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The Cultural Effects on Information Characteristics of Accounting Information Systems

Jong-Min Choe*

Kyungpook National University, School of Business
Department of Accounting, Buk-ku Sankyuk-dong 1370, Taegu 702-701

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ABSTRACT

This study empirically investigated cultural differences in the amount of information provided by management accounting information systems as well as the differences in organizational performance according to variations in the amount of information. Through cluster analysis, we classified sample firms into five organizational cultural types: Semi-innovative, innovative, bureaucratic, semi-bureaucratic and supportive. The results showed that in the semi-innovative firms, a greater amount of the traditional and advanced types of information is produced, while in bureaucratic firms, traditional information is much more provided than in the innovative, semi-bureaucratic and supportive firms. These results confirmed cultural differences in the amount of information produced. According to the results of this study, it was found that in organizational performance, the rankings of semi-innovative firms, which have the highest scores in the amount of information, are also the highest, and the performance scores in innovative firms are generally next to those of semi-innovative firms. Hence, it is concluded that there are cultural differences in the amount of information provided, and these differences affect organizational performance.

Keywords: Organizational Culture, Traditional Information, Advanced Information, Design of Information Systems

1. INTRODUCTION

Many studies [7, 15, 38, 61] have empirically investigated and suggested contextual variables that have an impact on the design of information systems (ISs). Through a contingency approach, they have examined relationships between contextual variables and information characteristics of ISs, which affect organiza-

* Email: choejj@mail.knu.ac.kr

tional performance. Most prior research, however, has primarily focused on the effects of such contextual variables as environmental uncertainty, organizational structure and task or technology.

Some researchers [17, 32, 56] indicated that the organizational culture is also a key contextual variable, which has an effect on the design and implementation process of the ISs. They argued that the design of a firm's ISs must be matched with the specific organizational setting, such as the culture, for the successful implementation of ISs. It was also asserted that a mismatch between the culture of an organization and the cultural assumptions embedded within the design of ISs can cause a costly implementation failure. Although previous research has stressed the importance of cultural effects in the design and implementation of ISs, the direct relationships between types of organizational culture and information characteristics (content, amount and format) that are key design elements of ISs have never been empirically confirmed.

Only a few studies [18, 36, 55, 62, 63] have examined and demonstrated the significant effects of national culture on the design and implementation of ISs. Kumar and Bjorn-Andersen empirically showed that national culture affects the values of system designers and their design behaviour. In Couger's study, he suggested that due to the variations in national culture, there are significant differences between the U.S. and Singaporean computer professionals regarding the potential for job motivation. Straub examined cross-cultural differences in the diffusion of information technology such as e-mail. He found that a national culture significantly influences the adoption and use of information technology. Tan et al. and Robichaux and Cooper also extensively explained and investigated the effects of national culture on the design and utilization of group support systems.

Since organizational culture, as shared norms and values of organizational members, naturally influences members' preferences for specific information characteristics, managers' information requirements may be expected to be culturally influenced and determined [54]. Culturally appropriate information characteristics may be preferred and even required more than characteristics that are regarded as culturally inappropriate. Thus, different types of organizational cultures may require different kinds of information, process differently and ultimately demand different design configurations of their ISs. In this study, we empirically investigate the effects of organizational culture on information characteristics of management accounting information systems (MAIS). MAIS collect, classify, summarize, and report information to managers in order to support them in their control of business activities [8]. Since MAIS are also a subsystem of the total ISs, information characteristics such as the amount of information produced

by MAIS seem to be inevitably influenced by the culture of a firm.

Using a cluster analysis, this study first, classifies and identifies types of organizational cultures. As a result of a cluster analysis, we empirically suggest various cultural typologies of firms that can explain variations in the information characteristics of MAIS. We also empirically confirm differences in the amount of types of information provided by MAIS, according to the variations of organizational cultures. In examining differences in the amount of information, we consider industrial types that seem to affect information characteristics. Moreover, this study demonstrates whether there exist any differences in the improvement of organizational performance, according to the variations in the amount of information produced that are caused by cultural variations. Finally, through a structural equation modeling technique, the current study investigates and analyzes the causal relationships among organizational culture, the amount of management accounting information and organizational performance.

Therefore, the results of this study can answer the following research questions: Is the amount of types of information provided by MAIS different according to variations in organizational culture?; does organizational culture significantly influence the amount of information produced?; are there any differences in the improvement of organizational performance according to variations in the amount of information produced?; does the amount of information provided have a significant impact on organizational performance?

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1 Factors Affecting Information Characteristics of ISs

2.1.1 Contextual variables and information characteristics of ISs

Characteristics of ISs, which are generally identified as design variables of ISs, can be broadly classified into three categories: Architectural characteristics, information presentation structures, and information characteristics [71]. Most prior research has empirically suggested that contextual variables that affect IS design include organizational environment, organizational structure, task or technology, and managerial decision-making style. In previous studies, the organizational environment and task have been commonly measured by perceived environmental uncertainty and task uncertainty. Galbraith [24] defined uncertainty as the difference between the amount of information required to perform the task

and the amount of information already possessed by an organization. Organizations that face high uncertainty, which is caused by environment and task, have to ask a large number of questions and acquire more information to learn the answers.

Prior studies [37, 41] empirically demonstrated the positive relationship between the environmental and task uncertainty and the amount of information produced by the ISs. Leblebici and Salancik found that environmental uncertainty has a significant effect on both the number of items of information and the additional amount of information required by loan officers in banks. Macintosh and Daft confirmed the significant positive relationships between the task variety and understanding and the information characteristics of amount and focus. In their study, the information focus refers to the precision of meaning conveyed by the information. In the study of Specht, the relationship between various task characteristics, such as analyzability, interdependence, variety and identity, and information quality requirements were empirically examined. He showed that information quality requirements, which are comprised of information aggregation, timeliness, accuracy, amount and relevance, are significantly correlated with task characteristics. Choe also demonstrated that when task uncertainty is high, the ISs must provide a large amount of broad-scope, timely and aggregated information to increase ISs performance. In his study, broad-scope information means qualitative, nonfinancial, external-oriented and ex-ante types of information. Aggregated information represents whether the report contains the diffuse and summarized information or specific and detailed types of information.

Organizational structure is viewed as either mechanistic or organic [9], and these dimensions of structure are related to the information processing capabilities of an organization. To complement and support the information processing capacity of an organizational structure, characteristics of ISs must fit with the organizational structural forms [26]. Choe empirically suggested that when an organizational structure is organic, to attain a high ISs performance, the ISs must produce a large amount of broad-scope, timely and aggregated types of information. Information characteristics of ISs also must fit with the personality and decision-making style of managers who require and use information. Barkin and Dickson [3] found that there are significant differences in the selection and utilization of information according to variations in cognitive style. Blaylock and Rees empirically showed that the degree of individual preference for a particular type of information is different according to individual cognitive style, such as sensing and intuition. Lederer and Smith investigated the relationship between preference for aggregated information and a user's cognitive style. They found

that summarized information appears to better serve the heuristic user, while detailed information better serves the analytic user.

2.1.2 The effects of contextual variables on the information characteristics of MAIS

The major functions of MAIS are to provide information for the planning, control and evaluation of business activities [57]. Recently, as manufacturing firms adopt enterprise resource planning (ERP) systems, the boundaries between accounting information systems (AIS) and other ISs seem to become vague. However, the identity of AIS does not disappear, and the roles or functions of AIS are almost the same as those of AIS in the pre-ERP era [25]. Types of information provided by MAIS can be classified into two categories: Traditional and advanced [12]. Traditional information is manipulated and produced by traditional management accounting techniques, such as budgeting, return on investment and variable costing, and advanced information is processed and produced by newer or contemporary techniques, such as activity-based costing, value chain analysis and target costing.

Most prior research has empirically confirmed the significant impact of contextual variables on the information characteristics of MAIS. Gordon and Narayanan [27] demonstrated that there are significant positive relationships among perceived environmental uncertainty, organic structure and the amount of external, nonfinancial and ex-ante types of management accounting information. Chenhall and Morris [14] showed that environmental uncertainty and decentralization have a significant direct impact on the perceived usefulness of the broad-scope, timely and aggregated types of information provided by MAIS. They also found the indirect effects of environmental uncertainty on the perceived usefulness of types of information through association with organizational structure.

Mia and Chenhall [45] empirically showed that the relation between the managers' use of broad-scope management accounting information and their performance is moderated by functional activities differentiated with respect to task uncertainty facing an organization. Chong [16] also confirmed the fact that task uncertainty and the extent of use of broad-scope information produced by MAIS have significant interactive effects on managerial decisions and finally, managerial performance. In the study of Harrison and Poole [29], the impact of technology, such as advanced manufacturing technology (AMT), on the amount of management accounting information was empirically investigated. They found that when a level of AMT is high, MAIS must provide a large amount of nonfinancial performance information in order to attain a higher production performance.

Although many studies have considered various contextual variables in the investigation of their impact on the information characteristics of MAIS, previous studies have omitted a key contextual variable: Organizational culture that must be considered first of all when designing MAIS [23]. Flamholtz et al. and Flamholtz [22] asserted that organizational culture, as an upper-level contextual variable, affects the design of control systems or MAIS as well as the type of organizational structure adopted and business strategy.

2.2 The Effects of Organizational Culture

Flamholtz defined organizational culture as the set of values, beliefs and social norms, which tend to be shared by its members and, in turn, tend to influence their thoughts and actions. Through a case study, Markus and Pfeffer [42] suggested that since organizational culture, as broader values and normative patterns, can guide worker behaviour, practices and policies, the design of MAIS that produce types of information to control the behaviour of organizational members must be fitted with culture. Cooper identified the impact of culture as a significant source of organizational inertia. Therefore, he asserted that ISs design which conflicts with an organization's culture can foster resistance of organizational members to a degree that implementation fails or results in a less than desired level of ISs performance. Tricker [65] also indicated that the concept of information can be viewed from a cultural perspective and thus, cultural dimensions must be significantly considered in ISs design.

Organizational culture provides an interpretive context that enables members of the culture to make sense of their surrounding objects, such as newly employed information technology or ISs [58]. In different cultural settings, since completely different interpretive schemes may be developed and applied, even the same ISs can acquire different meanings [53]. The same application of information technology or ISs may symbolize providing useful and preferred types of information or functions in one setting, and producing useless and aversive information in another. These positive or negative interpretations can be explained by tracing the development of values and assumptions pertinent to the ISs. Generally, when the application of ISs is culturally well compatible, positive interpretations are likely to be given to these ISs, and if the design of the ISs conflicts with cultural settings, organizational members may have negative meanings or interpretations about them. Ultimately, these different interpretations affect performance or outcomes of the ISs. Types of information provided by the ISs that attain positive interpretations are likely to be more preferred, required and utilized.

A few studies have examined the impact of organizational culture on the implementation of ISs. Weber and Pliskin [70] empirically showed that cultural differences of merged firms negatively influence the effectiveness of the integration of ISs during mergers and acquisitions. Kanungo et al. found that there are significant relationships between the innovative, supportive and bureaucratic cultural types and the information technology strategies, such as leading edge, free market and monopoly. Tolsby [64] suggested that in the Norwegian army, the organizational culture of instability and high job rotation is a hindrance to the successful adoption of information technology. Bhimani [6] empirically demonstrated that the degree of alignment between the cultural premise of the MAIS and that espoused by MAIS users significantly influence the system's perceived success.

From previous research and arguments, it seems to be proposed that there are cultural differences in the amount of information provided by MAIS, and that organizational culture significantly influences the amount of information. Hence, we can suggest the following Hypotheses 1and 2.

Hypothesis 1. Organizational culture has a significant impact on the amount of management accounting information produced.
Hypothesis 2. There are significant differences in the amount of management accounting information produced according to cultural variations.

2.3 Positive Impact of Information on Organizational Performance

2.3.1 Organizational learning effects of information

Virany et al. [68] defined organizational learning as a form of informational updating through which managers develop an understanding of relationships between organization actions and outcomes. The organizational learning process is roughly composed of three broad stages: Information collection (scanning), interpretation and learning (action taken) [19]. Huber [30] suggested four constructs or phases that are integrally linked to organizational learning. They comprise knowledge acquisition, information distribution, information interpretation and organizational memory. Knowledge acquisition is the process by which knowledge or information is obtained. The acquisition of knowledge requires both searching and noticing. Information distribution is the process by which information from different sources is shared and thereby leads to new information or understanding. Information interpretation implies that information is given meaning. In addition, it is the process of developing a shared understanding and conceptual schemes. Organizational memory is the means by which knowledge or informa-

tion is stored for future use.

Although various definitions of organizational learning have been suggested, it is evident that the provision of information is the beginning and a necessary condition of organizational learning. Information is a flow of messages or meanings, which might add to, restructure or change knowledge [40]. Knowledge is created and organized by the very flow of information, anchored to the commitment and beliefs of its holder. Nonaka [49] differentiated information from knowledge. He argued that information is a necessary medium or material in organizational learning for knowledge creation.

Individuals obtain and interpret information and learn by updating their mental models. Mental models are the interpretive schemes or cognitive models of the world on which managers rely in order to understand various environments [5]. Mental models direct the gathering and processing of stimuli (i.e. information), and stimuli, in turn, help to enforce or change mental models. Through interaction and communication, individuals share information and beliefs, resulting in organizational learning, which forms the organization's shared mental models [33]. Organizational learning is the process of updating and changing the organization's shared mental models. The organization's shared mental models are the knowledge base or belief structure of an organization that guides individual actions and ultimately organizational actions.

Accounting information is utilized in organizational learning as the raw material of learning [50]. Accounting information plays a critical role in creating new knowledge and updating the organization's shared mental models. The amount of management accounting information produced by MAIS is also material utilized in organizational learning [34]. The provision of a large amount of management accounting information can give rise to organizational learning and, consequently increase the performance of a firm. Kloot suggested that MAIS closely relate to the four constructs of organizational learning. Depending on environmental changes, MAIS can enhance the organization's ability to acquire knowledge, distribute and interpret information, and increase its memory. A large amount of nonfinancial performance information provided by MAIS positively affects knowledge acquisition. Financial performance measurement and evaluation may also contribute to knowledge acquisition and information interpretation. Accounting and budgetary control reports are likely to support information distribution as well as organizational memory.

In the research of Vandenbosch and Higgins [66, 67], the learning effects of information were empirically examined. Their results concluded that information quality has a positive impact on the degree of individual learning such as mental

model maintenance and building. In another study, Vandenbosch and Higgins presented a positive relationship between the amount of information acquisition and learning in an executive support systems context. Young and Selto [72] found that an information shortage (i.e. small amount of information) causes many problems in the manufacturing process because of ineffective learning. Chenhall [11] partially proved the organizational learning effects of total quality management (TQM) related performance information in TQM production systems. He asserted that performance information gives rise to organizational learning in the operational and strategic control process.

2.3.2 Organizational learning and the improvement of performance

Organizational learning is the process of improving actions or outcomes through better information and understanding [21]. The ultimate result of effective organizational learning is increased or improved organizational performance. With a resource-based view, the positive effects of learning on organizational performance can be explained. Resource-based theory suggests that the competitive advantage of a firm is caused by the firm's unique resource [60]. Since knowledge is also a valuable resource of a firm, creating and sustaining a firm's competitive advantage is considerably dependent on the knowledge and knowledge creation capabilities of that firm [39]. Therefore, valid organizational learning, by which unique knowledge is obtained, contributes to the attainment of the organization's competitive advantage and as a result, improves organizational performance.

Some researchers have empirically investigated the positive impact of organizational learning on a firm's performance. Through a case study, Mitki et al. [48] showed that organizational learning with the learning mechanism, such as a quality circle program, can lead to continuous productivity improvement. Barr et al. [4] empirically demonstrated that learning from environmental change is positively associated with the organizational renewal of a firm. Kraatz [35] found that interorganizational networks can promote social learning and, consequently, enhance the firm's ability to adapt to environmental change. In the study of Pennings et al. [51], they empirically suggested a positive relationship between learning from expansion experiences and the diversification success of a firm.

Based on prior research and arguments, it is concluded that organizational performance is positively influenced by the degree of organizational learning, and the amount of information provided has a significant positive impact on organizational learning. Accordingly, it is likely that organizational performance differs according to variations in the amount of management accounting information, which are caused by cultural variations, and that the amount of information sig-

nificantly influences organizational performance. Thus, the following Hypotheses 3 and 4 are suggested.

Hypothesis 3. There are significant differences in organizational performance according to variations in the amount of management accounting information produced.
Hypothesis 4. The amount of management accounting information produced has a significant impact on organizational performance.

3. RESEARCH METHOD

3.1 Measurement

3.1.1 Organizational culture

According to Wallach [69], shared values, norms and beliefs of people in an organization can be mapped on to an innovative, supportive and bureaucratic culture. In order to describe organizational culture completely, all three constructs are required. Culture is, therefore, measured in terms of parameters describing these three constructs. Covering almost all aspects of organizational culture, Wallach provided a validated instrument of 16 questionnaire items. Wallach's instrument has been used in IS research, such as Kanungo et al. Organizational culture was measured on a seven-point Likert-type scale that ranged from 'Never describe my firm (organization)' to 'Completely describes my firm'. The 16 items are: risk taking, results oriented, creative, stimulating, challenging and driving (six items for innovative), collaborative, relationship, freedom, equitable and trusting (five items for supportive), hierarchical, procedural, ordered, cautious and power oriented (five items for bureaucratic).

3.1.2 The amount of management accounting information produced

To measure types of management accounting information, 19 questionnaire items developed by prior research [13] were utilized. They include full costs, variable costs, capital budgeting, cost-volume-profit (CVP) analysis, product profitability, budgeting and variance analysis, return on investment and divisional profit (eight items for traditional information), activity-based costs, target costs, product life-cycle costs, activity-based management, value chain analysis, long-range forecasting, benchmarking, nonfinancial performance information, team performance, balanced score card and residual income (eleven items for advanced information).

Respondents were asked to indicate on a seven-point Likert-type scale, anchored by 'No amount of information, none supplied' and 'Very large amount of information, very high extent of provision', the extent or the amount of information that is provided by MAIS.

3.1.3 Organizational performance

Benefits of the provision of information are multidimensional. Therefore, any single indicator of performance may not be effective. In this study, we measured the perceived organizational performance of a firm over the last three years and its financial performance using two variables: Return on assets (ROA) and return on sales (ROS). Using seven questionnaire items developed by Gupta and Govindarajan [28], perceived performance was measured on a seven-point Likert-type scale. Seven question items include sales, growth, market share, pre-tax income, new product, employee morale and welfare. ROA focuses on the overall performance of a firm. ROS represents a firm's ability to generate income from sales revenue. Accounting data to compute ROA and ROS were collected from the firms' balance sheets and income statements in 2004, which were provided in the Korea Annual Report of Listed Companies.

3.1.4 Perceived environmental uncertainty

Factors of external environments include environmental dynamism, heterogeneity, hostility, competition and external needs. Perceived environmental uncertainty (PEU) totally comprises and represents all these external factors. Since PEU significantly influences the amount of information produced, this study measured PEU as a control variable. Four question items, developed by Miller [46], were utilized. Four questionnaire items are: Product obsolescence, technology change, components change and the life-cycle of product. Measures of PEU were made on a seven-point Likert-type scale.

3.1.5 Advanced manufacturing technology

AMT also affects the amount of information provided, and thus, this study considered AMT as a control variable. Since the level of AMT is closely related to the degree of automation, this study measured the degree of automation in the production systems to obtain the AMT measurement. Meredith and Hill [44] suggested a four-stage model to assess the degree of automation. Based on Meredith and Hill's model, a seven-stage model was developed: Partially automated stand-alone equipment, some automated stand-alone equipment, a greater number of automated stand-alone equipment, low level of integration, high level of integra-

tion, linked islands, and full integration. With the seven-stage model, respondents were asked to select the stage that best corresponds with the state of automation in their manufacturing systems.

3.2 Sampling and Data Collection

Data for this study were drawn from a survey of the current status of MAIS used in Korean manufacturing firms. 400 organizations were randomly selected from a population of about 1,000 firms that are listed on the Korean stock market. The manufacturing firms listed are medium to large in size and consequently, are likely to have more experience with MAIS applications than smaller firms. First, the chief accountants of the selected firms were contacted to ask them for their participation in the research. At the beginning, 154 organizations responded to requests for information. However, during the survey, 21 firms withdrew from the survey because they were unwilling to be clear about their state of MAIS. As a result, 133 firms were finally included in the study.

Table 1. Sample characteristics

Type of industry	Chemical industry	Machine industry	Auto-mobile	Electronic industry	Textile	Paper & pulp	Non-metal	Metal industry	Total
No. of firms	4	30	46	30	1	3	13	6	133

No. of employees	Below 300	300 - 500	500 - 1,000	1,000 - 5,000	5,000 -	Total
No. of firms	40	34	37	18	4	133

Total assets	Below 10 billion	10 - 30	30 - 50	50 - 100	100 billion -	Total
No. of firms	3	27	25	23	55	133

Total sales	Below 10 billion	10 - 30	30 - 50	50 - 100	100 billion -	Total
No. of firms	4	31	24	22	52	133

AMT level	1	2	3	4	5	6	7	Total
No. of firms	13	22	23	33	19	17	6	133

In order to collect data, questionnaires were given to the participating firms. Only chief accountants or accounting executives were selected as respondents since they well understand the utilization of management accounting information

and the firm's culture and performance. Before mailing the questionnaires, through telephone contact with the respondent, we notified mailing. After telephone notification (i.e. about one or two days later), a questionnaire with a cover letter was mailed to each respondent. A self-addressed stamped envelope was included with the questionnaire to ensure anonymous responses. After distributing the questionnaire (i.e. about one week later), through the second telephone contact, the contents of the questionnaire and the answering methods were explained The survey was conducted during a four-month period between June and September 2004.

To test non-response bias, the final sample was partitioned into two groups of early and late responses. The non-response bias was then examined through a t-test. The results showed no significant differences between the two groups regarding the number of employees ($t = -1.1$, $p>0.2$), sales volume ($t = -1.0$, $p>0.3$), total assets ($t = -1.2$, $p>0.2$) and AMT level ($t = -0.08$, $p>0.9$). Table 1 summarizes the sample characteristics according to the industrial type of the firms.

4. EMPIRICAL RESULTS

4.1 Reliability and Validity Test

Item analyses were performed with Cronbach Alpha coefficients for all multi-item scale measurements. In Table 2, the results of the Cronbach Alpha tests are presented. In the case of innovative culture, the Alpha coefficient increased after the deletion of two items (risk taking and results oriented). All Alpha coefficients are above 0.7, which is considered to be satisfactory for the reliability of a multi-item scale.

Table 2. Cronbach Alpha coefficients

Research variable	Before deletion		After deletion	
	No. of items	Alpha	No. of items	Alpha
Innovative culture	6	0.69	4	0.79
Supportive culture	5	0.82	-	
Bureaucratic culture	5	0.79	-	
Perceived environmental uncertainty	4	0.70	-	
Management accounting information	19	0.91	-	
Perceived organizational performance	7	0.89	-	

The questionnaire items measuring research variables had been used in previous empirical studies. However, the construct validities of these items were questionable. Principal component analysis with varimax rotation was used to determine if all items measuring a construct cluster together or not. That is, whether all items measuring a construct load onto a single factor or divide into multiple factors. Two separate joint factor analyses for management accounting information, perceived environmental uncertainty, constructs of culture and perceived organizational performance were carried out to acquire a more stable solution by increasing the ratio of the sample size to the number of items.

Table 3. Factor loadings of research variables (Varimax rotation)

Management accounting information	Factor					Innovative culture	Factor			
	1	2	3	4	5		1	2	3	4
1	0.85					1				0.79
2	0.83					2				0.70
3		0.72				3				0.79
4	0.62					4				0.66
5		0.71				Supportive culture				
6	0.54									
7	0.62					1		0.63		
8		0.84				2		0.77		
9		0.72				3		0.69		
10	0.80					4		0.84		
11				0.59		5		0.65		
12				0.57		Bureaucratic culture				
13				0.74						
14					0.82	1			0.79	
15					0.70	2			0.69	
Environmental uncertainty						3			0.77	
						4			0.66	
1			0.84			5			0.72	
2			0.81			Perceived performance				
3			0.55							
4			0.67			1	0.84			
						2	0.89			
						3	0.86			
						4	0.86			
						5	0.65			
						6	0.60			
						7	0.59			
Eigen value	5.9	2.4	1.8	1.3	1.1	Eigen value	5.7	3.5	2.8	1.2
% of var.	31.1	12.8	9.4	6.8	5.8	% of var.	27.3	17.0	13.6	5.7

* Factor loadings below 0.4 were not presented.

Table 4. Summary statistics of research variables

Variables	Mean	Standard deviation	Median	Minimum	Maximum
Innovative culture	4.3	1.0	4.2	1.7	7.0
Supportive culture	4.8	0.9	4.8	2.2	6.4
Bureaucratic culture	4.6	0.9	4.8	2.4	6.8
Advanced manufacturing technology	3.7	1.6	4.0	1	7
Perceived environmental uncertainty	3.0	1.0	3.0	1.0	6.0
Perceived organizational performance	4.7	0.9	4.8	2.0	7.0
Return on assets (ROA)	0.05	0.09	0.04	-0.33	0.35
Return on sales (ROS)	0.15	0.11	0.13	-0.12	0.79
Traditional information	4.7	1.0	4.6	1.1	7.0
Advanced information	3.6	1.1	4.0	1.0	6.2
Nonfinancial information	4.3	0.9	4.3	1.0	6.6
Profit information	4.0	1.2	4.0	1.0	6.5

Using the 0.4 criterion for significant item loading on a factor, the results showed that in the case of management accounting information, four factors with eigen values greater than one were extracted. However, Items 13 (budgeting and variance analysis), 14 (return on investment), 16 (team performance) and 17 (balanced score card) concurrently loaded onto Factor 1 and Factor 2. They were removed and the factor analysis was repeated. In this second factor analysis, the items of each factor were not confounded with the items in the other factors. Factor 1 comprises full costs, variable costs, target costs, capital budgeting, CVP analysis and product profitability. Thus, its title is traditional information. Factor 2, which is composed of activity-based costs, product life-cycle costs, activity-based management and value chain analysis, represents advanced information. Factor 4, which includes long-range forecasting, benchmarking and nonfinancial performance information, entails nonfinancial information. Factor 5, which comprises residual income and divisional profit, represents profit information. However, nonfinancial and profit information are kinds of advanced information. Alpha coefficients of traditional, advanced, nonfinancial and profit information are 0.86, 0.82, 0.64, and 0.72, respectively. The results of our final factor analysis are presented in Table 3. The values of mean and standard deviation for the research variables were calculated and are summarized in Table 4.

4.2 Cultural differences in the amount of information

4.2.1 Cultural variations: cluster analysis

With a cluster analysis, this study classified sample firms according to organizational cultural forms. In the current study, cluster analysis provides clusters of companies that are similar in three cultural constructs. In the cluster analysis, we used the hierarchical agglomerative method to form clusters because it generates nonoverlapping clusters and it has been the dominant method [1]. For the sorting or linkage rules, Ward's method was chosen since this technique optimizes the minimum variance within clusters [20]. We also used the squared Euclidean distance as the proximity measure.

Based on the values of the three constructs of culture: Innovative, supportive and bureaucratic, a cluster analysis was performed to produce clusters of organizations. In addition, the average amount of management accounting information produced and the mean organizational performance were calculated for each cluster. A critical issue in cluster analysis is to determine the optimal number of clusters. While there are formal decision rules to guide this process, heuristics are commonly used. A formal approach in determining the most appropriate number of clusters is to examine the distance coefficient. The distance coefficient is shown in Table 5. The points at which the distance coefficient suddenly jumps indicate suitable stages in the clustering sequence for analysis.

Table 5. Distance coefficient (Agglomeration schedule using Ward method)

Stage	123	124	125	126	127	128	129	130	131	132
Coefficient	80.9	87.9	95.0	105.3	120.9	138.0	160.3	190.1	232.9	343.7
Increasing rate of coefficient	-	8.6%	8.0	10.8	14.8	14.1	16.2	18.5	22.5	47.5%
No. of cluster	10	9	8	7	6	5	4	3	2	1

In Table 5, the distance coefficient increases greatly at three points - between the sixth and seventh clusters, between the fourth and fifth clusters, and between the third and fourth clusters. This implies that the four-cluster, five-cluster and seven-cluster solutions may be appropriate points for analysis. However, the four-cluster solution is a little small and the seven-cluster is a little big in terms of the number of clusters. Considering that three constructs of culture were utilized in cluster analysis, the five-cluster result provides suitable data to examine the variations in the amount of management accounting information, which were caused by cultural variations. Therefore, the five-cluster solution was used in the analysis.

The mean ranks of variables (i.e. three constructs of culture) within each cluster are presented in Table 6, along with the Kruskal-Wallis test results (χ^2 values) for each clustering variable. The χ^2 values show that statistical differences exist for individual variables across clusters. However, they do not provide evidence that significant differences exist between clusters. In the case of C4, the scores of the innovative and supportive culture are very high (i.e. ranked first), and the value of bureaucratic culture is also relatively high (i.e. ranked second). Thus, C4 represents the 'semi-innovative firms' of which culture is characterized by both the highly innovative, cooperative and trusting, and the well ordered.

Table 6. Mean ranks of cultural variables within clusters (Kruskal–Wallis test)

Cultural variables	Clusters					
	C1 (Supportive firms)	C2 (Semi-bureaucratic firms)	C3 (Bureaucratic firms)	C4 (Semi- innovative firms)	C5 (Innovative firms)	
	(n=30)	(n=16)	(n=30)	(n=21)	(n=36)	χ^2
Innovative culture	38.7(4)	29.4(5)	54.1(3)	111.7(1)	91.8(2)	78.6[a]
Supportive culture	60.8(3)	10.8(5)	43.1(4)	99.6(1)	97.9(2)	85.2[a]
Bureaucratic culture	31.0(5)	67.2(3)	102.7(1)	101.9(2)	46.6(4)	79.5[a]

* The numbers in parentheses are rankings of cultural variables across clusters. a: $p \leq 0.01$

In C5, the values of the innovative and supportive are relatively high (i.e. ranked second), of which the score of the bureaucratic is lower. Therefore, the title of C5 is 'innovative firms' of which cultural characteristics are only the highly innovative and cooperative. C3 is 'bureaucratic firms' that have cultural characteristics of both the rigidly hierarchical and ordered, and a little innovative, since the bureaucratic score is the highest (i.e. ranked first), and the value of innovative is in the middle (i.e. ranked third). In C1, the values of the innovative and bureaucratic are lower, while the supportive score is in the middle (i.e. ranked third). Therefore, C1 is 'supportive firms' of which culture is only characterized by the a little relationship-oriented and collaborative. The title of C2 is 'semi-bureaucratic firms' of which cultural characteristics are the a little hierarchical and ordered, because the value of bureaucratic is in the middle and the scores of the others are the lowest.

4.2.2 Differences in the amount of information produced

Before testing cultural differences in the amount of information, it was analyzed whether there are any differences in the level or degree of AMT and perceived environmental uncertainty between clusters, since AMT and perceived environmental uncertainty are likely to influence the amount of information provided by MAIS. According to the χ^2 values of the Kruskal-Wallis test, in AMT, there exist no significant differences between clusters (i.e. χ^2 =6.9, p=0.21). In the case of perceived environmental uncertainty, there are marginally significant (i.e. χ^2=8.5 p=0.079) differences. Thus, it seems that AMT and perceived environmental uncertainty do not significantly influence the variations in the amount of information across clusters.

The composition of industry types within the clusters was also analyzed, since the biased distribution of industry types across clusters may affect differences in the amount of information between clusters. Table 7 presents the distribution of industry types across five clusters. From this result, it is suggested that except for the non-metal, the distribution of industry types across the five clusters is not seriously biased. The Kruskal-Wallis test was employed to analyze whether there exist any differences in the distribution of industry types across clusters. The calculated χ^2 value was 4.3 (p=0.36). Therefore it is concluded that the distribution of industry types across clusters has no impact on differences in the amount of information among clusters.

Table 7. The distribution of industry types across clusters

Type	C1	C2	C3	C4	C5	Total
Automobile	12	6	9	9	10	46
Electronic	6	3	5	8	8	30
Nonmetal	2	1	7	-	3	13
Machine	9	6	5	2	8	30
Chemical	-	-	3	-	1	4
Metal	1	-	-	1	4	6
Paper & pulp	-	-	1	1	1	3
Textile	-	-	-	-	1	1
Total	30	16	30	21	36	133

Table 8 shows the results of the Kruskal-Wallis test for analyzing cultural differences in the amount of information. In C4 (semi-innovative firms), the scores of the amount of information produced are the highest (i.e. ranked first). In

the case of C5 (innovative firms), except for profit information, the values of the types of information are relatively high (i.e. ranked second and third). In C3 (bureaucratic firms), the rankings of advanced and profit information are in the middle, while the score of traditional information is relatively high (i.e. ranked second). The rankings of C2 (semi-bureaucratic firms) are the lowest. In the case of C1 (supportive firms), the rankings of profit and nonfinancial information are second and third, respectively, while the scores of other types of information are lower. According to these results, it seems that in firms of which cultural characteristics are innovative and supportive, a large amount of advanced information is provided, while in firms that have a bureaucratic cultural characteristic, a greater amount of traditional information is produced.

Table 8. Mean ranks of types of information within clusters (Kruskal–Wallis test)

Types of information	Clusters					χ^2
	C1 (Supportive firms)	C2 (Semi-bureaucratic firms)	C3 (Bureaucratic firms)	C4 (Semi-innovative firms)	C5 (Innovative firms)	
Traditional information	47.5(5)	51.7(4)	76.9(2)	87.1(1)	66.2(3)	18.4[a]
Advanced information	57.7(4)	54.0(5)	63.8(3)	90.4(1)	65.7(2)	11.8[b]
Nonfinancial information	63.2(3)	50.4(5)	57.0(4)	87.8(1)	70.2(2)	12.1[b]
Profit information	65.6(2)	60.5(5)	64.4(3)	80.7(1)	61.2(4)	4.2

* The numbers in parentheses are rankings of types of information across clusters.
a: $p \leq 0.01$, b: $p \leq 0.05$.

Table 9. Differences in the amount of information between clusters

	C3 C4	C4 C5	C3 C5	C1 C3	C2 C3
Traditional information	24 29 U=258	34 24 U=226[b]	36 26 U=317[c]	24 37 U=259[a]	17 27 U=145[b]
Advanced information	21 32 U=182[b]	35 23 U=217[b]	32 33 U=495	29 32 U=405	21 25 U=201
Nonfinancial information	21 33 U=171[a]	33 25 U=262[c]	25 35 U=316[c]	32 29 U=397	22 24 U=217
Profit information	23 30 U=237[c]	33 25 U=254[c]	33 32 U=486	31 30 U=437	22 24 U=220

* The numbers are mean rank. a: $p \leq 0.01$, b: $p \leq 0.05$, c: $p \leq 0.1$.

In terms of advanced information, the differences between C3 and C4, and between C4 and C5 were examined using the Mann-Whitney test and were found to be significant. These results are presented in Table 9. These results also confirm the fact that the firms, which have cultural characteristics of being innovative and supportive, require a large amount of advanced information. In the case of traditional information, there was no significant difference between C3 and C4, while the difference between C4 and C5 was significant at the 5% level. The amount of traditional information provided in C3 was also significantly greater than that of other groups: C1, C2 and C5. In terms of nonfinancial information, the amount of information produced in C5 was much more than in C3. From these results, it is demonstrated that in firms of which cultural characteristic is bureaucratic, a large amount of traditional information is provided. Hence, Hypothesis 2 (cultural difference in the amount of information) is supported.

Traditional information focuses on managing business activities by means of standards, variances and measurements established at the individual unit or level [47]. Under traditional information, the fundamental assumption is that maximizing individual performance will lead to organizational success [43]. Therefore, through traditional information that solely focuses on the individual unit or activity, an achievement of the group cooperation and objectives cannot be supported. However, advanced information considers interrelationships among functions or activities in controlling business activities. The focus of advanced information is not an individual unit, but the interrelated processes and activities To manage and control activities with considering the complex interaction and collaboration among functions, advanced information must be provided.

In an organization with a highly innovative and supportive culture, the achievement of creative, newer and enterprise-wide works is stimulated and actively pushed through the collaboration and harmonious relationships of organizational members. The supportive and innovative culture is characterized by both the encouraging and challenging atmosphere and by social and family values Thus, it is likely that in the firms, which have cultural characteristics of being innovative and supportive, newer and advanced types of information are more preferred and required. However, in a firm with a bureaucratic culture, orders, regulations and procedures are emphasized to control the execution of an individual activity or function. As the characteristics of a firm with a bureaucratic culture, the hierarchical and well-established order systems that can be used to specify individual courses of actions are suggested. Therefore, it seems that in the firms, which are characterized by bureaucratic culture, a large amount of traditional information is preferred and demanded.

4.3 Differences in the improvement of organizational performance

Table 10 shows the results of the Kruskal-Wallis test for analyzing the differences in organizational performance. In C4, the rankings of the amount of information are the highest and the scores of organizational performance are also the highest (i.e. ranked first and second). However, in the case of C1, the rankings of organizational performance are the lowest (i.e. ranked fourth and fifth). In terms of perceived organizational performance and ROA, the differences between C3 and C4, and between C4 and C5 were examined using the Mann-Whitney test and were found to be significant. These results are presented in Table 11. There were no significant differences in the organizational performance between C3 and C5. The reason why there aren't any significant differences may be that in C3 (bureaucratic firms), traditional information which is well compatible with a bureaucratic culture is much more produced, while in C5 (innovative firms), types of advanced information which are matched with a innovative and supportive culture are relatively much more provided.

Table 10. Mean ranks of organizational performance within clusters (Kruskal–Wallis test)

Organizational performance	Clusters					
	C1 (Supportive firms)	C2 (Semi-bureaucratic firms)	C3 (Bureaucratic firms)	C4 (Semi-innovative firms)	C5 (Innovative firms)	χ^2
Perceived organizational performance	60.6(4)	61.2(3)	59.1(5)	89.7(1)	68.1(2)	9.8[b]
Return on assets	48.5(5)	72.4(2)	54.7(4)	78.7(1)	60.0(3)	10.8[b]
Return on sales	44.0(5)	60.4(4)	65.3(3)	67.2(2)	67.3(1)	8.1[c]

* The numbers in parentheses are rankings of measures of performance across clusters.
b: $p \leq 0.05$, c: $p \leq 0.1$.

Table 11. Differences in performance between clusters (Mann–Whitney test)

Cluster	C3	C4	C4	C5	C3	C5	C1	C2	C1	C3
Perceived organizational performance	21	33	35	25	31	35	23	23	31	30
	U=178[a]		U=242[b]		U=465		U=239		U=433	
Return on assets	19	30	32	24	29	31	17	26	25	28
	U=154[b]		U=237[c]		U=411		U=116[b]		U=312	
Return on sales	23	25	26	27	30	31	18	26	23	31
	U=255		U=326		U=441		U=121[b]		U=245[c]	

* The numbers are mean rank. a: $p \leq 0.01$, b: $p \leq 0.05$, c: $p \leq 0.1$.

In Table 11, the scores of the organizational performance of C1 are significantly lower than those of C2 and C3. C1 is the supportive firms and thus, some amount of advanced information must be provided. However, in terms of types of advanced information, except for nonfinancial information, there were no significant differences between C1 and C2. C2, as the semi-bureaucratic firms, has the lowest scores in the innovative and supportive culture. Accordingly, compared with the scores of the innovative and supportive culture in C1, the amount of advanced information produced in C1 may be smaller. These relatively lower scores of the amount of advanced information seem to cause the lowest organizational performance in C1.

From the above results, it is indicated that there are significant differences in organizational performance according to the variations in the amount of information across clusters. This conclusion implies that culturally appropriate information is more preferred and utilized in organizational learning, and consequently, the knowledge created through valid learning may contribute to the improvement of performance. Therefore, we can accept Hypothesis 3.

4.4 Impact of Culture and Information

This study employed a structural equation modeling technique to analyze causal relationships among research variables. AMOS 4.0 was utilized as the analytical tool to estimate the measurement and theoretical models [2]. So theorized, distinct causal paths from organizational culture and types of management accounting information predict alternative outcomes with respect to organizational performance. Figure 1 displays both the theoretical model structure corresponding to the hypotheses and the measurement model. Figure 1 also presents individual structural path estimates. In Figure 1, the ellipse and box represent the unobserved variable (theoretical variable) and the observed variable (measurement variable), respectively.

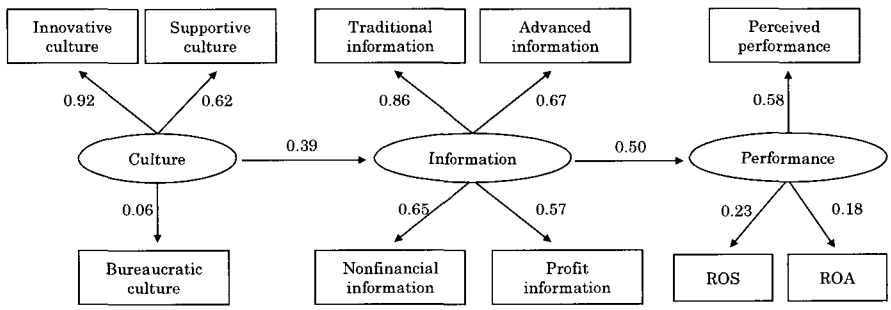

Figure 1. Structural path estimates

The observed χ^2 for the theoretical model was 82.8 (df=37; p=0.00). Although the significance (p–value) of χ^2 indicates a relatively poor fit between the model and the sample data, goodness of fit cannot be judged by χ^2 value alone. Since the p-value of χ^2 is sensitive to the sample size, a ratio of χ^2 to degrees of freedom (χ^2 value/degrees of freedom) can be employed as a fit index [10]. The χ^2 to degrees of freedom ratio in the range of 3 to 1 indicates an acceptable fit between the theoretical model and the sample data. The ratio of χ^2 to degrees of freedom was 2.2. Other indices of fit for the theoretical model are GFI (goodness of fit index) = 0.90, AGFI (adjusted goodness of fit index) = 0.84 and RMR (root mean square residual) = 0.062. GFI and RMR reflect the relative amount of the variances and covariances jointly accounted for by the model. However, there is no basic standard with which to evaluate them because their distributions are unknown [31]. Although a GFI value above 0.9 indicates a very good fit, GFI values around 0.8 also indicate an acceptable fit [52]. Therefore, the theoretical model in Figure 1 is judged to provide a moderate fit for the observed covariances.

Hypothesis 1 suggested that organizational culture significantly affects the amount of information provided. Consistent with this prediction, the path estimate between culture and the amount of information is significant (0.39, p=0.00). Thus, Hypothesis 1 is confirmed. Hypothesis 4 is also supported by a significant and positive relationship (0.50, p=0.00) between the amount of information and organizational performance. Hence, it is concluded that the differences in the amount of information according to organizational cultural forms can increase or decrease organizational performance. Table 12 shows these path estimates.

Table 12. Path coefficients of the theoretical and measurement models

Model	Path flow	Regression weights			Standardized regression weights
		Estimate	C.R.	p-value	
Theoretical model	Information ← Culture	0.43	3.56	0.00	0.39
	Performance ← Information	0.30	3.08	0.00	0.50
Measurement model	Innovative culture ← Culture	1.0*			0.92
	Supportive culture ← Culture	0.58	5.87	0.00	0.62
	Bureaucratic culture ← Culture	0.06	0.59	0.55	0.06
	Traditional information ← Information	1.0*			0.86
	Advanced information ← Information	0.81	7.85	0.00	0.67
	Nonfinancial information ← Information	0.71	7.54	0.00	0.65
	Profit information ← Information	0.69	6.34	0.00	0.57
	Perceived performance ← Performance	1.0*			0.58
	Return on sales ← Performance	0.04	1.65	0.09	0.23
	Return on assets ← Performance	2.38	1.30	0.19	0.18

*: Regression weight was set in 1.

5. CONCLUSION AND DISCUSSION

Prior research has argued that organizational culture as shared norms and values of people affects managers' preferences for specific information characteristics and ultimately, the design of ISs. However, the effects of organizational culture on the design of ISs have never been empirically confirmed. This study empirically investigated both cultural differences in the amount of information provided by MAIS, and the differences in organizational performance according to variations in the amount of information. First, according to the results of cluster analysis, we classified sample firms into five organizational cultural types: Semi-innovative, innovative, bureaucratic, semi-bureaucratic and supportive firms.

In the semi-innovative firms, the greater amount of the traditional and advanced types of information is produced. In bureaucratic firms, traditional information is much more provided than in the innovative, semi-bureaucratic and supportive firms. The amount of advanced information provided in the innovative firms is relatively greater. In the case of the semi-bureaucratic and supportive firms, except for nonfinancial information, there are no significant differences in the amount of information produced. However, the rankings of the amount of information provided are the lowest in semi-bureaucratic firms. A large amount of advanced types of information produced in innovative firms may be associated with innovative and supportive cultural characteristics. A greater amount of traditional information provided in bureaucratic firms may also be related with bureaucratic cultural characteristics. Thus, we confirmed cultural differences in the amount of information.

In terms of organizational performance, the rankings of semi-innovative firms, which have the highest scores in the amount of information provided, are also the highest. The scores of performance in innovative firms are generally next to those of the semi-innovative firms. However, basically, significant differences may not exist in the performance between innovative firms and bureaucratic firms, since a large amount of traditional information is provided in bureaucratic firms and relatively, the greater amount of advanced information is produced in innovative firms. The rankings of the performance of supportive firms are the lowest. Compared with the scores of the innovative and supportive culture of supportive firms, the smaller amount of advanced information produced in supportive firms seems to cause the lowest performance. This result suggests that the shortage of culturally appropriate types of information may give rise to invalid learning and thus, decrease organizational performance. Hence, this study dem-

onstrated performance differences according to variations in the amount of information.

With a structural equation modeling, we examined direct effects of culture on the amount of information as well as an impact of the amount of information on organizational performance. The results showed that culture has a significant positive impact on the amount of information, and the amount of information provided significantly and positively influences the increase of organizational performance. Based on these results, it is proposed that in the design of IS, a cultural approach must be employed to achieve an implementation success of IS. A cultural approach means that the cultural compatibility of the design of IS must be investigated and identified first of all since the IS that is culturally incompatibly designed cannot be accepted and utilized, and thus, results in a loss of organizational resource.

If the design of IS is not culturally compatible, there are two ways to obtain a culturally- matched IS design. One is by revising an IS design, and the other is undergoing a process to change organizational culture in advance. In revising or developing a new IS design, through user involvement with which user value assumptions become embedded into the new system's architecture, the IS design can be fitted with organizational culture. The methods of changing culture are very diverse. Bhimani suggested education, training, and group interaction and communication as some basic ways. The belief systems, such as performance measurement system, which define, communicate, and reinforce the basic values and goals for organization, can also be used to unlearn past norms, and infuse new values [59].

Limitations of this research, and future research efforts include: Our study was confined to MAIS. Thus, it is a little difficult to apply the results of this study to the design of general ISs. Future research must examine the effects of organizational culture on the design characteristics of general ISs. In this study, other contextual variables, such as environmental uncertainty, business strategy and technology, were not considered. It is likely that organizational culture interacts with other contextual variables, and thus, their interaction effects on the design of ISs are different from the impact of culture alone. We only considered the amount of information as a key characteristic of MAIS. There seems to be many other design variables of ISs that are influenced by organizational culture. Under diverse cultural settings, the differences in various design characteristics of ISs need to be investigated and identified. This study could not clearly demonstrate that if culturally inappropriate types of information are provided, a decrease in organizational performance is caused. It is expected that future studies will in-

vestigate and answer this question.

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