

## THE USEFULNESS OF MANAGEMENT ACCOUNTING SYSTEMS, FUNCTIONAL DIFFERENTIATION AND MANAGERIAL EFFECTIVENESS\*

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### Abstract

This study examines the role of broad scope information, made available by management accounting systems (MAS), in enhancing managerial performance. It is proposed that differentiation of activities into areas such as marketing and production is an organizational response to manage uncertainty. The paper argues that such differentiation of activities moderates the association between the extent to which managers use broad scope MAS information and performance. A study of 75 managers indicated that the association between the extent of use of broad scope MAS information and performance was stronger for managers of marketing than production activities.

Conventionally, the design of management accounting systems (MAS) has been confined to financial information internal to the organization with an historic orientation. However, the increased role of MAS to assist managers in attention directing and problem-solving tasks has resulted in the evolution of MAS to incorporate external and non-financial data focusing on marketing concerns, product innovation, strategic planning and predictive information related to these decision areas. Several studies have examined the extent to which such developments have been perceived as useful by managers (Larcker, 1981; Gordon & Narayanan, 1984; Chenhall & Morris, 1986). These studies have defined MAS by certain characteristics of information, in particular breadth of scope, timeliness, levels of aggregation and its integrative nature. Moreover, these studies report that perceived usefulness

of information is influenced by contextual factors such as structure, technology and environmental uncertainty.

Breadth of scope has been identified by researchers as a characteristic of MAS having particular significance in assisting managerial decision making (Gorry & Scott Morton, 1971; Hayes, 1977; Larker, 1981; Gordon & Narayanan, 1984). This is due to the requirement of managers within contemporary business environments (often characterized by high levels of uncertainty and technological complexity) for more information targeted at the specific elements of the operating situation (Galbraith, 1973; Ginzberg, 1980; Gordon & Narayanan, 1984). For example, it has been claimed that increased competition and technological change of an unpredictable nature make procedural or routinized, aggregated financial data of a deterministic nature less useful than

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more broadly based information, often of a non-monetary and probabilistic nature (Hayes, 1977; Gordon & Narayanan, 1984; Chenhall & Morris, 1986).

Existing studies have identified that elements of context influence managers' perceptions of the usefulness of broad scope information made available by MAS (Chenhall & Morris, 1986; Gordon & Narayanan, 1984). These studies of perceptions are limited as they indicate only that managers would be likely to use particular types of information if provided. The important link between the extent of use of the information and managers' performance has not been studied. A further limitation of our existing knowledge is a lack of understanding of the extent to which the relationship between elements of context and the extent of use of MAS information is influenced by the way organizations functionally differentiate activities, such as production, marketing and research and development, to limit the effects of uncertainty on the organizations.

The level of uncertainty faced by managers has been identified as important in influencing the selection of administrative procedures (Duncan, 1972), and the extent to which broad scope MAS information is perceived as useful (Gordon & Narayanan, 1984; Hayes, 1977; Govindarajan, 1984; Chenhall & Morris, 1986). One organizational response to uncertainty has been to functionally differentiate activities in ways that insulate particular tasks from uncertainty, while establishing boundary spanning functions to manage the uncertainty facing the organization (Thompson, 1967).

The current study sought to examine the extent to which the association between managers' use of broad scope MAS information and their performance was moderated by functional activities differentiated in respect to the uncertainty facing the organization. Sampling procedures were used to ensure that marketing activities were selected that faced relatively higher levels of uncertainty than production. This procedure was adopted following Thompson's (1967) observations that marketing is often associated with higher levels of uncertainty than production.

The study provided support for the view that the beneficial effects on managers' performance of using broad scope MAS information are moderated by the functional nature of activities. The results indicated stronger effects for marketing, which involved high uncertainty, than for production, which encompassed more certain tasks.

The remainder of the paper is structured as follows. First, prior literature is examined to develop a theoretical framework to explain the proposed relationships. This is followed by sections addressing the method, results and conclusions.

## PRIOR LITERATURE

### *Perceived use of broad scope MAS information*

Among the characteristics of MAS information, the breadth of scope of the information has been identified as potentially important in assisting managerial decision making (Gorry & Scott Morton, 1971; Hayes, 1977; Larcker, 1981; Gordon & Narayanan, 1984; Chenhall & Morris, 1986). Narrowly focused MAS information is derived from conventional financial accounts, tends to be concerned with events within the organization, and produces data that are financial and historic. Alternatively, broad scope MAS information includes external, non-financial and future oriented information.

Support for the importance of broad scope MAS information draws on the belief that managers are involved in a wide variety of tasks and processes which entail dealing with events which are complex and uncertain. The quantification of such events typically includes non-financial information, often related to the future. Despite the intuitive appeal of the proposition that broad scope information should be of assistance to managers, there are no studies that have examined whether the use of such information enhances managerial performance. A possible explanation for the lack of research on the impact of such information on performance is that the situations within which this relationship may hold are complicated by the influences of contextual settings.

Reasons to believe that context is important may be found in studies that have identified the effect of environmental and organizational factors on managers' perceptions of the usefulness of broad scope MAS information (Gordon & Narayanan, 1984; Chenhall & Morris, 1986). However, these studies cannot directly link use of broad scope MAS information with performance as there is no evidence that the MAS provides such information, or that managers actually use the information.

A potential link between perceptions of the use of information and performance has been suggested, based on the belief that managers are knowledgeable about the nature of their work. Moreover, they understand how such work may be expected to improve their performance. As a consequence they can judge how useful the information would be in assisting them in effective performance of their tasks (Ashton, 1974; Bruns, 1968; Joyce, 1977; Larcker, 1981). However, the extent to which managers possess sufficient self-insight to identify the requirements of effective task performance, and the requisite information, has been questioned by several researchers (Slovic & Lichtenstein, 1971; Nisbett & Wilson, 1977; Bonner & Lewis, 1990). The current study sought to extend prior research into the perceived utility of broad scope MAS information by examining, directly, the effects on performance of managers' use of broad scope information provided by their organization's MAS.

It appears reasonable to argue that if managers use broad scope information supplied by an MAS, then given comparable decision-making skills, their application of the information should provide a relative advantage in performing their managerial tasks and assist in improving their performance. However, there are many studies which have demonstrated that the efficacy of MAS is dependent on the contextual situation of the manager. Factors such as the external environment, structure, technology and size have been identified as moderating the effects of MAS information (Gordon & Narayanan, 1984; Bruns & Waterhouse, 1975; Merchant, 1981; Daft & McIntosh, 1984).

#### *Moderating effect of functional differentiation of activities*

A factor of particular importance to the current study, and one that generally has received little attention, is the role that functional differentiation of activities has on the relationship between the extent of use of broad scope MAS information and managers' performance.

Empirical studies that have identified links between perceived usefulness and uncertainty (Gordon & Narayanan, 1984; Chenhall & Morris, 1986) have examined profit centred firms or divisions within organizations. Consequently, managers could be expected to have had responsibility over a wide range of functional activities such as production and marketing. Organizations may attempt, however, to differentiate their activities in ways that limit the impact of uncertainty on the organization.

Thompson (1967) argued that differentiating boundary spanning activities, such as marketing and research and development, from production is an important organizational response to limit the impact of uncertainty. Where this can be achieved, the tasks associated with the production core are buffered, or protected, from external environmental uncertainty. This facilitates the co-ordination and control of the processes used to transform materials into output. The role of boundary spanning activities is to monitor and survey the external environment and plan responses. It follows that while an organization may face high levels of uncertainty within the external environment, the nature of the task uncertainty facing managers may differ depending on whether the tasks are differentiated with respect to production or marketing and whether they are buffered in the way suggested.

In the case of production managers, the operating environment of the firm (e.g. market conditions) may be subject to unpredictable demand, changing prices, competitors' actions and strategic priorities. However, if production is buffered from the environment then the tasks typically will be protected from the external environmental uncertainty. In such a situation,

the tasks are likely to be more analysable and involve fewer exceptions. Examples of such tasks include production of required outputs at identified times and the application of specified procedures and processes. Buffering of production from external environmental uncertainty may not necessarily occur in all organizations. However, where it does it seems less likely that broad scope MAS information would be suited to assist production managers in the performance of their tasks.

The situation for marketing managers may be quite different. They may face the same uncertain external environment as production managers, but because they must manage this environment their task uncertainty is high. Consequently, it is likely that broad scope MAS information will be of more assistance to marketing than production managers in improving their performance of the tasks which require an understanding of the complexity of markets, the nature of uncertainty in the environment and the potential impact of alternative decisions.

### *Hypothesis*

The proposition regarding the role of functional differentiation on the association between the extent of use of broad scope MAS information and managerial performance may be presented in the following hypothesis:

There will be no significant interaction between the extent of use of broad scope MAS information and the functional areas of production and marketing affecting managerial performance.

## METHOD

### *Sample*

The research design involved identifying organizations that provided broad scope information within the MAS. This was necessary as it is possible that low usage of broad scope MAS information could be due to lack of availability. Furthermore, enhanced performance could occur as a consequence of managers sourcing broad scope information from other management information systems (MIS). This raises the

possibility of a significant relationship between low usage of broad scope MAS information and high performance which is clearly contrary to the hypothesized effect for marketing managers. It was also necessary to examine if marketing and production activities faced different levels of task uncertainty. Moreover, it was important to confirm the expectation of this study that marketing activities faced higher levels of task uncertainty than production. This was necessary as it was expected that it is only in situations where marketing faces higher levels of uncertainty than production that functional differentiation will moderate the effect of the use of broad scope information on performance.

An initial sample of 20 manufacturing firms employing 1000 or more people was identified from a manufacturing directory. Size was used as an indicator of the likelihood that firms would possess formal financial control systems. Initial contact was made with the chief executives to gain the participation of the firms in the study. This provided a list of 12 firms.

Evidence that it was the MAS that provided broad scope information was derived from data collected by interview with the company finance director and senior managers. These data were confirmed by site visits. The decision mechanism employed to categorize MAS as generating broad scope information required firms' MAS to provide information in the following three areas:

(1) non-financial as well as financial information (e.g. indicators of scrap, machine downtime as well as production costs; delivery times in days as well as improved sales dollars from improvements in delivery);

(2) future information as well as historic (e.g. projected product prices and costs of production as well as historic and current prices and costs; information presented in probabilistic forms (least likely, most likely, most optimistic) as well as past trend data);

(3) information on external factors as well as internal data (e.g. competitors' market share as well as the company's budget for marketing promotions).

On the basis of these criteria, five firms

were identified as providing broad scope MAS information.

Also, during initial interviews, senior managers were asked to identify whether their marketing activities faced high levels of uncertainty and production activities faced low levels of uncertainty. For the five firms selected on the basis of providing broad scope MAS, senior managers indicated that all the production activities involved more certain tasks than those in marketing.

From the five selected firms, a sample of 29 marketing and 46 production managers was identified to participate in the study. Selection of managers was made by the chief executive, so the sample was not strictly random. Data were collected from functional managers on the extent of their use of broad scope MAS information. In addition, these managers provided data on their perceptions of the level of uncertainty involved in their tasks. Finally, the superiors of functional managers provided a formal evaluation of their subordinates' performance.

#### *Nature of broad scope MAS*

The MAS of the selected five firms could be classified as highly sophisticated, with all MAS being computerized and information available on line. While it is not possible within the confines of this paper to describe in full the dimensions of these MAS, some clarification as to their nature is possible by reference to a selection of anecdotes. (The product line in each of the firms is provided in Appendix A.)

A production manager within a dairy products company demonstrated the potential of his MAS on the computer screen in his office. He retrieved, in a matter of minutes, information on daily production volume, spoilage rates, finished goods inventory, production costs and past and projected sales volume.

A marketing manager in a chemical manufacturing company was observed preparing information for a budgetary meeting using the on-line MAS facilities. Within two hours he had reports including conventional sales and costs for the next 12 months and linkages of these figures with a three year strategy. He had prepared five "what-if" scenarios based on key strategic priorities.

These projections included detailed information on competitors' markets and likely cost structures.

Several production managers of a chocolate manufacturing firm expressed great pride in how well they had performed over the prior six months on the MAS performance evaluation scheme which included indicators such as defects, throughput times, material waste as well as overall costs of production. Marketing managers, in the same company, were judged on their success in predicting customer preferences and competitive actions in the market place in addition to more conventional measures targeted on increases in sales volume and revenue.

#### *Applications of broad scope MAS*

An important aspect of MAS design is to provide information relevant to the particular decision needs of managers. While a comprehensive discussion of the way in which broad scope MAS were used to assist in taking particular decisions is beyond the scope of this paper, it is possible to provide an overview of types of decisions taken by both production and marketing managers and the components of MAS used.

During interviews, the managers within the five firms providing broad scope MAS information indicated (in some cases by examples) that they used this information in making both operating as well as strategic decisions. The operating decisions mentioned by most production managers concentrated on cost control, quality assurance and throughout time, employee productivity and material purchases. The most important aspects of the MAS for these decisions were activity and cost budgets, cash budgets, and periodic performance evaluation. However, information on trends in demand provided potential assistance in scheduling and inventory policy and supplier negotiation. The strategic decisions commonly mentioned by the production managers related to replacement and modifications of fixed assets and equipment. All MAS provided facilities for capital budgeting, including discounted cash flow techniques and cost-volume-profit analysis.

For marketing managers decisions tended to be driven by market forces, but they had a

concern with the ability of the organization to provide products to satisfy customer expectation for quality, reliability and delivery. The information from the MAS of potential benefit focused on determinants of demand such as demographic information, government, industry and in-house surveys of customer preferences. A factor of importance within the chemical and paper and pulp companies was the implications to demand of government policies. Regulations on the imports of cheeses were of concern to the dairy products firm. The management of information related to these types of factors was the responsibility of the MAS operation in the studied firms. Several anecdotes are illustrative of the role of MAS for marketing managers.

A marketing manager in a chemical manufacturing company said, "due to ever changing technology and the increasingly vigilant greenies, we have to upgrade our equipment quite frequently and our budget and management accounting people have been providing information which we need for making necessary decisions".

In the paper and pulp manufacturing company, several marketing managers said "we are always in close contact with our product markets, we must know what's going on out there, the market here is deadly competitive. To survive, we have to constantly work on cost, price, quality, variety, innovation, and marketing promotions and we heavily use our MAS which is always on line".

By contrast, the MAS in the seven organizations excluded from the final sample, because of lack of availability of broad scope MAS information, produced conventional financial information with an internal focus. In the main, this information was provided for corporate reporting purposes. In addition, the MAS provided information for static budgets typically used only for control. For example, in an automotive component manufacturing company, the MAS was used to provide detailed information on budgets with comparison of actual revenues and costs against budgets and detailed reports on monthly variances. The MAS were computerized and providing quantitative, financial and historical information. There appeared to be little opportunity to use the MAS for problem solving activity of an operational or strategic nature.

### *Measurement instruments*

The instrument developed by Chenhall & Morris (1986) was adapted to assess the extent of use of broad scope MAS information. This instrument asks managers to indicate, on a seven point Likert scale, the extent to which they use six items of information provided by their organization's MAS. Prior research considering perceived usefulness of broad scope MAS information has shown that the six items represent a single construct (Chenhall & Morris; 1986). In regard to use, it may also be expected that managers facing relatively complex and uncertain decision environments will use more information including, in particular, broad scope information supplied by the MAS (Galbraith, 1973). A factor analysis again confirmed the unidimensional nature of the construct. The items used within the instrument and the results of the factor analysis are presented in Appendix B.

Inspection of the instrument used to measure extent of use of broad scope MAS information reveals that item 5 refers to non-financial information related to production activities. This raises the issue of the relevance of this item to marketing managers. Discussion with marketing managers during exploratory work prior to the study, and during data collection, indicated that marketing managers use non-financial information related to production for decisions such as assuring customers of product quality, the potential to service rushed orders and provide technical service. They tend to discuss these issues with production managers and often use the MAS information to negotiate a preferred outcome involving trade-offs between customers' satisfaction and the concerns of production managers. While it seems plausible that marketing managers would use this type of information, it remains unclear as to whether use of such information enhances the performance of marketing managers to a greater extent than production managers. While the factor analysis indicated acceptable construct validity for the instrument, the face validity of item 5 and its relatively low loading in the factor analysis make its inclusion

contentious for this study. To examine whether the inclusion or exclusion of item 5 had a material effect on the outcome of the study, the data were analysed both with and without item 5 included within the instrument used to measure extent of use of broad scope MAS information. As there were no significant differences in outcomes the analysis uses the instrument including item 5.

The mean score for the extent of use of broad scope MAS was 4.71 (standard deviation 1.44). Interestingly, there was a significant difference ( $t = 2.71, p < 0.01$ ) between the mean score for the extent of use of broad scope MAS for the marketing sub-sample ( $\bar{X} = 5.34, S.D. = 1.85$ ) and for production ( $\bar{X} = 4.66, S.D. = 6.16$ ). While this indicates a prevalence of use by marketing managers, there remains the issue of whether relative usage interacts with function to affect performance. This is, of course, the research question addressed in the hypothesis.

Managerial performance was assessed on a nine point scale by superiors rating their subordinate, functional managers. The mean for performance was 5.54 (standard deviation 0.90). The instrument used to assess performance is provided in Appendix C.

#### *Functional differentiation and task uncertainty*

As indicated earlier, in this study sampling procedures were used to ensure that marketing activities involved relatively higher levels of task uncertainty than production. Initially, senior managers' assessment of their firm's marketing and production activities suggested that marketing faced higher uncertainty than production. It was, however, necessary to confirm, at the level of individual managers, that their marketing activities involved high levels of uncertainty while production involved more certain tasks.

In general, the measurement of task uncertainty has not been without difficulties. A variety of constructs have been used to describe the uncertainty associated with tasks including task complexity and stability (Duncan, 1972), task difficulty and variability (Van de Ven & Delbecq, 1974), and task analysability and number of exceptions (Withey *et al.*, 1983).

Hirst (1983) found that the concept of task uncertainty was multidimensional with low correlations between separate constructs such as task difficulty and variability (Van de Ven & Delbecq, 1974), and external environmental uncertainty (Sathe, 1974). Brownell & Dunk (1991) discussed the danger of mis-specifying the effects of task uncertainty on MAS design when using concepts of task uncertainty that combine the dimensions of task difficulty (task analysability) and task variability (number of exceptions).

Given the mixed results in identifying generalizable measures of task uncertainty it was decided to examine, directly, the nature of the tasks facing marketing and production. This provided the opportunity to identify various aspects of the tasks which may be expected to increase the difficulty of the managerial functions. Perrow's (1970) dimensions of task "analysability" (routineness) and "number of exceptions" (the extent of unexpected or novel events) have directed much of the conceptualization of task uncertainty, and were used to guide assessment of task uncertainty in this study.

Information on task uncertainty was collected by site inspections, interviews with production, marketing and senior organizational managers. Functional managers were asked to assess uncertainty associated with their tasks using a rating scale. The rating scale involved scoring tasks in terms of routineness and exceptions using a scale of high – medium – low. In addition, operating procedures were assessed as being either "standardized" or "unstandardized". Local and overseas competition and product diversity were assessed using the high – medium – low scale.

Finally, all the production processes were judged to involve mass production technology. These technologies were all highly automated involving multiple conversion processes. For example, in the dairy products plant (one of the five firms), the raw material, which was mainly milk, went through a number of stages of the production process to generate, first, fresh milk and then cream, butter and cheese. Similarly,

the production process in the newsprint, paper and pulp, chemicals, and chocolate manufacturing company (the other four organizations in the sample) were highly automated producing standardized outputs. The results of the measurement of task uncertainty, the type of technologies, and the nature of products are provided in Appendix A.

It was clear from inspection of the materials management and the manufacturing processes in the five organizations that production tasks could be classified as highly routine with few exceptions to standard operating procedures. All marketing and senior organizational managers indicated that the marketing of products and the development of product strategies had become increasingly difficult in recent years as a consequence of increased local and overseas competition. In addition, marketing managers indicated that markets had become more complex because of the development of multiple product strategies. These factors had generated tasks that were not highly analysable (low routineness) and involved high levels of unexpected and novel decisions (high exceptions).

For production activities, operating procedures were found to be standardized, while in marketing they were all non-standardized. In regard to product competition, virtually all organizations faced a high level of local and international competition. The exception was in the case of newsprint where local competition was rated as medium.

Finally, product diversity provides an indication of complexity and a potential for low routineness and high exceptions. Managers in organizations producing chocolate, dairy products and chemicals scored high product diversity. Managers in the paper and pulp company scored medium, while those in newsprint rated product diversity as low.

From observation of Appendix A it is apparent that all of the production managers scored the routineness of their operations as high, while marketing scored their tasks as low (15) or medium (14). In regard to exceptions, all production managers scored this as low, while marketing scores were high (12) and medium

TABLE 1. Managers: function by task uncertainty

Function	Task uncertainty		
	High	Medium	Low
<b>Routineness:</b>			
Production	46	0	0
Marketing	0	14	15
<b>Exceptions:</b>			
Production	0	0	46
Marketing	12	17	0

(17). These data are presented in Table 1. In the case of both exceptions and routineness, chi-squared statistics indicated statistical differences between cells (75.0,  $p < 0.01$ , d.f. = 2 for both exceptions and routineness). These results confirm the effectiveness of the sampling procedures.

Consideration of the differences in scores of levels of routineness and exceptions between functional managers, and the statistical support for such differences, supports the view that in this study production managers faced tasks which were more certain (analysable and fewer exceptions) than was the case for marketing managers.

## RESULTS

The hypothesis of the study was tested using the regression equation below:

$$Y = \beta_1 + \beta_2 F + \beta_3 X + \beta_4 FX + e, \quad (1)$$

where  $Y$  = managerial performance;  $F = -1$  for production, and  $+1$  for marketing;  $X$  = the extent of use of broad scope MAS (difference scores from the overall mean).

Rejection of the hypothesis required that  $\beta_4$  in equation (1) be both significant and greater than zero. The results presented in Table 2 show that  $\beta_4$  is positive and significant at the  $p < 0.05$  level. This supports rejection of the null implied in the hypothesis. The regression results indicate that there is a significant interaction between the functional areas and the extent of use of broad scope MAS information affecting managerial performance. More specifically, the results indicate that the slope of  $Y = f(X)$  is



TABLE 2. Results of regression of managerial performance on extent of use of broad scope information ( $X$ ), function ( $F$ ) (marketing = +1, production = -1) and their interaction ( $FX$ )

Variables	Coefficient and value	Standard error	$t$ -value	Significance levels, two-tailed
Constant	$\beta_1 = 5.86$	0.09	63.00	0.01
Extent of use of broad scope				
MAS information ( $X$ )	$\beta_3 = -0.00$	0.07	-0.02	NS
Functional areas ( $F$ )	$\beta_2 = 0.25$	0.09	2.70	0.01
Interaction ( $FX$ )	$\beta_4 = 0.14$	0.07	2.07	0.05

Adj.  $R$  squared = 0.15,  $F_3, 71 = 4.05, p < 0.01$ .

significantly different in the two functional areas of the organizations (see Brownell, 1985). As is the case in all regression studies not employing ratio scaled data, only the highest order interaction term is interpretable (Southwood, 1978). Consequently, no attempt was made to interpret the coefficients within equation (1) that related to extent of use of broad scope MAS information or function.

While the significance of the interaction enables rejection of the null hypothesis, it does not indicate whether the association between performance and the extent of use of broad scope information is significantly different from zero in either production or marketing. This is of practical importance as the designers of MAS have an interest in developing systems that will provide positive benefits for particular groups of managers.

It is possible to test the separate effects of the extent of use of broad scope MAS information on performance in marketing and production. This involves decomposing equation (1) into two separate equations, one relating to production and the other to marketing managers (Brownell, 1981, p 852). Using the value of  $F = -1$ , equation (1) can be reconstructed for production managers as:

$$Y = (\beta_1 - \beta_2) + (\beta_3 - \beta_4)X. \quad (2)$$

Similarly, using  $F = +1$ , equation (1) can be reconstructed for marketing managers as:

$$Y = (\beta_1 + \beta_2) + (\beta_3 + \beta_4)X. \quad (3)$$

Inserting the values for the respective coefficients from Table 2 into the equations (2) and (3) we obtain:

$$Y = 5.61 - 0.14X \text{ (Production managers)} \quad (4)$$

and:

$$Y = 6.11 + 0.14X \text{ (Marketing managers)}. \quad (5)$$

The composite coefficients for equations (4) and (5) and their standard errors were developed from the coefficients and the related variance/covariance matrix generated from equation (1). Table 3 presents all four coefficients in equations (2) and (3). Inspection of this table reveals that the coefficient for production [ $(\beta_3 - \beta_4)$  in equation (2)] is not significant at conventional levels of significance. In the case of marketing managers, the coefficient [ $(\beta_3 + \beta_4)$  in equation (3)] was positive and is significant at the  $p < 0.05$  level using a one-tailed test. While readers must draw their own conclusions from these tests, it can safely be concluded that the significant interaction term in equation (1) indicates that use of broad scope MAS enhances performance in marketing to a greater extent than in production. Figure 1 presents a graphical representation of equations (4) and (5) and illustrates that the slopes of the separate regression lines are significantly different from each other.

TABLE 3. Composite regression coefficients derived from decomposition of results of fitting equation (1)

Coefficient	Value	Standard error	$t$ -value	Levels, two-tailed
$\beta_1$	5.86	0.09	63.00	0.01
$\beta_2$	0.25	0.09	2.70	0.01
$(\beta_3 - \beta_4)$	-0.14	0.11	-1.30	NS
$(\beta_3 + \beta_4)$	0.14	0.08	1.73	0.10

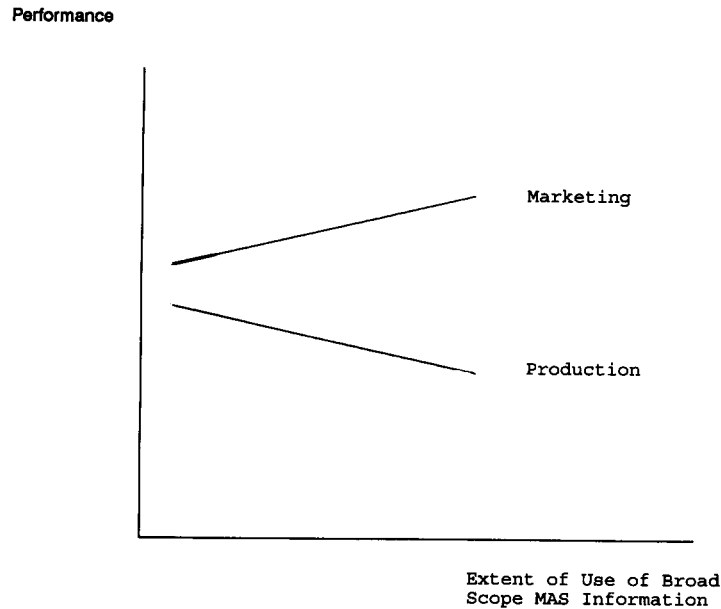


Fig. 1. The impact of broad scope MAS information on production and marketing managers' performance.

### CONCLUSIONS

The results of this study support the view that the beneficial effect on managerial performance of using broad scope MAS information is moderated by differentiation of activities in ways that isolate uncertainty within particular functions. Moreover, the results indicated that a higher usage of broad scope MAS information was associated with enhanced performance for marketing activities but not for production at conventional levels of statistical significance. The study extends prior research on perceived usefulness of MAS information (Gordon & Narayanan, 1984; Chenhall & Morris, 1986) to the association between the extent of use of such information and improved managerial performance. It addresses the suggestion for future research by Chenhall & Morris (1986, p. 31) that "Perhaps, most importantly, the effect of different types of MAS on managers' performance should be investigated".

To the extent that use of broad scope MAS information appeared to be most beneficial in marketing, several possible areas for future research are apparent. For example, the types

of marketing decisions that might be assisted by using broad scope MAS information, and the specific nature of the information would assist in targeting particular aspects of MAS that may assist in improving managerial performance. Further work examining other dimensions of MAS such as timeliness, various forms of aggregations and MAS decision models would add to our knowledge of the role of MAS in improving managerial performance.

As with other studies, there are limitations associated with this study. First, while considerable care was taken to collect valid and reliable data, the measurement of task uncertainty was somewhat crude. Although we are confident that the data collected provided a reliable indication that production activities faced lower levels of uncertainty than marketing, the measurement of task uncertainty did not involve conventional indexes. Use of existing instruments was considered to be inappropriate and potentially misleading because of their lack of suitability to this study. The measurement of performance was also crude, involving only a single item. Second, the sample was not random and while the studied firms were representative of typical

manufacturers, care should be taken when generalizing the results to other industries. Third, the study examined a single moderating variable, and it is possible that other factors are implicated in the association between the extent of use of broad scope MAS information and performance. Finally, and most importantly, the study used presumed differences in task uncertainty between the functions of production and marketing to explain how functional differentiation moderates the association between use of broad scope MAS information and performance. It is possible that there are other systematic differences between functionally differentiated activities that could help explain the hypothesized effects.

Within these limitations, the results of the study indicated that understanding of the way

in which greater usage of broad scope MAS information assists in improving managers' performance is enhanced by considering the way tasks are functionally differentiated to manage uncertainty within organizations. While the results are clearly a modest extension of the body of research exploring the usefulness of MAS information, they do add to our understanding about which factors at the organizational level potentially affect the design of MAS. This orientation may be considered as having greater practical significance to management accountants than individual level studies which conclude, somewhat unrealistically, that MAS should be designed to cater for individual differences such as personality, cognitive style or educational background and training.

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#### APPENDIX A: SELECTED CHARACTERISTICS OF THE SAMPLE ORGANIZATIONS

Characteristics	Organizations				
	1	2	3	4	5
Nature of products	Chocolate	Dairy processing	Chemicals	Paper & pulp	Newsprint
Technological process	Mass product	Mass product	Mass product	Mass product	Mass product
Production task					
No. Managers	9	9	9	10	9
Characteristics:					
Routineness	High (9)	High (9)	High (9)	High (10)	High (9)
Exceptions	Low (9)	Low (9)	Low (9)	Low (10)	Low (9)
Operating procedures	Standardized (9)	Standardized (9)	Standardized (9)	Standardized (10)	Standardized (9)
Marketing task					
No. managers	6	6	6	6	5
Characteristics:					
Routineness	Low (6)	Medium (6)	Low (6)	Low (3)/Medium (3)	Medium (5)
Exceptions	High (6)	Medium (6)	High (6)	Medium (6)	Medium (5)
Operating procedures	Non-standardized (6)	Non-standardized (6)	Non-standardized (6)	Non-standardized (6)	Non-standardized (5)
Competition:					
Local	High (6)	High (6)	High (6)	High (6)	Medium (5)
International	High (6)	High (6)	High (6)	High (6)	High (5)
Product diversity	High (all)	High (all)	High (all)	Medium (all)	Low (all)

Rating scale: High, Medium, Low.

APPENDIX B

The following questions are about managers' use of information made available by the management accounting system (MAS) of their organization.

Managers were asked to indicate, when making various organizational decisions, how much they used MAS information of the following characteristics:

	Factor loadings
1. Information which relates to possible future events (e.g. future government trade policies).	0.85
2. Information on the likelihood (quantified) of future events occurring (e.g. probability estimates).	0.86
3. Information of a non-economic nature such as customer preferences, employee attitudes, labour relations, attitudes of government and consumer bodies, competitive threats.	0.79
4. Information on broad factors external to their organization such as economic conditions, population growth, technological developments.	0.78
5. Information of a non-financial nature related to production activities such as output rates, scrap levels, machine efficiency, employee absenteeism.	0.50
6. Information related to product markets such as market size, growth in market share.	0.78

Eigen value = 3.53; variance explained = 58.8%.

APPENDIX C: SUPERIOR-RATINGS OF PERFORMANCE

Managerial performance may be regarded as the degree to which managerial roles are accomplished. Please respond by placing a number from 1 (well below average) to 9 (well above average) in the appropriate space, to rate your evaluation of the recent overall performance of each of the following managers who have been reporting directly to you. The following scale should be used for reference:

Very low				Average					Very High
1	2	3	4	5	6	7	8	9	

Name of the manager ----- The overall recent performance -----