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The Effects of Computer Usage, Environmental Uncertainty and Management Accounting Systems on Small Business Performance

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ABSTRAK

Penyelidikan ini mengkaji kesan "Perceived Environmental Uncertainty (PEU) " dan penggunaan komputer ke atas prestasi sistem pengurusan perakaunan (MAS). Prestasi diukur menggunakan pertumbuhan nilai pasaran terkumpul dan kadar (GMK) pertumbuhan harta tetap (GFA). Perniagaan kecil dan sederhana ditakrifkan sebagai syarikat yang mempunyai 10 hingga 100 orang pekerja. Keputusan analisis menunjukkan bahawa PEU menyederhanakan prestasi MAS , dimana kesan positif didapati apabila tahap PEU tinggi. Analisis juga menunjukkan bahawa tahap penggunaan komputer juga memberi kesan ke atas MAS. Prestasi MAS meningkat apabila tahap penggunaan komputer meningkat. Pada tahap yang rendah PEU dan penggunaan komputer memberi kesan yang negatif ke atas MAS.

ABSTRACT

Using a sample of SME managers/owners as subjects, this study examined the moderating effects of perceived environmental uncertainty (PEU) and computer usage on the management accounting system (MAS) or 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). SME was defined as companies with between 10 to 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 had a negative relationship with performance.

INTRODUCTION

While there has been much research interest in the relationship on contextual variables with the design of management accounting systems (MAS) for large business organizations, the study of MAS and its relationship to performance for small and medium scale enterprises (SMEs) has been relatively neglected. This is unfortunate since SMEs which form in important component of a nation's business sector also requires suitable management accounting information to facilitate management decision making. The notions underlying contingensy theory which suggests the particular features of a MAS are contigent upon a number of specific contextual variables which affect organizations may also have applications in the context of MAS for SMEs. It is, for example, not clear whether contigency variables such as environmental uncertainty will affect the management accounting system or performance relationship. Is there a direct relationship between MAS and performance? This study attempts to address some of these issues.

More specifically this study examines the moderating effects of two contextual variable, environmental uncertainty and computer us-

age on the MAS or performance relationship. These contextual variables are considered important in determining the extent to which MAS can affect SMEs business performance. 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 SME 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 (Lawrence & Lorsch, 1967 : Chenhall & Morris , 1986). 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 (Galbraith, 1977). In other words, when PEU is high, it is likely that sophisticated MAS should be provided to the manager or owner of the SME to facilitate decision making which in turn should improve performance.

MAS is viewed as sophisticated and dynamic when it posseses four basic characteristics of broadness in scope (i.e futuristic information, external and qualitative information), availability on time, aggregation and intergration and at the same time also incorporates the characteristics of a traditional type of MAS information (Gordon & Narayanan, 1984; Chenhall & Morris, 1986). 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 (Gordon & Narayanan, 1984 ; Mia, 1989). 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 basic. More over the information should be intergrated and aggregated so that the manager can have a clear idea of the financial situation of the SME. Simon et. al. (1954) make 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 (1984) 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 or owner with an overall view (aggregated) of the business and the interrelationships between the component activities of the business (intergrated) 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 intergrated and not aggregated. This sort of information which is not broad in scope (i.e. is internal, historical and quantitative) is useless because it cannot facilitate economic and non-economic decisions and provides no estimates of future events. Similarly, if the information is not aggregated and intergrated it is unlikely to provide the manager or owner with an understanding of how a decision can impact components of a business and the business as a whole (Amigoni, 1978). 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 (Tushman & Nadlere, 1978). Under these conditions there is little or no need for sophisticated MAS information since decision making is routine and f uture events are fairly predictable. Giving

managers or owners of SMEs sophisticated MAS information under these circumstances may create information overload and be dysfunctional. This in turn could adversely affect performance.

The foregoing 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 hypothesis:

H_1 : The effects of sophisticated MAS information (χ_1) on SMEs performance (Y) will be different depending on the level of perceived environmental uncertainty (χ_2).

Following the technique adopted by Schoonhoven (1981), the above hypothesis can be festated mathematically as follows :

$\frac{\delta Y}{\delta \chi_1}$ will be greater when χ_2 is high than when it is low. That is,

$$\frac{\delta Y}{\delta \chi_1} = b_1 + b_2\chi_2$$

Computer usage in organizations and its effects on various aspects of organizational structure and performance has also attracted much research attention (Carter, 1984; Storey, 1987). The implications of computer technology on structural patterns of decision making, for example, has been extensively studied (Robey, 1976, 1977, 1981; Whistler, 1970). Of interest in this study is the moderating effect of computer usage on the MAS or performance relationship.

The level of sophistication of a MAS may be influenced by the level of computerization adopted by the SME. Timely information can be more easily facilitated by the existence of computers. Similarly intergrated and aggregated MAS information will also be produced more easily if it is computer generated. How quickly or how easily intergrated and aggregated MAS information can be generated will be dependent obviously on the level of computerization. It is like that more elementary usage of computers will be less effective in generating sophisticated MAS than more advanced computerization of the SMEs 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 suggests H :

H_2 : The effects of sophisticated MAS information (χ_1) on SMEs performance (Y) will be different depending on the level of computer usage (χ_2).

Mathematically this hypothesis may be restated as follows :

$\frac{\delta Y}{\delta \chi_1}$ will be greater when χ_2 is high than when it is low. This is, $\frac{\delta Y}{\delta \chi_1} = b_1 + b_2\chi_2$

METHODS

Subjects were a sample (N=) of managers or owners of SMEs drawn from Queensland. The names of the managers or owners and their company were obtained from the Australian Small Business Directory. Small businesses were defined as those with between 10 to 100 employees. A covering letter was sent to the manager or owner of SME 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.

Variable Measurement

The variables incorporated into the questionnaire were perceived environmental uncertainty (PEU), management accounting systems (MAS) information computer usage and SME performance.

Perceived Environmental Uncertainty (PEU)

An individuals PEU is made up of two dimensions; the individuals' work environment and the individuals' perception of uncertainty that they face in that work environment. Work environment is a set of stimuli to which individuals are exposed in their work situations and to which they attempt to respond (see Ferris, 1977). Uncertainty perceived by a manager, for example, in his work environment is a state

arising from his perdiction of outcomnes from the actions he takes to achieve them; the more he is able to predict the outcomes from his actions, the less the uncertainty (Mia, 1988). A manager's perceived environmental uncertainty in this study, derives from the completeness of information concerning available courses of actions and outcomes of those actions, and the completeness of information concerning the likelihood that certain courses of actions will lead to certain outcomes.

Then 12- item instrument developed by Duncan (1972) and revised by Sathe (1974) was used to measure PEU (see Ferris, 1977, Chenhall & Morris, 1986). The instrument measures PEU on 12- items using 5-point scale ranging from 1 (never) to 5 (always). Examples of the items are: "In doing your job, how frequently are you certain about which method is best?", "How frequently is it difficult to determine whether decisions you have made were correct?" , and "In doing your job, how frequently are you certain about job adjustment to deal with environmental change?". A Manager's score for his PEU was the average of his scores under each of the 12-items. The cronbach alpha static of interal reliability for the measure was 0.74 which compares favourably with previous studies (see Cronbach, 1951; Ferris, 1978; Chenhall & Morris, 1986).

Management Accounting System (MAS)

The extent to which a manager perceives he or she obtains or receives sophisticated MAS information was assessed using the instrument developed by Chenhall and Morris (1986). The instrument measures the extent to which a manager perceives he obtains or receives information having the characteristics of dynamis MAS information (namely, broadness in scope, availability on time, aggregation, and intergration). Items in the instrument measuring the availability of: broad in scope information are 1 to 6, timely information are 7 to 10; aggregated information are 11 to 17, and intergrated information are 18 to 20. Responsed are recorded using a 7-point Likert-type scale ranging from 1 (very little) to 7 (very great). Examples of items included in the measure are: "To what extent have you obtained information which relates to possible future events?", "To what extent have you received requested information immediately on request?" and "To what extent have you perceived information on precise targets for activities of all sections within your department?". A manager's score for the extent to which he perceived he obtained or received necessary information was the average of his score under each of the items. The Cronbach alpha statistic of internal reliability was 0.76 which is highly satisfactory (Nunnally, 1978).

Computer Usage

Computer usage was measured using an instrument adopted by Zeffane (1989). In this instrument which is attached in the Appendix, 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 and accounting, sales and services and inventory control. The Cronbach aplha statistic of internal reliability for the measure was 0.79.

SME Performance

Previous studies have used self rating measures of performance such as the nine-item scale developed by Mahoney et. al. (1963). These self rating measures of performance have been criticised on the grounds that they are subject to a "leniency" bias and not as good as other measures that are objective. Bearing these criticisms in mind this study adopted two measures of performance which are more objective than self rating measures. Ideally the return on invest ment (ROI) or some other measure of profitability should have been used to measure SME performance but this proved difficult since managers have been known to be reluctant to divulge such information. To get around this problem we used the growth in market value of the firm (GMV) and the growth in fixed assets (GFA) as measure of performance. The GMV of the SME was, for example, determined using the following formula:

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

where initial investment is the initial capital invested in the business of the purchase price of the business when it started.

x is the compound growth rate which is used as one of the performance.

t is the number of years since the business

started.
PMV is the 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 dollar amount of the fixed assets at the start business and the dollar amount of the fixed assets at present. Both these measures in terms of the value of x, obtained by applying of the above formula, were used as measures of performance in testing the various hyphotheses.

Statistical Analyses and Results

TABLE 1 presents the descriptive statistics and TABLE 2 the correlation matrix for the variables utilised in this study.

As there is no significant multicollinearity amongst the independent variables, two separates regressions were used to test each of the hypotheses H_1 and H_2 :

$$Y = \alpha + b_1\chi_1 + b_2\chi_2 + b_3\chi_1\chi_2 + \xi$$

where, Y = performance measure
χ_1 = MAS information
χ_2 = PEU for H_1 and Computer Usage for H_2
$\chi_1\chi_2$ = Interactions

To accept H_1 and H_2 the coefficient b_3 should be significant ($b_3 = 0$) and positive to support the direction of the hypothesis.

The results for testing H_1 which are reported in TABLE 3 and 4 show that the interaction between MAS and perceived environmental uncertainty is significant and in the predicted direction ($p< 0.05$, $p < 0.001$). The prediction model in the equation explained 39.3% (with GMV as the dependent variables) and 63% (with GFA as the dependent variable) of the variance ($R^2 = 0.393$ and 0.63, $F = 3.02$ and 7.97, $p< 0.06$ and 0.0024) in performance, respectively. Therefore, the results indicate that MAS and PEU interacted at a significant level to positively impact managerial performance.

In addition 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 (Schoonhoven, 1981). This specific ("multiplier interaction") model of contigency relationship has also been used by Gupta and Govindarajan (1984).

TABLE 1. Descriptive statistics for the variable

Variables	Mean	Std Dev	Range
GMV	0.24	0.16	0.03 - 0.58
GFA	0.21	0.14	0.03 - 0.58
PEU	4.45	1.12	2.00 - 6.00
CU	3.28	1.50	1.00 - 6.20
MAS	4.09	1.10	1.82 - 6.47

TABLE 2. Correlation matrix for the variables

	GMV	GFA	PEU	CU	MAS
GMV	1.00				
GFA	0.46*	1.00			
PEU	-0.22	-0.24	1.00		
CU	0.09	0.04	0.12	1.00	
MAS	-0.04	-0.13	0.12	0.23	1.00

*$p < 0.01$

TABLE 3. Test of Hypothesis H_1
The interaction between MAS and PEU on GMV

Variable	Coefficient	T * Value	Level of Significance (P)
MAS	-0.43	-2.24	< 0.05
PEU	-0.50	-2.48	< 0.03
MAS * PEU	0.08	2.17	< 0.05
Constant	2.58	2.75	< 0.01
R^2 = 39.3 %	F = 3.02 , P < 0.06		

* Two- tailed Test

TABLE 4. Test of Hypothesis H_2
The interaction between MAS and PEU on GFA

Variable	Coefficient	T* Value	Level of Significance (P)
MAS	-0.52	-4.15	< 0.001
PEU	-0.52	-4.30	< 0.001
MAS * PEU	0.10	3.93	< 0.001
Constant	2.94	4.82	< 0.001
R^2 = 63.0 % , F = 7.97 , P < 0.0024			

* Two-tailed Test

TABLE 5. Test of Hypothesis H_2
The interaction between MAS and Computer Usage on GMV

Variable	Coefficient	T * Value	Level of Significance (P)
MAS	-0.28	-2.97	< 0.02
CU	-0.29	-2.27	< 0.05
MAS * CU	0.07	2.12	< 0.07
Constant	1.46	3.75	< 0.007
R^2 = 62.0 %	F = 3.84 , p < 0.05		

* Two- tailed Test

TABLE 6. Test of Hypothesis H_2
The interaction between MAS and Computer Usage on GFA

Variable	Coefficient	T* Value	Level of Significance (P)
MAS	-0.32	-4.22	< 0.001
CU	-0.35	-3.45	< 0.01
MAS * CU	0.08	3.35	< 0.01
Constant	1.59	5.10	< 0.001
R^2 = 74.0 % , F = 6.56 , P < 0.01			

* Two-tailed Test

FIGURE 1
Significant interaction between MAS and PEU on GMV.

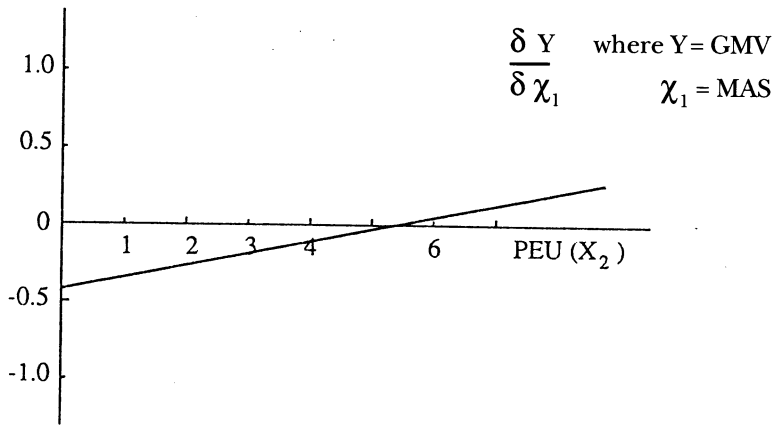


FIGURE 2
Significant interaction between MAS and PEU on GFA.

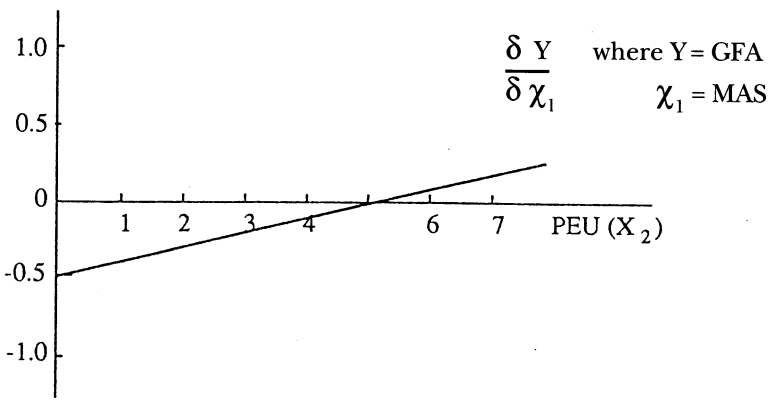


FIGURE 3
Significant interaction between MAS and CU on GMV.

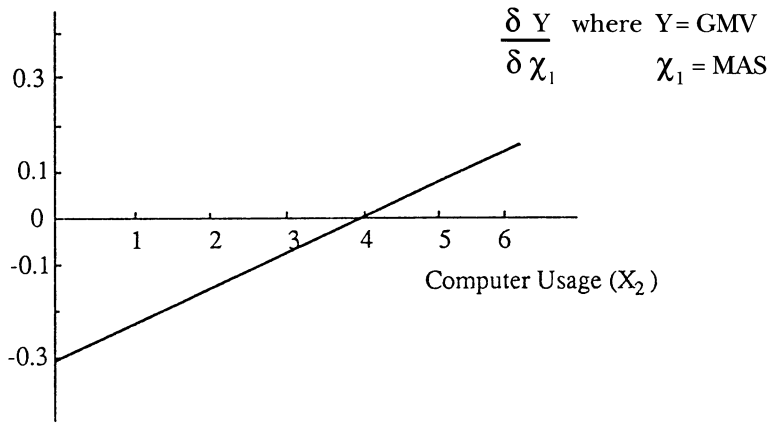
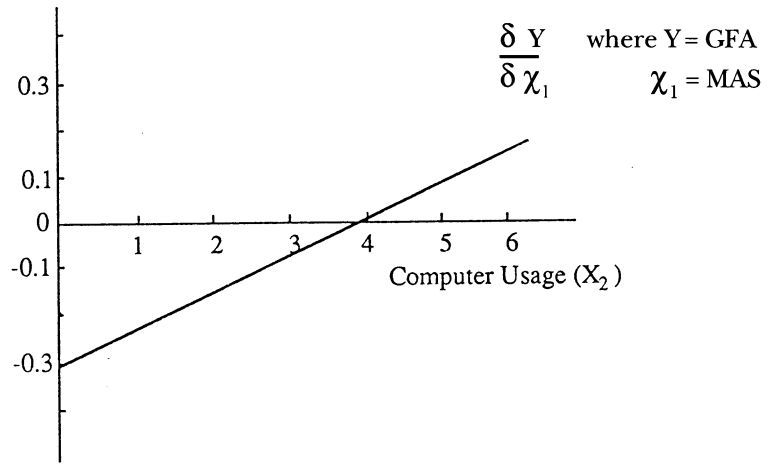


FIGURE 4
Significant interaction between MAS and CU in GFA.



FIGURES 1 and 2 present the graphical representation of the results. The vertical axis represents the effects of MAS on performance and the horizontal axis indicates the degree of PEU. 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 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 TABLE 5 and 6 suggest that the interaction between computer usage and MAS are significant and in the predicted direction ($p<0.07$, $p<0.01$). The prediction model in the equation explained 62% (for GMV as the dependent variable) and 74% (for GFA as the dependent variable) of the variance ($R2 = 0.62$ and 0.74, $F = 3.84$ and 6.56, $p<0.05$ and 0.01) in performance, respectively. Therefore, the results indicate that MAS and computer usage interacted at a significant level to affect managerial performance.

FIGURES 3 and 4 present the graphical representation of the results. Both the figures suggest that the higher the levels of computer usage the more positive relationship between MAS and performance.

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 in infact a negative relationship between MAS and performance. This result is expected since as pointed out earlier, giving managers sophisticated MAS at low levels 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 straight forward 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 characterised by uncertainty, there are a diversity of decisions, and there are considertble difficulties in predicting events then it is more appropriate that SME managers or owners are 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 3 and 4, 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 analysed 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 performance it is almost a precondition that SME owner or managers acquire and use computers.

In general terms these results also have significance in terms of contigency theory applications. First, this study has shown that problems of small business performance can be studied in the context of contigency theory and that other contigency variables should be examined in future studies. These other variables can be identified in terms of cultural, organizational, interpersonal, and individual variables (Govindarajan, 1986). Evidence from psychology and management research suggest, for example, that personality variables should be examined to evaluate their effects on performance (Gul, 1984;1986). Second, the application of multiple regression and partial derivatives of the regression equation promises to be a useful way of analysing contigency relationships, particularly, in the context of interaction relationships.

Limitations of this study include the small size of the sample. This was an exploratory investigation and we are now in the process of collecting a larger and more representative sample. This study used GMV and GFA as measures of performance. Future studies should considere other measures of performance which are more closely related to profitability. 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 (1981), 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. We, however, have no evidence of this one way or another.

In summary, this study using a sample of SME managers or owners as subjects found that PEU and computer usage are significant variables which moderate the relationship between MAS and performance. More, specifically, we found that 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 only be used when there is high PEU and there is considerable computerization facilities and usage. In the absence of these "perconditions" managers or owners of SMEs should perhaps continue to use traditional MAS information.

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