Full Length Research Paper

Which types of management accounting system information can be used to respond adequately to environmental uncertainty? The effects of user participation and tolerance of ambiguity

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Previous research findings have shown that the relationship between environmental uncertainty and the usefulness of management accounting system (MAS) information is varied. However, there are few studies exploring whether the personalities would influence the aforementioned relationship. This paper argued that the tolerance of ambiguity produces different levels of need for various types of MAS information. Through a survey of 306 middle managers of publicly owned companies in Taiwan, and by using LISREL to perform this analysis, the present study has revealed that environmental uncertainty has a direct effect, specifically, on the usefulness of aggregated information. However, the indirect effects of environmental uncertainty on the usefulness of broad-scope, aggregated, and timely information are brought about through positive association with user participation. Furthermore, the mediating effect of user participation is stronger under the conditions of a low tolerance of ambiguity (TA), than it is in conditions of high TA. This study has found that high environmental uncertainty indirectly leads to particularly high usefulness of MAS information through user participation. Furthermore, compared to managers with a high TA, those with a low TA are more sensitive to user participation, when considering the relationship between environmental uncertainty and the usefulness of MAS information.

Key words: Management accounting system, user participation, tolerance of ambiguity, interaction-term LISREL.

INTRODUCTION

Many previous studies have explored the impact of environmental uncertainty on the design of management accounting systems (MAS). For example, when managers are confronted with a highly unstable environment, they require broad-scope, timely, and aggregated MAS information (Gordon, 1984; Chenhall and Morris, 1986; Mia, 1993; Gul, 1991; Chong and Chong, 1997). However, conclusions regarding the uncertainty or usefulness of MAS information are inconsistent. For instance, the positive relationship between environmental uncertainty and the usefulness of broad-scope information was demonstrated by Gordon (1984), and Mia and Chenhall (1994). However, the same relationship

was not found in Chenhall and Morris' (1986) research. In order to avoid questionable conclusions, some researchers have used managerial variables as mediating variables for the relationship between environmental uncertainty and the usefulness of MAS information, such as decentralization (Gul and Chia, 1994; Bouwens and Van, 2007), firm's size (Jusoh, 2010), SBU strategies (Chong and Chong, 1997), strategic change (Gerdin and Greve, 2004; Naranjo and Hartmann, 2007), and task uncertainty (Gul and Chia, 1994; Fisher, 1996; Choe, 1996, 1998; Gerdin, 2005). In contrast to previous studies, this research simultaneously considers managerial variables (user participation) and personality (tolerance

of ambiguity) in the structural relationship between environmental uncertainty and the usefulness of MAS information.

Prior research has demonstrated that user participation in the development process of the information system is a suitable way of defining the requirements (Hertog and Wielinga, 1992; Saleem, 1996; McKeen et al., 1994; Choe, 1998). However, few studies have demonstrated the mechanism of user participation under the condition of environmental uncertainty. This study proposes that user participation serves as an important median variable to strengthen the usefulness of the MAS information against the threat of environmental uncertainty. While previous research in accounting demonstrates the impact of uncertainty on the usefulness of MAS information, these studies have yet to investigate the issue of the individual differences that can influence the need for information, in order to deal with a particular level of uncertainty. Kenrich and Dantchik (1983) proposed that an individual's unique characteristics and situational factors have a combined effect on their behavior. Fisher (1996) later argued that when an individual is confronted with environmental uncertainty, the individual's personality (locus of control) produces different levels of need for various types of information. Adopting the views of Fisher, this study considers 'tolerance of ambiguity' (TA) as a moderator, as TA reflects an individual's general feelings and attitudes towards an ambiguous situation (Budner, 1962). In particular, TA can have an effect as the information individuals receive from an uncertain situation may influence the usefulness of the MAS information. Therefore, the main objectives of this research are as follows: 1) To explore the mediating role of user partici-pation in the causal relationship between environmental uncertainty and the usefulness of MAS information; and 2) to determine whether the mediating effect of user participation on the relationship between environmental uncertainty and the usefulness of MAS information is adjusted by TA.

LITERATURE REVIEW AND FORMULATION OF THE HYPOTHESIS

Gordon and Miller (1976), and Gordon and Narayanan (1984) demonstrated that when environmental uncertain-ty is high, information pertaining to external conditions, non-financial information, and ex ante information is needed. Chenhall and Morris (1986) referred to the research of Gordon and Miller (1976) and Gordon and Narayanan (1984) to define the contents of MAS information, which were based on the characteristics of information, that is, broad-scope, timely, aggregated, and integrated information. Subsequent scholars, such as Mia and Chenhall (1994), Gul (1991), Mia (1993), Gul and Chia (1994), and Fisher (1996), made use of the four kinds of information characteristics developed by

Chenhall and Morris (1986) as the foundational design of the MAS, in order to explore the relationship between contextual variables and the MAS design.

Smith (1999) demonstrated that the decisions adopted by a manager are contingent upon resource requirements, information systems, as well as the unique personality traits of the decision maker. Some studies in psychology reveal that the influence of personality lies largely in the interactions between factors related to personality (that is, attitude, value concept, and faith) and cognitive style (Dermer, 1973; Lal and Hassel, 1998). Certain related studies on MAS have already broadly discussed the relationship between recognizing environmental uncertainty and the usefulness of MAS information. However, these studies do not simultaneously include the factors of user participation and personality. In particular, it is necessary to examine whether people respond in a similar manner to a high level of uncertainty.

Environmental uncertainty and MAS information

Environmental uncertainty has been viewed as an important factor influencing the design of MAS (Chenhall and Morris, 1986; Gul and Chia, 1994; Chong and Chong, 1997). In general, studies have argued that uncertainty renders performance as an uncontrollable, incomplete, or irrelevant standard of measure (Hartmann, 2000; Marginson and Ogden, 2005, Schulz et al., 2010). As long as environmental uncertainty increases, the cause-effect relationship of the problem becomes increasingly complex (Chenhall and Morris, 1986; Fisher, 1996). At the same time, the disturbance caused by unanticipated and unusual factors will hinder the planning and execution of a decision. In this case, the decision maker has no clear objectives, proper procedures or principles to follow (Gul and Chia, 1994; Gul, 1991). Broad-scope MAS information would assist a manager in dealing with such factors of uncertainty (Chenhall and Morris, 1986, Jusoh, 2010, Scholz et al., 2010). Aggre-gated MAS information leads to cause-effect results, which in turn describes the relationship between the action and the results. Financial and non-financial aggre-gated data, cross-departmental aggregated statistics, as well as statistical analysis information all assist a manager to judge and determine the appropriate solution (Chenhall and Morris, 1986; Fisher, 1996). When operating in a highly dynamic environment, a manager is required to attend to a considerable amount of information in unexpected situations. Timely information can provide dynamic data that will assist managers in performing better in a fast changing environment (Chenhall and Morris, 1986; Fisher, 1996). From the preceding discussion, this study proposes the following hypothesis:

H_1: Environmental uncertainty has a direct and positive

effect on the usefulness of broad-scope, timely, and aggregated information.

The mediating effect of user participation

Management accounting systems have been identified as having decision-facilitating and decision-influencing functions (Gordon and Narayanan, 1984; Garrison and Noreen, 1998). However, regardless of the ability of such a system, if it cannot fulfill a user's needs, it will be unable to manifest true system performance. Literature related to information systems provides brief discussions on the importance of user participation in system development. Some studies have shown that the degree of influence that a user applies affects the overall system design (Barki and Hartwick, 1989; Saleem, 1996). A discussion on the influence of user participation can be divided into two parts. The first is that the information derived from user participation in the system design can reduce discrepancies between system capabilities and user needs (Choe, 1998). The benefits of user participation include the following: providing accurate and complete requirement needs (Robey and Farrow, 1982), possessing actual specialized knowledge that is otherwise unavailable to system design engineers, increasing the capabilities of the system so that it better suits their needs, and providing the opportunity for solving potential conflicts between users and designers (Keen, 1981). The information derived from user participation also increases user acceptance of the system through the development of realistic expectations of system capabilities (McKeen et al., 1994). The second part of the discussion on the influence of user participation analyzes the emotional aspects, including strengthening the sense of ownership of the system (Robey and Farrow, 1982), increasing the commitment of the user towards the system, ensuring the user understands the value of the system (McKeen et al., 1994), and lessening the resistance of the user towards the new system (Alter, 1978). Hence, this research deduces that managers who suffer from information inefficiency due to environmental uncertainty would be supported by the MAS through user participation. Furthermore, the various kinds of information would often confuse managers with regard to the information needed in situations of high uncertainty (Ives and Olson, 1984). Thus, managers would need to participate in the development of the MAS in order to increase the user's understanding of the information characteristics and their application to environmental uncertainty. When environmental uncertainty is high and user participation is not encouraged, users receive information passively without being appropriately aware of their application or information characteristics. As per the preceding discussion, we hypothesize that:

H_2: Environmental uncertainty has an indirect effect on the usefulness of broad-scope, timely, and aggregated information through user participation.

The moderating role of TA

In accounting research, some studies have confirmed that the manner in which information is used is determined by a person's subjective process of understanding such information, while the information condition is determined by that individual's cognitive structure (Gul, 1984; Dermer, 1973; Lal and Hassel, 1998). Consequently, individuals with different personalities who face environmental uncertainty will develop different strategies, or make different decisions, in order to face these uncertainties. In the face of a high level of uncertainty, managers may assume a positive and aggressive attitude, or alternately, a passive attitude. Some managers may even adopt a negligent attitude. The manager's response is intricately tied to their individual personality (Ho and Rodgers, 1993; Fisher, 1996; Lal and Hassel, 1998). Differences in personality can influence the manner in which a decision-maker uses information to combat the threat of environmental uncertainty (Lal and Hassel, 1998). Fisher (1996) demonstrates that the individual's locus of control can adjust the relationship between environmental uncertainty and broad-scope, timely, and aggregated MAS information. Finally, Fisher (1996) concludes that the information system should be designed by taking into consideration different personalities.

An ambiguous situation is defined as "one which cannot be adequately structured and categorized by an individual because of insufficient clues" (Budner, 1962). When a situation is uncertain, it is likely to be perceived as ambiguous, (Ho and Rodgers, 1993). Eihorn and Hogarth (1985) specified that ambiguity is an increasing function of uncertainty, which has not been ruled out by a person's knowledge of the situation. A person with a low TA will view uncertain scenarios as a type of threat, and in order to escape the factors of uncertainty and unexpectedness, the individual will aggressively seek information and take action to minimize the threat. Alternatively, a person with a high TA will not perceive ambiguity as a threat, and therefore they will choose to neglect or escape the ambiguity without aggressive action (Norton, 1975; Faircloth and Ricchiute, 1981; Gul, 1984; Teoh and Foo, 1997; Lal and Hassel, 1998; Hartmann, 2005). Ashford and Cummings (1985), Gul (1986), and Tsui (1993) discussed the effect of TA on system performance under different uncertain environments. According to them, in order to minimize the level of ambiguity, a person with a low TA will aggressively search for additional information, and will recognize how to use it (Norton, 1975; Faircloth and Ricchiute, 1981; Gul, 1984; Lal and Hassel, 1998). On the basis of the aforementioned literature review, this study anticipates

that high environmental uncertainty will confound the decision-maker, with regard to the factors that affect decisions and results. A manager who has a high TA will neglect the existence of the ambiguity, and they will also be unable to aggressively find a feasible plan or a definite use for the information. Such managers will simply accept the MAS information without question. In this situation, user participation does not strengthen the ability to recognize the appropriate relationship between environmental uncertainty and MAS information. However, this is different in the case of managers who have a low TA. These managers will aggressively deal with high environmental uncertainty in order to lessen the threat of ambiguity. Therefore, user participation will increase the need and recognition for refined MAS information (that is, broad-scope, timely, and aggregated information). Thus we hypothesis that:

H_3: The mediating effect of user participation on the relationship between environmental uncertainty and the usefulness of MAS information (that is, broad-scope, aggregated, and timely) is moderated by TA.

RESEARCH METHODS

Sampling

This study surveyed 600 sub-unit managers from the top 600 Taiwanese manufacturing companies. These companies were randomly selected from a list of publicly owned companies. Each manager was sent a questionnaire with a cover letter and a self-addressed, prepaid envelope. In recognition of the sensitive nature of some of the information requested, the cover letter provided a statement ensuring the anonymity of the respondents. The mail out yielded a response rate of 51%. Seven of the managers were excluded from the study due to incomplete responses.

Variables measures

Perceived environmental uncertainty

This study investigates environmental uncertainty as the subjective interpretation of the critical decision-maker, which is consistent with the research conclusions from Downey et al. (1975), and Gordon and Narayanan (1984). A Likert seven-point scale was used to measure the perceived environmental uncertainty (PEU). The survey included seven questions designed to understand the manager's perceptions with regard to the predictability and stability of various aspects of their organization's industrial, economic, technological, competitive, and customer environments. The Likert scale is commonly used in behavioral accounting research (Gordon and Narayanan, 1984; Chenhall and Morris, 1986; Mia, 1993; Gul and Chia, 1994; Chong and Chong, 1997; Choe, 1998).

MAS information characteristics

The instruments for measuring the MAS information characteristics, such as broad-scope, timely, and aggregated information, were adapted from the tool developed by Chenhall and Morris (1986). Following Chenhall and Morris, in the present study this instrument is used to measure the respondent's perceptions regarding the usefulness of the MAS information. Broad-scope information refers to the orientation of external, non-financial, and future-orientation information that is different from the traditional MAS. Timely information refers to the provision of information on request (with minimal delay), and the frequency of reporting. Aggregated information refers to the information that has been specified and compiled according to a particular time period, or by a functional area, and analyzed by a decision model (e.g., DCF, differential analysis, inventory model).

User participation

Responding to a questionnaire based on existing tools enhances the validity and reliability of the measurements (Barki and Hartwick, 1994). The present study employs a user participation instrument adapted from Barki and Hartwick (1994), which was originally developed by Barki and Hartwick (1989). It contains 14 questions pertaining to the user's contributions, and the degree to which they participate in the system development process.

Tolerance of ambiguity

TA refers to the information or cues received from specific situations. It is often defined as a cognitive characteristic of individuals. The TA instrument was developed by Bunder (1962), and modified by Dermer (1973), and Durrheim and Foster (1997). The instrument consists of 16 statements, including three kinds of ambiguities (novelty, complexity, and insolubility) and several categories of responses (repression, denial, anxiety, discomfort, destruction and avoidance). A higher score indicates a higher TA.

Method of analysis

The present study employed the nested-structural equation model to test hypotheses 1 and 2, and the interaction effect LISREL model to test hypothesis 3. The first step in the analysis was to determine the estimated structural relations by examining environmental uncertainty and the usefulness of the MAS information on the general model (known as the unconfined model and the structural model) to test hypothesis 1. The second step was to construct a confined model 1, which involves user participation in the structural relations between environmental uncertainty and the usefulness of the MAS information. A Chi square difference test was employed on confined model 1 and the unconfined model. If the Chi square value shows a significant difference, the data indicates that the mediating role of user participation can increase the suitability of the entire model. Thereafter, this research focuses on the coefficient path of each model when carrying out significant tests and comparisons. In order to explore the moderating effect of TA, the third step was to divide the total sample into low or high TA, and separately construct the structural relationships between uncertainty, user participation, and the usefulness of the MAS information. The structural equation model of uncertainty, user participation, and usefulness of the MAS information in the low or high TA samples is defined in confined models 2 and 3. The next step was to compare the Chi square differences between confined model 2 and confined model 3 with the unconfined model. If both these Chi square difference values were significant, it would imply that the division of the model into low or high TA can increase the structural fit. Thereafter, this study can focus on the coefficient path of each model when carrying out significant tests and comparisons for the purpose of testing hypothesis 3.

Figure 1 describes the research framework of this study. The PEU has a direct and indirect effect through user participation in the usefulness of MAS information. Further mediation of the effect of
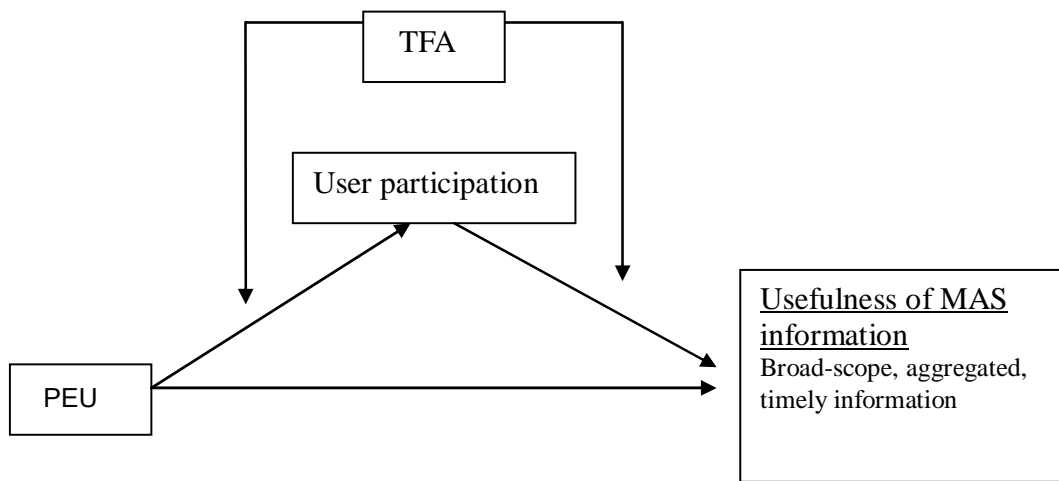
Figure 1. The structural relationship of research variables.

Table 1. Cronbach α coefficients and validity.

Variable	No. of items before deletion	α	No. of items after deletion*	α	GFI
Perceived environmental uncertainty	10	0.56	7	0.77	0.92
Broad-scope information	6	0.79	6	0.86	0.91
Aggregated information	6	0.84	6	0.90	0.93
Timely information	4	0.75	4	0.85	0.93
User participation	6	0.72	6	0.84	0.91
TA	16	0.61	14	0.81	0.95

* Items that had an insignificant path coefficient in the measurement model were deleted.

user participation as adjusted by the TA is shown in Figure 1.

ANALYSIS AND RESULTS

Reliability and validity assessment

Reliability analysis

This research used Cronbach α coefficient to measure the consistency of all the measurement variables in this study. The information in Table 1 shows that the Cronbach α values of the measurement items are all above 0.7, thereby conforming to generally accepted levels.

Validity analysis

In order to confirm the validity of each measurement variable, this study employed LISREL to measure the effectiveness of each measurement model. If the measuring items converge to the same measurement variables, the goodness of fit index (GFI) values of each

measurement model would be greater than (or approximately) 0.9 (Hair et al., 1995). Table 1 shows that after deleting the insignificant measurement items, all the GFI levels of each measurement variable meet the minimum suggested value of 0.9. The number indicates that each variable contains a certain level of structural validity. In addition, in order to confirm the discrimination of the three MAS information dimensions (scope, aggregation and timeliness), we conducted a discrimination analysis on the three information characteristics, as well as a Chi square difference test between the coefficients of one (the confined model) and the unconfined coefficient (the unconfined model). Table 2 demonstrates that the Chi square difference is significant, thereby proving that the level of fit of the confined model is lower than that of the unconfined model. As such, broad-scope, timely, and aggregated information contains sufficient discriminating validity.

Estimating the fit of the causal model

Table 3 shows that the levels of fit index of the causal

Table 2. Discriminating validity.

Model	χ^2	Df	$\Delta\chi^2$
The coefficients of broad-scope information and timeliness equal one	128.79	233	
The coefficients of broad-scope information and timeliness are not confined	116.09	232	12.7**
The coefficients of broad-scope information and aggregation equal one	171.05	253	
The coefficients of broad-scope information and aggregation are not confined	220.64	252	49.59**
The coefficients of timeliness and aggregation equal one	194.33	253	
The coefficients of timeliness and aggregation are not confined	179.58	252	14.75**

** $p < 0.05$.

Table 3. Estimated parameters for the causal model.

Path	Estimated parameters of path
EU-Broad-scope information	0.11
EU-Timely information	0.04
EU-Aggregated information	0.19*

* $p < 0.10$; ** $p < 0.05$; GFI = 0.87; NFI = 0.85; CFI = 0.87; RMSR = 0.13.

Table 4. Difference between the χ^2 on unconfined and confined models.

Model	χ^2	Df	$\Delta\chi^2$
Unconfined model	578.45	553	
Confined model 1 (involving user participation as a mediating variable)	565.34	552	13.11**

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

model with the GFI value at 0.87, NFI at 0.85, CFI at 0.87, and RMSR at 0.13 did not reach the theoretically suggested values (Jöreslog and Sörbom, 1989). Furthermore, the modifying index value (0.39) provided by LISREL is above the suggested standard of 3.84 (Hair et al., 1995). Those fit indexes reveal that based on the present variables, the structural model can no longer include other path parameters to strengthen its suitability. This means that the model only considers the direct effect of environmental uncertainty on the usefulness of MAS information, which is incomplete.

Testing the hypotheses

Environmental uncertainty and the usefulness of MAS information

Table 3 demonstrates that environmental uncertainty has a significant effect on the usefulness of the aggregated MAS information. However, environmental uncertainty does not have a significant effect on increasing the usefulness of broad-scope or timely data. In addition, in Table 5 (the confined structure model) the estimated parameters of environmental uncertainty on broad-scope and timely information are also insignificant. Therefore,

the direct effect on environmental uncertainty only exists in the usefulness of aggregated information and not in broad-scope or timely information. Thus hypothesis 1 is not supported.

The mediating effect of user participation

The information in Table 4 indicates that the Chi square difference in the unconfined and confined models is significant ($\Delta\chi^2 = 13.11$, $P < 0.05$). This result demonstrates that the consideration of the mediating role of user participation increases the fit of the structural model. Table 5 demonstrates that the path coefficients of environmental uncertainty on user participation, as well as the path coefficients of user participation on broad-scope, timely, and aggregated information, are all significant. This finding implies that the mediating effect of user participation on the relationship between environment uncertainty and usefulness of MAS information is significant. This result corroborates and supports hypothesis 2.

The moderating of TA

Table 6 shows that the differences of χ^2 between the high

Table 5. Estimated parameters for confined structure models.

Path	Estimated parameters of path	Path	Estimated parameters of path
EU-Broad-scope	0.08	Par-Broad-scope	0.19**
EU-Timely	0.12	Par-Timely	0.15*
EU-Aggregated	0.17*	Par-Aggregated	0.24***
EU-Par	0.36***		

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Table 6. Difference of χ^2 between the high (low) tolerance model and the full model.

Model	χ^2	df	$\Delta\chi^2$
Unconfined model (full sample)	528.45	553	
Confined model 2 (low tolerance)	498.32	552	30.13***
Confined model 3 (high tolerance)	547.23	552	18,78**

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 7. Estimated parameters for structural models of the low (high) TA sample.

Low TA		High TA		Difference between low or high TA : t-test
Path	Estimated parameters of path	Path	Estimated parameters of path	Difference between low or high TA
EU-Broad-scope	0.09	EU-Broad-scope	0.06	0.03(0.045)
EU-Timely	0.17	EU-Timely	0.16	0.01(0.055)
EU-Aggregated	0.18*	EU-Aggregated	0.08	0.1(1.012)
EU-Par	0.33**	EU-Par	0.21*	0.12 (1.045)
Par-Broad-scope	0.41***	Par-Broad- scope	0.10*	0.31 (2.57)***
Par-Timely	0.31**	Par-Timely	0.12*	0. 21 (2.03)***
Par-Aggregated	0.53***	Par-Aggregated	0.18*	0.35 (3.67)***

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

(low) tolerance model, and the full model, are significant. Therefore, the moderating effect of TA on the structural model is also significant. This outcome demonstrates the presence of an interactive effect of TA. In this case, in order to ensure the path signal on the structural models according to the inference of hypothesis 3, we conducted a LISREL path evaluation on the low / high TA sample. Based on the estimated parameters for the structural models of the low (high) TA in Table 7, regardless of the TA level, the path coefficient of environmental uncertainty on user participation was significant, and the path coefficients of user participation on the usefulness of all types of MAS information are also significant.

However, under the condition of high TA, the coefficient path of user participation on the usefulness of MAS information is less significant than it is in the low TA sample using the t-test. This finding reveals that the mediating effect of user participation on the relationship between environmental uncertainty and the usefulness of MAS information is more significant with a low TA, than it

is in with a high TA. This result implies that user partici-pation is a weak-form moderator (as posited by Hartmann and Moers, 1999) which corroborates hypothesis 3.

In addition, Table 7 shows that the direct paths of the environment on the usefulness of MAS information are insignificant (except for the path of Eu to aggregated information), regardless of a low or high TA. This finding is consistent with Table 5 and does not support hypothesis 1.

CONCLUSION AND MANAGERIAL IMPLICATIONS

The impacts of environmental uncertainty and contextual factors have received a considerable amount of attention in accounting research. Different from the previous study issues, this study simultaneously considers the mediating effect of user participation and the moderating effect of tolerance of ambiguity. Utilizing the nested structural equation model, this study demonstrates that the

usefulness of MAS information is not a monotonic function of environmental uncertainty.

The findings of this study reveal that environmental uncertainty only directly increases the usefulness of the aggregated MAS information. Moreover, the indirect effect of environmental uncertainty on the usefulness of broad-scope, timely and aggregated MAS information is statistically significant through user participation. Therefore, when environmental uncertainty increases, user participation can significantly strengthen the usefulness of MAS information.

Furthermore, the present study argues that individuals with different TA levels do not react to uncertainty in a similar manner. By using LISREL to examine the interaction effects of TA, it indicates that the path of environmental uncertainty on the usefulness of MAS information is indifferent between the low TA and high TA samples.

However, the indirect path coefficient of environmental uncertainty to the usefulness of MAS information through user participation is more significant in the low TA than the high TA samples. This implicates that as compared to managers with high TA, those with low TA are more sensitive to user participation in the relationship between environmental uncertainty and usefulness of MAS information.

This study contributes to the extant literature on the complex relationship between environmental uncertainty and usefulness of MAS information. On the one hand, this study identifies the structure model which streng-thens the fit between high environmental uncertainty and high usefulness of MAS information. This form of contin-gency aligns with the findings in management accounting research by Gerdin and Greve (2004). On another hand, this study offers additional empirical support for the notion that organizations adopt their MAS information to control the requirements of various situations (argued by Gerdin, 2005).

It is insufficient for firms to provide more sophisticated MAS information to managers when the environmental uncertainty is high. They must consider contextual variables in the relationship between environmental uncertainty and MAS design. The finding of the present study specifies a situation wherein MAS information is suitable when user participation and personality are taken into consideration. This consequence can highlight the conjunctive relationship between personality and the external environment, which increases the efficient use of MAS information.

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