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Ferdinand A. Gul
Chinese University Hong Kong

William Glen
Griffith University

Alan Ruguang Huang
Griffith University

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Ferdinand A. Gul, William Glen, and
Alan Ruguang Huang

The motivation for this contingency-type study is based on the notion that prior studies on management accounting systems (MAS) has almost entirely focussed on large business organizations and neglected consideration of the effects of contextual variables and MAS on organizational effectiveness or performance of small business. Using a sample of small business (SB) managers/owners as subjects, this study therefore examined the moderating effects of perceived environmental uncertainty (PEU) and computer usage on the management accounting system (MAS)/ performance relationship. Performance in this study was measured using the compound growth rate of market value of the firm (GMV) and growth rate of fixed assets (GFA). SB was defined as companies with between 10 and 100 employees. Results using multiple regression analyses and partial derivatives of the regression equations showed that PEU moderated the effects of MAS on performance with MAS having a positive effect on performance under high levels of PEU. In addition, the results also showed that levels of computer usage moderated the effects of MAS on performance with MAS also having a positive effect on performance under conditions where there was a high level of computer usage. Under low levels of PEU and computer usage MAS had a negative relationship with performance.

INTRODUCTION

The application of contingency theory to research in management accounting has attracted a considerable amount of interest. In general, the contingency frameworks that have been applied suggest that organizations which achieve a fit between their structures and contexts are in some sense more effective [12]. Contextual variables have been defined to include technology [28], environment [10] and organization size [11]. Based on these frameworks several studies in accounting have been conducted which in some measure substantiate the contingency interpretation.

Ferdinand A. Gul • Department of Accountancy, The Chinese University of Hong Kong, Hong Kong.
William Glen and **Alan Ruguang Huang** • Faculty of Commerce, Griffith University, Nathan, Queensland, 4111 Australia.

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In particular there has been some interest in the application of contingency theory to design of management accounting systems (MAS). The importance of conducting this type of research, which examines the relationship of contextual variables to MAS, has been emphasized by several researchers [26]. In response to this need, Gordon and Narayanan [5] for example, studied the interaction between contextual variables on MAS and found that perceived environmental uncertainty (PEU) and organizational structure affected MAS designs with high PEU requiring more broad scope MAS. In a similar vein, Chenhall and Morris [3] found that there was a relationship between PEU, organizational interdependence and structure which in turn affected managers' perceptions of the usefulness of management accounting systems (MAS); high PEU, organizational interdependence and decentralized structures resulted in managers' perceiving higher levels of usefulness for certain characteristics of MAS. Two aspects of these (and other) studies which provides the basic motivation for the present paper are (i) the complete preoccupation with contingency relationships in large business organizations and (ii) the failure to account for linkages between contextual variables, MAS and performance [16].

The question of whether these contingency perspectives are also in an empirical sense applicable to MAS in small business organizations has unfortunately not been addressed. While there are no apparent reasons why these contingency relationships are not applicable to small business organizations, the question still needs to be empirically tested. In particular, since small businesses are an important component of a country's economy, the identification and study of the factors that could affect their effectiveness is a worthwhile endeavour.

Organizational effectiveness or performance which is in fact an important end-product in the contingency "fit" theory is also another question that requires further empirical testing [16]. Unless these contingency "fit" relationships are shown to have an effect on performance much of the work in the area may remain sterile and academic. Figure 1 summarizes these relationships.

Based on the foregoing discussion this study examines the relationship of contextual variables to MAS and their effects on performance in small business organizations which is defined as any organization with between 10 and 100 employees. More specifically, the study examines the moderating effects of environmental uncertainty and computer usage on the MAS/performance relationship. While environmental uncertainty has been previously studied, computer usage (CU) is a new contextual variable which has received relatively little attention in the literature despite its importance as a dimension of technology and its pervasive influence in organizations [2]. Two separate hypotheses which specifically examine the moderating

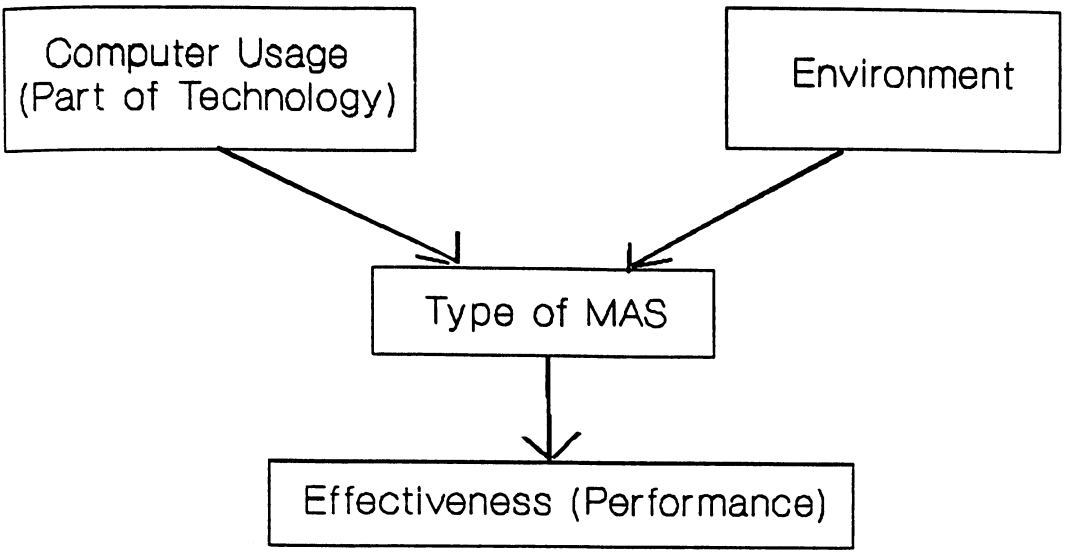


Figure 1. Simple Framework for Relationships of the Variables

effects of PEU and CU on the MAS/performance relationship are tested in this study. The next section of the paper describes these variables and develops the relevant hypotheses for testing. This is followed by a section on the methodology of the study and the statistical analyses adopted. The results and discussion of the results are taken up at the end of the paper.

Development of Hypotheses

A manager or owner of a SB may perceive environmental uncertainty (PEU) in terms of task uncertainty, diversity of decisions, difficulties of predicting events, complexity of planning and control activities, and the extent of lead time [3, 12]. PEU has been identified as an important factor that could affect the extent to which managers would require MAS information. The higher the level of PEU, the greater the amount of information that the manager has to process in order to achieve a particular level of performance [4]. In other words, when PEU is high, it is likely that sophisticated MAS should be provided to the manager/owner of the SB to facilitate decision making which in turn should improve performance.

MAS is viewed as sophisticated and dynamic when it possesses four basic characteristics of broadness in scope (i.e, futuristic information, external information and qualitative information), availability on time, aggregation and integrated and at the same time also incorporates the characteristics of a traditional type of MAS information [3,5]. Note that the traditional type

of MAS information is generally historical, quantitative, expressed mainly in monetary terms and is often related to events that are internal to the organization [5, 14]. Thus a sophisticated or dynamic MAS in addition would be future oriented, external, qualitative, timely, aggregated and integrated.

When PEU is high it is unlikely that the traditional type of MAS can facilitate decision making and performance. Managers would require both external and internal, quantitative and qualitative information on a timely basis. Moreover, the information should be integrated and aggregated so that the manager can have a clear idea of the financial situation of the SB. Simon et al. [21] makes the point that managers operating in a high PEU situations have a greater need for sophisticated MAS in terms of broad scope and timely information to make informed decisions in areas, such as, pricing and inventory control. This proposition was borne out in a study by Gordon and Nanayanan [5] who found that there was a relationship between high PEU and managers' need for broad scope MAS information. High PEU situations which are characterized by unpredicted events require timely information so that plans and sales strategies can be modified quickly. These unpredicted events also require aggregated and integrated MAS information that provides the manager/owner with an overall view (aggregated) of the business and the inter-relationships between the component activities of the business (integrated) such as marketing, wages, sales, raw materials, control etc.

The foregoing discussion suggests that the four characteristics of a dynamic or sophisticated MAS are complementary and interdependent and should be present to cope with high PEU. Consider a situation (high PEU) where information is timely but not broad in scope, not integrated and not aggregated. This sort of information which is not broad in scope (i.e., is internal, historical and quantitative) is less useful because it cannot facilitate economic and non-economic decisions and provides no estimates of future events. Similarly, if the information is not aggregated and integrated it is unlikely to provide the manager/owner with an understanding of how a decision can impact components of a business and the business as a whole [1]. Thus it seems reasonable to consider and take into account all these four characteristics in identifying the level of MAS sophistication.

In a low level of PEU (which is characterized by routine jobs, fairly predictable future events, low level of job complexity, etc) it is easy to apply predetermined rules, procedures and standards to particular jobs [25]. Under these conditions there is little or no need for sophisticated MAS information since decision making is routine and future events are fairly predictable. Giving managers/owners of SBs sophisticated MAS information under these circumstances may create information overload and be dysfunctional. This in turn could adversely affect performance.

The discussion suggests that under high PEU conditions sophisticated MAS information is desirable to facilitate decision making and improve performance. On the other hand when PEU is low, such sophisticated levels of MAS are unlikely to improve performance. This reasoning suggests the following interaction hypothesis:

H1: The effects of MAS information (X_1) on SBs performance (Y) will be different depending on the level of perceived environmental uncertainty (X_2).

To test this hypothesis the following regression was used:

$$Y = \alpha + b_1X_1 + b_2X_2 + b_3X_1X_2 + \xi \qquad (1)$$

where Y = performance measure
X_1 = MAS information
X_2 = PEU
X_1X_2 = Interactions.

Following the technique adopted by Schoonhoven [20], the above hypothesis and regression equation can be restated mathematically as follows:

$$\frac{\delta Y}{\delta X_1}$$

will be positive when X_2 is high than when it is low. That is,

$$\frac{\delta Y}{\delta X_1} = b_1 + b_3X_2.$$

Computer usage in organizations and its effects on various aspects of organizational structure and performance has also attracted much research attention [2, 23]. The implications of computer technology on structural patterns of decision making, for example, has been extensively studied [17, 18, 19, 27]. Of interest in this study is the moderating effect of computer usage on the MAS/performance relationship.

The level of sophistication of a MAS may be influenced by the level of computerization adopted by the SB. Timely information can be more easily facilitated by the existence of computers. Similarly integrated and aggregated MAS information will also be produced more easily if it is computer generated. How quickly or how easily integrated and aggregated MAS information can be generated will be dependent obviously on the level

of computerization. Zeffane [29] makes the point that computers with their substantial capacity for assimilating, processing and storing information, facilitate an increased consolidation of the decision areas and the increased quantification of decision processes. In other words, he argues that computers integrate areas of decision making and control that were formerly independent of each other. It is likely that more elementary usage of computers will be less effective in generating sophisticated MAS than more advanced computerization of the SBs activities.

In other words, the use of computers without sophisticated MAS information will not improve performance as much as highly computerized sophisticated MAS information. This reasoning sugests H2:

H2: The effects of MAS information (X_1) on SBs performance (Y) will be different depending on the level of computer usage (X_2).[1]

To test this hypothesis the following regression was used:

$$Y = \alpha + b_1X_1 + b_2X_2 + b_3X_1X_2 + \xi \qquad (2)$$

where Y = performance measure
X_1 = MAS information
X_2 = Computer Usage
X_1X_2 = Interaction.

Mathematically this hypothesis and regression equation may be restated as follows:

$$\frac{\delta Y}{\delta X_1}$$

will be positive when X_2 is high than when it is low. That is,

$$\frac{\delta Y}{\delta X_1} = b_1 + b_3X_2.$$

METHOD

Subjects were a sample (N=48) of managers/owners of SBs drawn from the Engineering industry in Queensland. The names of the managers/owners and their company were obtained from the 1990 Metal and Engineering Industry Yearbook which identifies members of the Metal and Engineering Industry Association by products and services. A covering letter was sent to

the manager/owner of 200 SBs, which were defined as those with between 10 to 100 employees requesting for participation in the study. Each subject was provided with a stamped self-addressed envelope to return the completed questionnaire directly to the researchers. A total of 48 usable responses were obtained. Twenty six of the respondents were Chief Executive Officers, 20 were managers and two were the company secretaries. The average time spent in the current organization for the managers/owners was 10.3 years.

Measurement of Variables

The variables incorporated into the questionnaire were perceived environmental uncertainty (PEU), management accounting systems (MAS) information, computer usage (CU) and SB performance. The instruments are attached in the Appendix.

Perceived Environmental Uncertainty

Several interpretations and definitions of environmental uncertainty exist. This study adopted the concept of "task environment" used by Thompson [24] and Govindarajan [6] which is composed of customers, suppliers of material, labour and capital, competitors for both markets and resources and regulatory authorities which include government and labour unions. Uncertainty perceived by the managers in his/her work environment is a state arising from his/her ability to predict outcomes relating to the components identified earlier. Uncertainty in this study therefore means the unpredictability in the actions of the customers, suppliers, competitors and regulatory groups.

PEU was measured using an instrument developed by Miles and Snow [15] and adopted by Govindarajan [6]. The instrument required subjects to state on a seven-point scale (varying from "highly predictable" to "highly unpredictable") how predictable or unpredictable each of the seven factors was in the context of their business. The seven factors were manufacturing technology, competitor's actions, market demand, product attributes/design, raw material availability, raw material price, government regulation and labor union actions. The alpha Cronbach obtained for this measure was 0.72.

Management Accounting System (MAS)

MAS was measured using a modified version of a scale developed by Chenhall and Morris [3] which contained 23 items or characteristics of information. The instrument measured managers' perceptions of both the usefulness of the various characteristics of MAS as well as the extent to which

the firm's MAS contains the information characteristics or attributes. Responses for the questions on usefulness were recorded on a 7-point scale from 1 (not at all useful) to 7 (most useful), while responses for the questions on the extent to which these characteristics were available in the firm's MAS were recorded on a similar 7-point scale ranging from 1 (small extent) to 7 (great extent). As pointed out earlier, the characteristics of a sophisticated or dynamic MAS were that they had to be broad in scope, available on time; aggregated and integrated. In other words, a measure of MAS sophistication had to take into account all these characteristics [14].

In addition to taking a composite measure of all the characteristics of MAS, identified in the preceding paragraph, the overall measure of MAS sophistication used in this study was the total score for the combined scales which measured both usefulness and extent of availability of the various characteristics or attributes of MAS. This is a departure from two prior related studies which used only one of the dimensions (i.e., usefulness or extent of availability) for measuring MAS. Chenhall and Morris [3] measured the perceived usefulness of MAS characteristics whereas Mia [14] measured the perceived availability of MAS characteristics. In this study the combined overall measure of both usefulness and availability was considered more relevant as an antecedent variable than the individual measures since MAS information characteristics which are perceived to be useful but not available, is unlikely to have an impact on organisational effectiveness. Alternatively, information characteristics which are available in the firm's MAS, but not perceived to be useful would similarly also be questionable in terms of its contribution to performance. Thus, it was preferred to adopt an overall measure of MAS sophistication by combining the two scales. The Cronbach statistic of internal reliability for this overall measure was 0.91.

Computer Usage (CU)

Computer usage was measured using an instrument adopted by Zeffane [29]. In this instrument computer usage was evaluated in terms of the extent of computer usage [on a 7-point scale, little or no extent (1) to great extent (7)] for fourteen functional areas. These functional areas included planning, training, finance and accounting, sales and services and inventory control. The Cronbach alpha statistic of internal reliability for the measure was 0.91.

Small Business Performance

Previous studies have used self-rating measures of performance such as the nine-item scale developed by Mahoney et al. [13]. These self rating measures of performance have been criticized on the grounds that they are

subject to a "leniency" bias and not as good as other measures that are objective. Ideally the return on investment (ROI) or some other measure of profitability should have been used to measure SB performance, but this proved difficult since managers were reluctant to divulge such information. To overcome this problem, we used managers' subjective estimates of the growth in market value of the firm (GMV) and the growth in fixed assets (GFA) as measures of performance or organizational effectiveness[4]. Owners/Managers were requested to estimate the market value of their business and fixed assets when they started, the current value of both these items and the number of years they have been in operation. Using this information the GMV of the SB was, for example, determined by applying the following formula:

$$\text{initial investment } (1+x)^t = \text{PMV of the firm,}$$

where 'initial investment' = initial capital invested in the business or the purchase price of the business when it started.
x = compound growth rate which is used as one of the measures of performance.
t = number of years since the business started.
PMV = estimated present market value of the firm provided by the respondents.

The other measure of performance was determined in the same way as the above except that instead of initial capital and present market value we used the dollar amount of the fixed assets at the start of the business and the dollar amount of the fixed assets at present. Both these measures in terms of the value of x, obtained by applying the above formula, were used as measures of performance in testing the various hypotheses.

Statistical Analyses and Results

Table 1 presents the descriptive statistics and Table 2 the correlation matrix for the variables utilized in this study.

Table 1
Descriptive Statistics for the Variables

Variables	*Mean*	*Std.Dev.*	*Range*
GMV	0.32	0.37	−0.07 − 2.10
GFA	0.29	0.32	−0.11 − 1.80
PEU	4.27	0.98	1.83 − 6.00
CU	3.53	1.57	1.00 − 7.00
MAS	4.49	0.86	2.30 − 6.68

Table 2
Correlation Matrix for the Variables

	GMV	*GFA*	*PEU*	*CU*	*MAS*
GMV	1.00				
GFA	0.48*	1.00			
PEU	−0.20	−0.22	1.00		
CU	−0.13	−0.24	0.12	1.00	
MAS	−0.23	−0.27	0.08	0.21	1.00

* $p < 0.01$

Two separate regressions were used to test each of the hypotheses H1 and H2:

$$Y = \alpha + b_1X_1 + b_2X_2 + b_3X_1X_2 + \xi$$

where Y = performance measure
X_1 = MAS information
X_2 = PEU for H1 and Computer Usage for H2
X_1X_2 = Interactions.

To accept H1 and H2 the coefficient b_3 should be significant ($b_3 \neq 0$) and positive to support the direction of the hypotheses.

Southwood [22] pointed out that if X_1 and X_2 are interval-scale (but not ratio scale) variables then their points of origin are totally arbitrary. If the origin points X_1 and X_2 are replaced by $X_1 + K_1$ and $X_2 + K_2$, repectively then the unstandardized coefficient b_1 and b_2, their standard errors, their level of significance, their standardized counterparts β_1 and β_2 and the constant α will change. However, the unstandardized coefficient b_3, its standard error, its level of significance, the R^2 and F ratio for the whole equation will remain unchanged. In other words as pointed out by Govindarajan [6] the use of equations (1) or (2) is to obtain information regarding the nature and impact of interaction between X_1 and X_2 on Y and not about the nature of the main effects.

Examining only the interaction terms, however, gives insufficient information for properly testing the contingency hypotheses. In order to determine whether a symmetrical or nonmonotonic effect was present the interaction term needs to be mathematically elaborated and the results then graphically displayed. This is done by graphing a partial derivative from the larger regression equation [20].

The results for testing H1 which are reported in Tables 3 and 4 show that the interaction between MAS and perceived environmental uncertainty

Table 3
MAS, PEU and GMV

Variables	*Coefficient*	*T* value*	*Significance*
MAS	−0.58	−2.28	$p < 0.02$
PEU	−0.64	−2.01	$p < 0.05$
MAS*PEU	0.11	2.32	$p < 0.03$
Constant	3.72	2.71	$p < 0.01$

Note: $R^2 = 26.2\%$; $F = 3.55$; $p < 0.02$; * Two-tailed test

Table 4
MAS, PEU and GFA

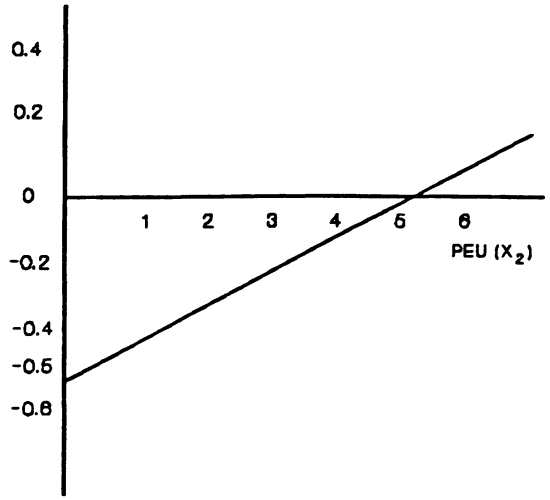
Variables	*Coefficient*	*T* value*	*Significance*
MAS	−0.50	−2.72	$p < 0.01$
PEU	−0.54	−2.32	$p < 0.02$
MAS*PEU	0.09	2.17	$p < 0.05$
Constant	3.23	2.77	$p < 0.00$

Note: $R^2 = 26.6\%$; $F = 3.98$; $p < 0.01$; * Two-tailed test

is significant and in the predicted direction ($p < 0.03$, $p < 0.01$). The prediction model in the equation for H1 explained 26.2% (with GMV as the dependent variable) and 26.6% (with GFA as the dependent variable) of the variance ($R^2 = 0.262$ and 0.266, $F = 3.55$ and 3.48, $p < 0.02$ and 0.01) in performance, respectively. Therefore, the results indicate that MAS and PEU interacted at a significant level to positively impact organizational performance.

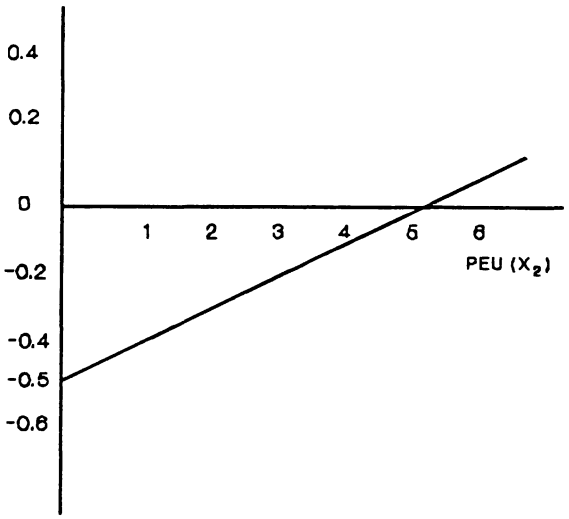
In addition, as suggested earlier, we pushed the analysis of the interaction into a second stage by graphing the partial derivative of the regression equation. In this way we can have a clearer understanding of the interaction effects and whether X_1 had a nonmonotonic effect on Y. Mathematically this hypothesis may be restated as follows: $\delta Y/\delta X_1$ will be positive when X_2 is high than when it is low. That is, $\delta Y/\delta X_1 = b_1 + b_3X_2$

If the value $\delta y/\delta x_1$ is both positive and negative over the entire range of X_2 then the relationship between Y and X_1 would be regarded as nonmonotonic [20]. This specific ("multiplier interaction") model of contingency relationship has also been used by Gupta and Govindarajan [9]. Figures 2 and 3 present the graphical representation of the results. The vertical axis represents the effects of MAS (X_1) on performance (Y) and the horizontal axis indicates the degree of PEU(X_2). The plotted line represents the change in performance given a change in MAS over the range of PEU. Both the figures which represent a nonmonotonic pattern suggest that it is



$$\frac{\partial Y}{\partial X_1} \quad \text{where} \quad \frac{\partial Y}{\partial X_1} = \text{GMV} \quad \text{MAS}$$

Figure 2. Significant Interaction between MAS and PEU on GMV



$$\frac{\partial Y}{\partial X_1} \quad \text{where} \quad \frac{\partial Y}{\partial X_1} = \text{GFA} \quad \text{MAS}$$

Figure 3. Significant Interaction between MAS and PEU on GFA

Table 5
MAS, Computer Usage (CU) and GMV

Variables	*Coefficient*	*T* value*	*Significance*
MAS	−0.21	−2.72	$p < 0.01$
CU	−0.20	−2.04	$p < 0.05$
MAS*CU	0.04	1.99	$p < 0.05$
Constant	1.35	3.56	$p < 0.00$

Note: $R^2 = 22.0\%$; $F = 2.88$; $p < 0.05$; * Two-tailed test

Table 6
MAS, Computer Usage (CU) and GMV

Variables	*Coefficient*	*T* value*	*Significance*
MAS	−0.17	−2.71	$p < 0.01$
CU	−0.16	−2.02	$p < 0.05$
MAS*CU	0.03	1.96	$p < 0.05$
Constant	1.19	3.73	$p < 0.00$

Note: $R^2 = 26.5\%$; $F = 3.61$; $p < 0.02$; * Two-tailed test

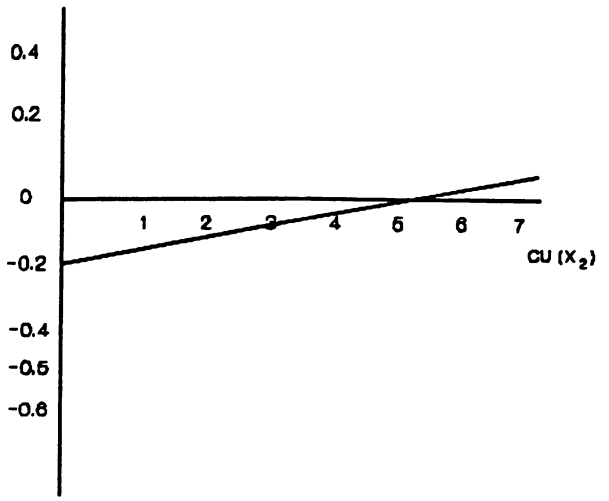
only at higher levels of PEU that there is a positive relationship between MAS and performance.

Similarly, the results for testing H2 which are presented in Tables 5 and 6 suggest that the interaction between computer usage and MAS are significant and in the predicted direction ($p < 0.05$, $p < 0.04$). The prediction model in the equation for H2 explained 22.0% (for GMV as the dependent variable) and 26.5% (for GFA as the dependent variable) of the variance ($R^2 = 0.22$ and 0.265, $F = 2.88$ and 3.61, $p < 0.05$ and 0.02) in organizational performance, respectively. Therefore, the results indicate that MAS and computer usage interacted at a significant level to affect organizational performance.

Figures 4 and 5 present the graphical representation of the results. Both the figures suggest that there is a positive relationship between MAS and performance at higher levels of computer usage.

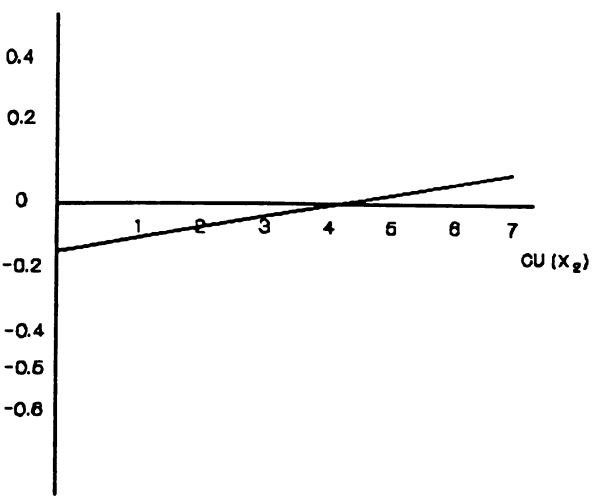
Discussion

The results obtained in this study support the first hypothesis that the effects of MAS on performance as measured in terms of GMV and GFA is moderated by the level of PEU. At low levels of PEU there is in fact a negative relationship between MAS and performance. This result is expected since as pointed out earlier, providing managers sophisticated MAS at low levels



$$\frac{\partial Y}{\partial X_1} \quad \text{where} \quad \frac{\partial Y}{\partial X1} = \text{GMV} = \text{MAS}$$

Figure 4. Significant Interaction between MAS and CU on GMV



$$\frac{\partial Y}{\partial X_1} \quad \text{where} \quad \frac{\partial Y}{\partial X_1} = \text{GFA} = \text{MAS}$$

Figure 5. Significant Interaction between MAS and CU on GFA

of PEU may create information overload and be dysfunctional. The tasks facing the managers under low levels of PEU are routine, reasonably predictable and planning is a relatively straightforward affair. In which case, therefore, the type of information that would be appropriate would be less sophisticated MAS. However, when PEU is high in terms of the fact that the tasks are characterized by uncertainty, there are a diversity of decisions, and there are considerable difficulties in predicting events then it is more appropriate that SB managers/owners use sophisticated MAS. Thus, the results which show that MAS has a positive impact on performance under conditions of high environmental uncertainty is consistent with this reasoning.

Similarly, the results also support the hypothesis that the effects of MAS on performance is moderated by the level of computer usage. As shown in Figures 4 and 5 , MAS has a positive relationship with performance only in conditions when there is a high level of computer usage. This is clearly understandable since sophisticated MAS is not only available, but more easily interpreted and analyzed with the use of computers. Consider, on the other hand, the existence and use of sophisticated MAS without computers! For MAS to have a successful impact on organizational performance it is perhaps useful that SB owner/managers acquire and use computers.

In general terms these results also have significance in terms of contingency theory applications. First, this study has shown that problems of small business performance can be studied in the context of contingency theory and that other contingency variables should be examined in future studies. These other variables can be identified in terms of cultural, organizational, interpersonal, and individual variables [6]. Evidence from psychology and management research suggest, for example, that personality variables should be examined to evaluate their effects on performace [7, 8]. Second, the application of multiple regression and partial derivatives of the regression equation promises to be a useful way of analyzing contingency relationships, particularly, in the context of interaction relationships.

Limitations of this study include the relatively small size of the sample which is drawn from one industry in one georaphical area. This study used (managers' estimates of) GMV and GFA as measures of organizational performance which are not the same as ROI. Future studies should consider other measures of performance which are more closely related to profitability such as the ROI. In addition, from an analyses point of view, the existence of the significant main effects, which were ignored in this study, suggest that the functions found could be really nonlinear functions rather than linear. As pointed out by Schoonhoven [20], if this were true, then the significant interaction effects obtained are really only artifacts of the main variables' nonlinear properties. This could happen because the nonlinear effects are

being "forced" into the interaction terms of each equation, since they essentially have no other means of expressions. There is no evidence of this one way or another.

In summary, this study using a sample of SB managers/owners as subjects found that PEU and computer usage are significant variables which moderate the relationship between MAS and organizational performance. More specifically, MAS had a positive impact on performance only under conditions of high PEU and high levels of computer usage. The findings therefore suggest that sophisticated MAS information should perhaps only be used when there is high PEU and there is considerable computerization facilities and usage. In the absence of these "preconditions" managers/owners of SBs should perhaps continue to use traditional MAS information.

APPENDIX

Computer Usage

This part is to assess the level of computer usage in your firm to facilitate management decision making. Please indicate th extent of computer usage for each of the activities listed below, by circling the most appropriate number.

	Small extent					Great extent		Not applicable
(a) Planning	1	2	3	4	5	6	7	9
(b) Training	1	2	3	4	5	6	7	9
(c) Stock Control	1	2	3	4	5	6	7	9
(d) Maintenance and Repair	1	2	3	4	5	6	7	9
(e) Production/Production Scheduling and Control	1	2	3	4	5	6	7	9
(f) Sales and Services	1	2	3	4	5	6	7	9
(g) Market Research	1	2	3	4	5	6	7	9
(h) Operational Research	1	2	3	4	5	6	7	9
(i) Finance and Accounting	1	2	3	4	5	6	7	9
(j) Buying	1	2	3	4	5	6	7	9
(k) Organization and Methods	1	2	3	4	5	6	7	9
(l) Public Relations	1	2	3	4	5	6	7	9
(m) Research and Development	1	2	3	4	5	6	7	9
(n) Transport	1	2	3	4	5	6	7	9

Management Accounting System

Listed below are TWENTY-THREE information attributes. Two questions are addressed in relation to EACH of them.

i. How USEFUL is the information attribute to performing the overall duties of your present.
ii. To what EXTENT do you believe you organization's management accounting system contains this information attribute?

(Please CIRCLE the relevant NUMBER on EACH of the 7-point scales below) or circle 9 if *not-applicable.*

a: Reports are provided frequently on a systematic, regular basis	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	
b: Information which relates to possible future events (if historical information is more useful for your needs, mark the lower end of the scale.)	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
c: Information provided on the different sections or functional areas in your organization, such as marketing and production, or sales, cost, or profit centres.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
d: *Nonfinancial* information that relates to market inforamtion such as market size, growth share etc. (if you find that a *financial* interpretation of marketing information is most useful for your needs, please mark the lower end of the scale).	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
e: Requested information to arrive immediately on request	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
f: Information that relates to the impact that your decision have on the performance of the organization	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
g: Noneconomic information, such as customer preferences, employee attitudes, labor relations attitudes of Government and consumer bodies, competitive threat.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
h: Information on the effect of events on particular time periods (e.g. monthly/ quarterly/annual summaries, trends, comparisons etc.)	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA

i: Information in forms which allow you to conduct what if analyses	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
j: Information in formats suitable for input into decision models such as	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
i. discounted cash flow analysis (e.g., future cash inflows and outflows discounted to present values for decision making)	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
ii. incremental or marginal analysis (e.g., analysis of changes in variable costs)	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
iii. inventory analysis (e.g., use of models to purchase and maintain inventory	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
iv. credit policy analysis (e.g., an analysis and evaluation of the extent of credit and its impact of profitability)	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
k: *Nonfinancial* information that relates to production information such as outputs rates, scrap levels, machine efficiency, employee absenteeism, etc. (if you find that a *financial* interpretation of production information is more useful for your needs please mark the lower end of the scale)	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
l: Information which has been processed to show the influence of events on different functions, such as marketing or production associated with particular activities or tasks.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
m: Costs separated into fixed and variable components.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
n: Information on the impact that your decision will have throughout your organization and the influence of other individuals' decisions on your area of responsibility	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
o: Qualification of the likelihood of future events occurring (e.g., probability estimates)	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA

p: Precise targets for the activities of all division/ departments within your organization.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
q: There is no delay between an event occurring and relevant information being reported to you.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
r: Information on broad factors external to your organization, such as economic conditions, population growth, technological developments, etc.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
s: Information on the effect of different sections' activities on summary reports such as profit, cost, revenue reports for the Organization	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA
t: Information supplied to you automatically upon its receipt into information systems or as soon as processing is completed.	Not at all useful	1	2	3	4	5	6	7	Most Useful	NA
	Small Extent	1	2	3	4	5	6	7	Great Extent	NA

Environmental Uncertainty

Below is a list of environmental factors. How *predictable/unpredictable* are each of the following factors with respect to your company? (Please circle appropriate response)

	Highly Unpredictable							Highly Predictable
a. Manufacturing technology	1	2	3	4	5	6	7	9
b. Competitor's actions	1	2	3	4	5	6	7	9
c. Market demand	1	2	3	4	5	6	7	9
d. Product attributes/design	1	2	3	4	5	6	7	9
e. Raw materials availability	1	2	3	4	5	6	7	9
f. Raw materials price	1	2	3	4	5	6	7	9
g. Government regulation	1	2	3	4	5	6	7	9
h. Labour union actions	1	2	3	4	5	6	7	9

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NOTES

1. The coefficient b_3 should be positive for both H1 and H2 which implies that the positive impact of X_1 on Y is stronger for higher as compared to lower levels of PEU (H1) and computer usage (H2).
2. Factor analyses proved that the items were all acceptable and that the measure is unidimensional.
3. Intuitively one could argue that a less sophisticated MAS would have less computer usage and vice versa. This suggest the existence of multicollinearity, but as shown in Table 2 this was not a problem.

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