship between analyzer strategy and the extent of use of time-focused customer measures. A positive and significant relationship between emphasizing prospector strategy and the innovation measures implies that firms use innovation measures at a greater extent for the firms emphasizing prospector strategy. This finding

seems to be consistent with Miles and Snow's contention that prospector strategy tends to place greater reliance on innovation activities. The inherent results indicate that firms that compete through innovation and product market development tend to be more open to new performance measures that enable their managers to improve knowledge, skills, processes and information.

With regards to the influence of analyzer strategy on the use of time-focused customer measures, the results imply that a greater emphasis of the analyzer strategy requires a higher extent of usage of these particular measures. This, in part, is consistent with McDaniel and Kolari's (1987) study where they reveal that analyzers perceive marketing research and computerized customer information systems to be a more important component of organizational strategy than do defenders. Higher extent of use of customer related measures for firms emphasizing analyzer strategy is consistent with the argument forward by Miles and Snow in that marketing and applied research are the most influential members of the dominant coalition in an analyzer. In another note, they point out that "successful imitation by an analyzer is accomplished through extensive marketing surveillance systems". Later, Snow and Hrebiniak (1980) argue that analyzers, because of their tendency to imitate successful product and market innovations of prospectors, tend to emphasize selling and have a distinctive competence in marketing/selling. Subsequently, McDaniel and Kolari (1987) found that marketing officers of analyzer banks viewed promotional and marketing research activities as being important to organizational strategy.

Meanwhile, Slater and Narver (1993) found that market and customer orientation is also essential to the success (profitability) of analyzers. These arguments provide the explanations why firms emphasizing analyzer strategy has a positive influence on the use of time-focused customer measures. It is also interesting to note that time-focused customer measures are used more extensively compared to the product-focused customer measures among the firms. This indicates that the use of time-focused customer measures like on-time delivery and customer response time are more important than product-focused customer measures such as percentage of shipments returned and number of warranty claims among the Malaysian manufacturing companies.

The overall conclusion to be drawn from this empirical evidence is that perceived environmental uncertainty exhibits a limited influence on the use of multiple performance measures in the Malaysian context and setting. Again, this means that information that is broad scope and external to the firms are not that important to the firms given the low uncertainty of the Malaysian environment. It can also be concluded that business strategy sets the need for types of information in terms of performance measures. As prospector strategy is more flexible, firms emphasizing this strategy would prefer to use much broader range of information.

## REFERENCES

- Abernethy MA, Lilis AM (1995). The impact of manufacturing flexibility on management control system design, *Acc., Org. Soc.*, 20(4): 241-258.
- Aiken M, Bacharach SB., and French JL (1980). Organizational structure, work process and proposal making in administrative bureaucracies. *Acad. Manage. J.*, pp. 631-652.
- Anand M, Sahay BS, Saha S (2005). Balanced scorecard in Indian companies. *Vikalpa*, 30(2): 11-25.
- Anderson EW, Fornell C, Lehmann, DR (1994). Customer satisfaction, market share, and profitability: Findings from Sweden, *J. Mark.*, Vol 58(3): 53-66.
- Atkinson AA, Balakrishnan R, Booth P, Cote JM, Grout T, Mali T, Roberts H, Ulan E, Wu A (1997). New directions in management accounting research. *J. Manage. Acc. Res.*, 9: 80-108.
- Banker RD, Potter G, Srinivasan D (2000). An empirical investigation of an incentive plan that includes non-financial performance measures, *Acc. Rev.*, 75(1): 65-92.
- Blau JR, McKinley W (1979). Ideas, complexity, and innovation. *Administrative Sci. Quarterly*, 24(2): 200-207.
- Bourgeois LJ (1985). Strategy goals, perceived uncertainty, and economic performance in volatile environments. *Acad. Manage. J.*, 28(3): 548-573.
- Brownell P (1987). The Use of Accounting Information in Management Control. In Ferris, R. and Livingstone, J. L. (Eds), *Management Planning and Control: Behavioural Foundations*, 7: 177-196.
- Bryant L, Jones DA, Widener SK (2004). Managing value creation within the firm: An examination of multiple performance measures, *J. Manage. Acc. Res.*, 16: 107-131.
- Carpenter MA, Fredrickson JW (2001). Top management teams, global strategic posture, and the moderating role of uncertainty. *Acad. Manage. J.*, 44(3): 533-545.
- Chapman CS (1997). "Reflections on a contingent view of accounting", *Acc. Org. Soc.*, 22(2): 189-205.
- Chenhall RH, Morris D (1986). The impact of structure, environment and interdependence on the perceived usefulness of management accounting systems, *Acc. Rev.*, 61: 16-35.
- Chong VK, Chong KM (1997). Strategic choices, environmental uncertainty and SBU performance: A note on the intervening role of management accounting systems, *Acc. Bus. Res.*, 27(4): 268-276.
- Conant JS, Mokwa MP, Varadarajan PR (1990). Strategic types, distinctive marketing competencies and organizational performance: a multiple measures-based study, *Strat. Manage. J.*, 11: 365-383.
- Dess G, Davis P (1984). Porter's (1980) Generic strategies as determinants of strategic group membership and organizational performance, *Acad. Manage. J.*, 27(3): 467-488.
- Dewar RD, Dutton JE (1986). The adoption of radical and incremental innovations: an empirical analysis. *Manage. Sci.*, pp. 1422-1433.
- Downey HK, Slocum JW (1975). Uncertainty: Measures, research, and sources of variation. *Acad. Manage. J.*, 18: 562-578.
- Duncan R (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Sci. Quarterly*, 17: 313-327.
- Ezzamel M (1990). The impact of environmental uncertainty, managerial autonomy and size on budget characteristics, *Manage. Acc. Res.*, 1: 181-197.
- Gordon LA, Narayanan VK (1984). Management accounting systems, perceived environmental uncertainty and organizational structure: an empirical investigation, *Acc. Org. Soc.*, 9(1): 33-47.
- Gordon L., Miller D (1976). A contingency framework for the design of accounting information systems, *Acc. Org. Soc.*, 1: 59-69.
- Gosselin M (1997). The effect of strategy and organizational structure on the adoption and implementation of activity-based costing, *Acc. Org. Soc.*, 22 (2): 105-122.
- Govindarajan V (1984). Appropriateness of accounting data in performance evaluation: An empirical examination of environmental uncertainty as an intervening variable. *Acc. Org. Soc.*, 9(2): 125-135.
- Govindarajan VJ, Gupta AK (1985). Linking control systems to business unit strategy: Impact on performance, *Acc. Org. Soc.*, 10: 51-66.
- Guiding C (1999). Competitor-focused accounting: an exploratory note, *Acc. Org. Soc.*, 24: 583-595.
- Gul F, Chia YM (1994). The effects of management accounting systems, perceived environmental uncertainty and decentralized on managerial performance: a test of three-way interaction, *Acc. Org. Soc.*, 19: 413-426.
- Hage J (1980). *Theories of organizations*. New York: Wiley.
- Hair JF, Anderson RE, Tatham RL, Black WC (1998). *Multivariate Data Analysis*, Prentice Hall International, Inc. New Jersey.
- Hambrick DC (1983). Some tests of the effectiveness and functional attributes of Miles and Snow's strategic types. *Acad. Manage. J.*, 26(1): 5-26.
- Hicks DT (1997). Impediments to adopting ABC at smaller organizations, *Cost Manage. Update*, 74: 1-3.
- Hoque Z, James W (2000). Linking balanced scorecard measures to size and market factors: Impact on organizational performance, *J. Manage. Acc. Res.*, 12: 1-17.
- Hoque Z, Mia L, Alam M (2001). Market competition, computer-aided manufacturing and use of multiple performance measures: An empirical study, *British. Acc. Rev.*, 33: 23-45.
- Iltner CD, Larcker DF (1997). Quality strategy, strategic control systems, and organizational performance, *Acc. Org. Soc.*, 22: 293-314.
- Iltner CD, Larcker DF (1998). Are non-financial measures leading indicators of financial performance? An analysis of customer satisfaction, *J. Acc. Res.*, 36: 1-35.
- Kaplan RS, Norton DP (1992). The balanced Scorecard: Measures that drive performance, January-February. *Harvard. Bus. Rev.*, pp. 71-79.
- Kaplan RS, Norton DP (1996). *Translating Strategy into Actions: The Balanced Scorecard*. Boston, MA: Harvard Business School Press.
- Kaplan RS, Norton DP (2001). *The Strategy-focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment*, Harvard Business School Press, Boston, MA.
- Keats BW, Hitt MA (1988). A causal model of linkages among environmental dimensions, macro organizational characteristics, and performance", *Acad. Manage. J.*, 31(3): 570-598.
- Kennerly M, Neely A (2002). A framework of the factors affecting the evolution of performance measurement systems, *Inter. J. Operations. Prod. Manage.*, 22(11): 1222-1245.
- Kettinger WJ, Grover V, Guha S, Segars AH (1994). Strategic information systems revisited: A study in sustainability and performance. *Manage. Information Syst. Quarterly*, pp. 31-58.
- Khandwalla PN (1972). The effect of different types of competition on the use of management controls. *J. Acc. Res. Autumn.*, pp. 275-285.
- Khandwalla PN (1973). Effect of competition on the structure of top management control. *Acad. Manage. J.*, 16(2): 285-295.
- Lawrence PR, Lorsch JW (1967). *Organization and Environment*. Harvard: University Press.
- Libby T, Waterhouse JH (1996). Predicting change in management accounting systems, *J. Manage. Acc. Res.*, 8: 137-150.
- Lynch R L, Cross KF (1995). *Measure Up! Yardsticks for Continuous Improvement*, Cambridge, Basil Blackwell.
- Maiga AS, Jacobs FA (2003). Balanced scorecard, activity-based costing and company performance: An empirical analysis, *J. Manage.*, 15(3): 283-301.
- McDaniel SW, Kolari JW (1987). Marketing strategy implications of the Miles and Snow strategic typology, *J. Mark.*, 51(4): 19-30.
- Merchant KA (1981). The design of corporate budgeting system: Influence on managerial behaviour and performance, *Acc. Rev.*, pp. 813-829.
- Mia L (1993). The role of MAS information in organizations: An empirical study, *British. Acc. Rev.*, 25: 269-285.
- Miles RE, Snow CC (1978). *Organizational Strategy, Structure, and Process*, New York: McGraw Hill.
- Miliken FJ (1987). Three types of perceived environmental uncertainty about the environment: State, effect, and response uncertainty. *Acad. Manage. Rev.*, 12: 133-143.
- Miller D, Friesen PH (1982). Innovation in conservative and entrepreneurial firms, *Strat. Manage. J.*, pp. 1-27.
- Minzberg H (1979). *The structuring of organizations: A synthesis of the research*. Englewood Cliffs, N.J.: Prentice-Hall.
- Moch MK, Morse EV (1977). Size, centralization and organizational adoption of innovations, *Am. Sociol. Rev.*, 42: 716-725.
- Nanni AJ, Dixon R, Vollmann TG (1992). Integrated performance

- measurement: Management accounting to support the new manufacturing realities, *J. Manage. Acc. Res.*, 4: 1-19.
- Neely A (1999). The performance measurement revolution: why now and what next?, *Inter. J. Operations. Prod. Manage.*, 19(2): 205-228.
- Neely A, Gregory M, Platts K (1995). Performance measurement system design, *Inter. J. Operations. Prod. Manage.*, 15(4): 80-116.
- Nunnally JL (1978). *Psychometric Theory*, 2<sup>nd</sup> ed., New York: McGraw-Hill.
- Olson EM, Slater SF (2002). The balanced scorecard, competitive strategy, and performance, *Business Horizons*, May-June, pp.11-16.
- Otley DT (1999). Performance management: A framework for management control system design, *Manage. Acc. Res.*, 10: 363-382.
- Parnell JA (1997). New evidence in the generic strategy and business performance debate: A research note, *British J. Manage.*, 8: 175-181.
- Parnell JA, Wright P (1993). Generic strategy and performance: An empirical test of the Miles and Snow typology, *British. J. Manage.*, 4: 29-36.
- Perera S, Harrison G, Poole M (1997). Customer-focused manufacturing strategy and the use of operations-based non-financial performance measures: A research note, *Acc. Org. Soc.*, 22(6): 557-572.
- Porter ME (1980). *Competitive Strategy*. New York: The Free Press.
- Romanelli E, Tushman ML (1986). Inertia, environments, and strategic choice: A quasi-experimental design for comparative-longitudinal research, *Manage. Sci.*, 32(5): 608-621.
- Shortell SM, Zajac EJ (1990). Perceptual and archival measures of Miles and Snow's strategic types: A comprehensive assessment of reliability and validity, *Acad. Manage. J.*, 33(4): 817-832.
- Simons R (1987). Accounting control systems and business strategy: An empirical analysis, *Acc. Org. Soc.*, 12(4): 357-374.
- Simons R (1990). The role of management control systems in creating competitive advantage: new perspective, *Acc. Org. Soc.*, 15(1/2): 127-143.
- Slater SF, Narver JC (1993). Product-market strategy and performance: An analysis of the Miles and Snow Strategy types. *European. J. Mark.*, 27(10): 33-51.
- Smith KG, Guthrie JP, Chen M (1989). Strategy, size and performance, *Organ. Stud.*, 10(1): 63-81.
- Snow CC, Hrebiniak LG (1980). Strategy, distinctive competence, and organizational performance. *Administrative Sci. Quarterly*, 25: 307-335.
- Starbuck WH (1976). Organizations and their environments. In Dunnette MD (Ed.), *Handbook of Industrial and Organizational Psychology*, Chicago: Rand McNally. pp. 1069-1124.
- Steers RM (1977). *Organizational Effectiveness*. CA: Goodyear Publishing Co.
- Thomas AS, Litschert RJ, Ramaswamy K (1991). The performance impact of strategy-manager coalignment: An empirical examination. *Strat. Manage. J.*, 12(7): 509-522.
- Van der Stede WA, Chow CC, Lin TW (2006). Strategy, choice of performance measures, and performance, *Behavioral Res. Accounting*, 18: 185-205.
- Venkatraman N (1989). Strategic orientation of business enterprises: The construct, dimensionality, and measurement. *Manage. Sci.*, 35(8): 942-962.
- Walker OC, Ruekert RW (1987). Marketing's role in the implementation of business strategies: A critical review and conceptual framework. *J. Mark.*, 51: 15-33.
- Waterhouse JH, Tiessen P (1978). A Contingency Framework for Management accounting systems research. *Acc. Org. Soc.*, 3(1): 65-76.
- Woodward J (1965). *Industrial organizations: Theory and practice*. London: Oxford University Press.