

Choe, Jong-min

## Article

# The strategic alignment of management accounting information systems, and organizational performance

Global Business & Finance Review (GBFR)

### Provided in Cooperation with:

People & Global Business Association (P&GBA), Seoul

*Suggested Citation:* Choe, Jong-min (2017) : The strategic alignment of management accounting information systems, and organizational performance, Global Business & Finance Review (GBFR), ISSN 2384-1648, People & Global Business Association (P&GBA), Seoul, Vol. 22, Iss. 4, pp. 50-64, <https://doi.org/10.17549/gbfr.2017.22.4.50>

This Version is available at:

<https://hdl.handle.net/10419/224385>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by-nc/4.0/>



# The Strategic Alignment of Management Accounting Information Systems, and Organizational Performance

Jong-min Choe

*Professor, School of Business, Kyungpook National University, Taegu, Republic of Korea*

## A B S T R A C T

Using structural equation modeling, this study empirically examined the causal relationships among the level of advanced manufacturing technology (AMT), facilitation of alignment, the degree of strategic alignment of management accounting information systems (MAIS), and the improvement of production performance. The causal relationships between MAIS strategic alignment and information characteristics of MAIS were also investigated. Results showed that the level of AMT has a significant and positive impact on alignment facilitation. A significant causal relationship between alignment facilitation and MAIS strategic alignment was also found. It was shown that under high degrees of MAIS strategic alignment, MAIS must provide broad-scope and integrated types of information. The causal relationships between MAIS strategic alignment and organizational performance were significant and positive. Thus, it is concluded that under high levels of AMT, high degrees of MAIS strategic alignment positively contribute to the improvement of a firm's production performance.

*Keywords: MAIS strategic alignment; Alignment facilitation; Information characteristics of MAIS; Production performance*

## I . Introduction

Strategic alignment of information systems (IS) has become an important research topic. Thus, many studies (e.g., Alina and Daniel, 2013; King and Teo, 1997; Wu, Straub, and Liang, 2015) have suggested definitions and types of IS strategic alignment and investigated its impact on performance. Das, Zahra, and Warkentin (1991) have suggested a framework that links strategic IS planning and business strategy,

and relates it to company performance. Alina and Daniel (2013) defined the strategic alignment of IS as a collaborative process among business strategy, business organization, and IS infrastructure and strategy. King and Teo (1997) proposed four types (i.e., degrees) of alignment: administrative, sequential, reciprocal, and full integration. They also empirically examined and demonstrated the positive effects of the degrees of alignment on organizational performance. Wu, Straub, and Liang (2015) defined IS strategic alignment as the fit between business strategy and IS strategy. They confirmed the positive impact of IS strategic alignment on business performance.

In investigating the effects of IS strategic alignment on performance, some prior studies did not consider contingency variables that may influence the strategic

Received: Jun. 20, 2017; Revised: Oct. 16, 2017; Accepted: Nov. 17, 2017

† Jong-min Choe

Professor, School of Business, Kyungpook National University,  
Taegu, Republic of Korea

Tel. +82-53-950-5445 E-mail: [choejj@knu.ac.kr](mailto:choejj@knu.ac.kr)

alignment of IS. Rather, they focused on the alignment between IS strategy and business strategy without considering the causal factors of alignment. It is generally assumed that the advanced manufacturing technology (AMT) adopted by manufacturing firms requires a high level of strategic alignment of management accounting information systems (MAIS) (Banker, Bardhan, and Chen, 2008; Fullerton, Kennedy, and Widener, 2013). However, the causal relationships between AMT, strategic alignment of MAIS, and organizational performance have not been empirically examined.

In examining the impact of IS strategic alignment on organizational performance, previous research has considered the overall IS. Thus, in most previous studies, only macro measures of organizational performance, such as market growth, return on sales, return on investment, and company reputation, were considered. However, the overall IS are composed of many types of sub-IS. There exist wide differences in the actual degree of strategic alignment according to the type of sub-IS (Tallon, 2011). The level of strategic alignment of the overall IS seems to be the mixed results of the strategic alignment of various types of sub-IS. Accordingly, it may be more appropriate to investigate the impact of sub-IS strategic alignment on performance. In prior studies, the effects of sub-IS (i.e., MAIS) strategic alignment have never been examined.

In aligning IS with business strategy, there are many facilitating activities (i.e., alignment facilitation) (Preston and Karahanna, 2009). Thus, using structural equation modeling, the current study empirically investigated and analyzed the causal relationships between AMT, MAIS strategic alignment, facilitation of alignment, and organizational performance. The present study also examined and identified relevant information characteristics of MAIS when the level of MAIS strategic alignment is high. Hence, the results of this study can answer the following research questions: Is the degree of MAIS strategic alignment different according to the levels of AMT?; Under high levels of AMT, does a high degree of MAIS strategic alignment really lead to increased performance?;

What are the roles of alignment facilitation when the level of AMT is high?; What are relevant information characteristics of MAIS when the degree of MAIS strategic alignment is high?

## II. Theoretical Underpinnings and Hypotheses

### A. AMT and MAIS Strategic Alignment

AMT relates to the physical hardware of the manufacturing process and is defined as consisting of technological advancements in automation that is used in the production process (Wagner, Moll, and Newell, 2011). AMT allows an organization to obtain production systems with many forms of flexibility (Rao and Bargerstock, 2011). Because of these forms of flexibility, AMT brings various strategic benefits, such as quality improvement, economies of scope, and shortened lead and delivery times. AMT, which provides diverse tangible and intangible benefits, is regarded as the premiere competitive weapon to achieve manufacturing and business goals (Fullerton, Kennedy, and Widener, 2013). Since manufacturing capabilities are more central to determining the strategic position of a firm, the strategic importance of AMT is also enormous (Fullerton, Kennedy, and Widener, 2013). This strategic consequence requires the consideration of AMT as a key variable in the formulation and implementation of business strategy. The adoption and configuration of AMT must be closely aligned with manufacturing and business strategy.

In implementing AMT, the planning, control and evaluation of production activities through the provision of information are the most important roles of MAIS (Wagner, Moll, and Newell, 2011). MAIS collect, classify, summarize, and report information to managers to assist them in their control of production activities. Adopting only AMT does not guarantee higher production performance. According to the complementary theory, the successful implementation of AMT requires complementary MAIS (Milgrom and Roberts, 1995).

MAIS that are not matched with AMT are likely to cause poor production performance. The notion of complementarity implies that MAIS can interact with AMT to produce higher performance than would be achieved by AMT alone (Sim and Killough, 1998).

Sim and Killough (1998) developed a formal optimizing model in which AMT, business strategy and MAIS assist firms to maximize their expected profits. The essential element of their thesis is that profitability is maximized when strategy, AMT, and MAIS are clustered in a way that exploits potential complementarities between them. They predict that profitable firms develop linkages among business strategy, AMT, and MAIS to include: Flexibility or differentiation strategy, high levels of AMT, and strategically aligned MAIS. They claim that there are synergies in employing complementary choices of strategy, AMT and MAIS, which enhance profitability. They point out that firms failing to achieve complementary relationships among strategy, AMT, and MAIS are likely to encounter serious economic losses.

MAIS must be complementary to AMT to realize the strategic benefits of AMT and to attain higher production performance (Milgrom and Roberts, 1995; Sim and Killough, 1998). MAIS must fit with the strategically important position of AMT. Thus, MAIS should also be linked to the goals and strategies of business or manufacturing. To support and evaluate the achievement of the strategic advantages of AMT, the design and development strategy of MAIS must be aligned with the firm's strategy set, such as business strategy, mission, and objectives. In conclusion, MAIS have to serve the implementation of AMT as well as business strategy. MAIS, which are designed in that way, can be used to encourage employees to behave in accordance with a firm's business strategies.

For example, it has been argued that financial performance measures, which are one design element of MAIS, lack relevance to AMT in that they do not reflect and are inconsistent with the strategic factors of quality, flexibility, and dependability of supply. To support and evaluate realization of the strategic benefits of AMT, MAIS must provide non-financial performance information that reflects and is aligned with strategic

goals (Gates and Germain, 2015; Honggowati, Aryani and Rahmawati, 2015). Bouwens and Abernethy (2000) empirically found that the production systems of customization, which is the strategic focus of a firm, affect the design of MAIS. The results of their study indicated that under high customization systems, MAIS must provide types of customer or market related broad scope and aggregated information, which also reflect the strategic orientation of a firm.

Banker, Bardhan, and Chen (2008) empirically showed that under high degrees of AMT, the use of activity-based costing more contributes to the improvement of plant performance than under low levels of AMT. Based on the complementarity theory, they suggested that activity-based costing is a strategically more suitable mechanism to control and monitor the implementation of AMT. Accordingly, a high level of AMT, which generally demands a large amount of investment and which is strategically more important than a low level of AMT, may require a closer integration or alignment with the business strategy. As a result, under a high level of AMT, a high degree of integration between MAIS planning and business strategic planning may be also needed. Based upon these arguments, we can formulate as follows:

- HI.** The level of AMT adoption has a positive impact on the degree of MAIS strategic alignment.

## **B. MAIS Strategic Alignment and Alignment Facilitation**

To achieve the alignment of MAIS with business strategy, we can refer to means of IS strategic alignment. Cohen (2008), and Preston and Karahanna (2009) surveyed many firms to investigate the critical factors which are thought to influence the alignment of IS with strategy. Based on the responses of the IS and general managers, they broadly suggested five important factors. They include educating upper managers, upper managers' commitment to IS, business objectives for IS, IS manager involvement in strategic planning process, and educating IS management about

business goals. Chen (2010), and Wu, Straub, and Liang (2015) also empirically reported on the organizational policies and practices that contribute to the alignment. These comprise the firm's experience with IS planning, clarity and consistency in strategic orientation, the interaction between business and IS managers, and the IS understanding of the business managers.

For the alignment of MAIS with business strategy, mechanisms composed of similar elements, which were suggested by Cohen (2008) and Preston and Karahanna (2009), are needed. Alignment with strategy is a collaborative process among business strategy, organization, and the components of MAIS (Alina and Daniel, 2013; Budiman and Wijaya, 2016). The participation of management accountants in the strategic planning process, the clarity of the business strategic orientation, the management accountants' collective understanding of business goals, the education of management accountants about the business and manufacturing strategies, and so forth may be primary ways to attain alignment. These facilitating activities enhance and contribute to the alignment of MAIS with business strategy. The success of aligning MAIS with business strategy is dependent on the conditions of this facilitation (Cohen, 2008; Chen, 2010). Therefore, it seems that to attain successful MAIS strategic alignment, the facilitation must be arranged first according to the level of AMT.

When the level of AMT is high, facilitation of alignment must be well-coordinated to obtain high degrees of MAIS strategic alignment. If the facilitation is poorly prepared, a strategic MAIS planning process may not proceed. Hence, conditions of alignment facilitation may be a proxy indicator of the degree of alignment. However, under a low level of AMT, since the degree of MAIS strategic alignment is also low, well-coordinated facilitation may not be required. Based upon this reasoning, we can propose as follows:

- H2.** The level of AMT adoption positively influences alignment facilitation.
- H3.** Alignment facilitation has a positive impact on the degree of MAIS strategic alignment.

### C. MAIS Strategic Alignment and Information Characteristics

In most IS design research (e.g., Choe, 2004; Tillema, 2005), three information dimensions (i.e., information scope, timeliness, and integration) are considered as the key design variables of IS. Narrow-scope information tends to be concerned with events within the organization, and results in data that are financial and historic. Alternatively, broad-scope information includes external, non-financial, and future-oriented material. Timeliness is usually specified in terms of the ability to provide information on request and the frequency of reporting. Information integration deals with a variety of ways to collect or sum the data within periods of time or areas of interest, such as responsibility centers or functional areas. Information characteristics of MAIS that are aligned with business strategy can be inferred from the information characteristics of strategic IS.

Since business strategic planning is a highly uncertain and complex task, timely and aggregated types of information are required to support the strategic planning process (Jermias and Gani, 2004; Choe, 2016). Hence, to influence and support the formulation and implementation of a business strategy, MAIS must provide broad-scope, aggregated, and non-periodic types of information (Kober, Ng, and Paul, 2007). Tillema (2005) and Wiersma (2008) empirically confirmed the positive relationship between highly uncertain tasks and broad-scope, timely, and integrated types of information. Jorgensen and Messner (2010) also indicated that MAIS which are integrated with business strategy provide external, future-oriented, aggregated, and broad-focused types of information. Thus, it is likely that when the degree of MAIS strategic alignment is high, to support the implementation of manufacturing or business strategy and the achievement of strategic goals, MAIS also must provide broad-scope, timely, and integrated types of information. Based upon these arguments, we can propose that:

- H4.** The degree of MAIS strategic alignment positively influences the provision of broad scope, timely, and integrated types of information.

## D. Impact on Organizational Performance

Aligning IS with business strategy is a means that appropriately considers business objectives or strategies in strategic IS planning (Teubner, 2007; Chen, 2010). IS strategic alignment helps to ensure that the IS function supports organizational goals and activities at every level by identifying critical applications for development and ensuring that adequate resources are allocated to critical applications. Therefore, it is a way for a firm to secure competitive advantages from IS applications. Mithas and Rust (2016) also suggested that the fit between IS planning and business strategy creates synergy through the coordination of different functions, leading to competitive advantage and, ultimately, to superior performance.

Wu, Straub, and Liang (2015) empirically showed the positive effects of IS and strategy alignment on financial returns. Leidner, Lo, and Preston (2011), and Nianxin et al. (2012) empirically demonstrated that IS strategic alignment has a positive effect on market growth and innovation but a negative impact on company reputation. Cohen (2008) also confirmed that organizational performance is different according to the degree of IS strategic alignment. Sabherwal and Jeyaraj (2015) found a circular relationship between IS strategic alignment and IS success (i.e., business performance). They argued that aligning IS with business strategy improves organizational performance and, conversely, that increased performance contributes to achieving high degrees of IS strategic alignment. Accordingly, if MAIS planning is not coordinated with manufacturing or business strategy, it is likely that it will be very difficult for MAIS to support business strategies and to contribute to the achievement of strategic goals. It is assumed that the degree of MAIS strategic alignment also has a positive impact on organizational performance. Hence, we can suggest that:

- H5.** The degree of MAIS strategic alignment has a positive effect on organizational performance.

## III. Research Methods

### A. Sampling and Data Collection

Data for this study were drawn from a survey of the current status of MAIS used in Korean manufacturing firms. 500 organizations were randomly selected from a population of approximately 1,000 firms that are listed on the Korean stock market. In this study, interval random sampling technique was used. The manufacturing firms listed are medium to large in size and consequently are likely to have more experience with MAIS and AMT applications than are smaller firms. A medium-sized firm usually means that its number of employees is between 300 and 500. Large-sized firms imply that their number of employees is more than 500. Data were collected by a survey questionnaire administered to chief factory accountants. Only chief factory accountants were selected as respondents, since they understand both the degree of MAIS strategic alignment and the firm's AMT level and performance.

In order to collect data, questionnaires were administered to the participating firms. We pre-tested our Korean questionnaires by asking three professionals in the information systems areas to assess its logical consistency, ease of understanding, and sequence of items, etc. Based on the collected comments, we made several minor modifications in the wording and readjusted the item sequence. For the validation of the questionnaires, a pilot study was also conducted with the accountants of four manufacturing firms. Through the pilot test, the instrument was refined again to improve respondents' comprehension and to adapt the questions they found unclear.

An initial letter was sent to the chief factory accountant of each firm explaining the nature and purpose of the research. About 1 week 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. A total of 131 responses were returned. However, five responses were excluded from the study because of incomplete data. Finally, 126 usable

**Table 1.** Sample characteristics

Type of industry	Chemical industry	Machine industry	Auto-mobile	Electronic industry	Textile	Food	Paper & pulp	Non-metal	Metal industry	Total
No. of firms	24	11	16	28	8	9	12	10	8	126
No. of employees		Below 300	300 - 500	500 - 1,000	1,000 - 5,000	5,000 -	Total			
No. of firms		35	19	30	29	13	126			

data were collected yielding a response rate of 25%. The response rate was a little low. Thus, we tested that there exist any differences between the sample firms (126 firms) and the other non-sample firms (374 firms). The results of t-test and  $\chi^2$  test showed that no significant differences exist in total assets ( $t=0.2$ ,  $p=0.8$ ), total sales ( $t=1.0$ ,  $p=0.27$ ), and the distribution of industrial types ( $\chi^2=4.2$ ,  $p>0.2$ ). The survey was conducted during a 4-month period between October 2015 and February 2016. Table 1 summarizes the sample characteristics according to the industrial type of the firms.

To test non-response bias, the final sample was partitioned into two groups according to 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 ( $t=0.83$ ,  $p=0.4$ ), AMT level ( $t=1.27$ ,  $p=0.21$ ), degrees of MAIS strategic alignment ( $t=-0.72$ ,  $p=0.46$ ), sales volume ( $t=1.22$ ,  $p=0.22$ ), and organizational age ( $t=-1.1$ ,  $p=0.25$ ).

## B. Measurements

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 (1987) 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 amount of automated stand-alone equipment, low level of integration, high level of integration, linked islands, and full integration. Since

low-automated manufacturing firms in Korea are very dissimilar in terms of the amount of stand-alone equipment employed (Korea Production Committee, 2013), the first stage (i.e., the stand-alone stage) was subdivided into three stages according to the number of pieces of unitary equipment. In the second step (i.e., the cells stage), the level of integration was divided into low and high (Meredith and Hill, 1987). Hence, the second step was also subdivided into two stages in accordance with the level of 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.

Degree of MAIS strategic alignment is defined as the degree of integration of MAIS planning with business strategic planning (Chen, 2010). King and Teo (1997) developed a four-stage model of MAIS strategic integration: administrative, sequential, reciprocal, and full integration. In the present study, this four-stage model was used to measure the degree of MAIS strategic alignment. This study also measured the degree of fit between MAIS planning and business strategic planning with two questionnaire items to prove the external validity of the four-stage model. The two question items address the degree of the fit between MAIS planning and business strategic planning, and the degree of the reflection of MAIS planning in business strategic planning. The degree of fit was measured on a seven-point Likert-type scale. In a seven-point Likert-type scale, '1' means very low degrees of fit or reflection, and '7' implies very high degrees of fit or reflection.

Among various information characteristics, orientation, time horizon, frequency, focus, aggregation, financial/non-financial, quantitative/qualitative, and periodic/non-periodic were specifically selected. Orientation

determines whether data items report primarily internal or external facts. Time horizon defines whether data items are ex-post, reporting what has happened, or ex-ante, reporting what is expected to occur. Frequency represents how many times the reports are produced in a given period. Focus shows whether data items are broad and diffuse or specific and narrow. Aggregation shows whether the reports contain too little or too much detail. Financial information is expressed in monetary terms. Quantitative information is expressed in numeric terms. Periodic/non-periodic addresses whether data items are to be reported periodically, or at any undetermined time. In this study, the actual information characteristics of MAIS were measured on a seven-point Likert-type scale.

In measuring facilitation of alignment, nine factors that enhance and contribute to alignment were considered (Cohen, 2008; Preston and Karahanna, 2009). These were: MAIS manager's understanding of business strategy, MAIS manager education about business goals and objectives, MAIS manager involvement in business strategic planning, upper management's understanding of MAIS strategy, upper management education about MAIS strategy, user participation in MAIS planning, upper management commitment to MAIS, ability of MAIS management to keep up with advances in information technology, and MAIS responsiveness to user needs. Using these factors, nine questions were developed and measured on a set of seven-point Likert-type scale.

Since MAIS strategic alignment contributes to the realization of the strategic advantages of AMT, this study measured the improvement in production performance through AMT and the financial performance using two variables: (1) return on assets (ROA) and (2) return on sales (ROS). Using the 19 questionnaire items developed by Agarwal (1997), the degrees of improvement in production performance were measured on a seven-point Likert-type scale that ranged from 'Not improved, worse' to 'Highly improved.' The 19 items comprise improvements in four dimensions, such as cost, quality, flexibility and dependability of supply, which are the core elements of production performance in AMT. The 19 items were: new product,

product volume, speed in new products, product changeover, and R&D (five items for flexibility), lead time, delivery, production lead time, and customer requirements (four items for dependability of supply), product performance, product durability, specifications, design and engineering, product features, and perception of quality (six items for quality), production cost, material cost, labor cost, and overhead cost (four items for cost). Accounting data to compute ROA and ROS were collected from the firms' balance sheets and income statements for 2015, which were provided in the Korean annual reports of listed companies.

## IV. Results

### A. Reliability and Validity Test

The questionnaire items measuring research variables have been used in previous empirical studies. However, the construct validities of these items were questionable. Principal Factor (component) analysis with varimax rotation was used to determine if all items measuring a construct cluster together or not. To execute factor analysis, the number of samples must be four or five times of the question items used in the survey (Hair et al., 2005). In this study, 36 questionnaire items were utilized. When the number of samples is smaller than four or five times of the question items, separate joint factor analysis can be employed. Two separate joint factor analyses for alignment facilitation, information characteristics, and production performance were carried out to acquire a more stable solution by increasing the ratio of the sample size to the number of items.

Using the 0.4 criterion for significant item loading on a factor, the results show that in the cases of information characteristics and production performance, three factors with Eigen values greater than one were extracted, respectively. However, in terms of information characteristics, item 4 (time horizon) of factor 1 was confounded with the items of factor 2. Item 4 was removed and the factor analysis was repeated. In



this second factor analysis, the items of each factor were not confounded with the items of the other factors. Factor 1 comprises quantitative/qualitative, financial/non-financial, and orientation. Thus, its title is information scope. Factor 2, which is composed of focus and aggregation, represents information integration. Factor 3, which includes frequency and periodic/non-periodic, entails information timeliness.

In the case of production performance, in factor 1, items 6 (lead time) and 8 (customer requirements) were confounded with the items of factor 2. Thus, items 6 and 8 were removed. In the second analysis, no item was confounded. Factor 1 (delivery, product performance, product durability, specifications, design and engineering, product features, and quality) represents quality and dependability of supply. Factor 2 (production lead time, production cost, material cost, labor cost, and overhead cost) represents cost reduction. Factor 3

(new product, product volume, speed of new product, product changeover, and R&D) shows increased flexibility. The results of our final factor analysis are presented in Table 2. From these results, it is confirmed that the construct validities of each variable are very high.

To prove the external validity of the four-stage model (i.e., the measure of the degree of MAIS strategic alignment), we employed Pearson correlation analysis. The correlation coefficient between the four-stage model and the degree of fit (i.e., the fit between MAIS planning and business strategic planning) was 0.56 (p=0.00). Thus, it is concluded that the instrument for the degree of MAIS strategic alignment has external validity. A single scale for the research variable was created by averaging a respondent's scores over the items measuring each variable. The Alpha coefficient, mean, and standard deviation for the research variables were calculated and are summarized

**Table 2.** Factor loadings of research variables (Varimax rotation)

Production performance	Factor			Alignment facilitation	Factor			
	1	2	3		1	2	3	4
1			0.84	1	0.59			
2			0.61	2	0.84			
3			0.80	3	0.73			
4			0.75	4	0.79			
5			0.69	5	0.84			
6	0.68			6	0.77			
7		0.66		7	0.85			
8	0.82			8	0.72			
9	0.89			9	0.82			
10	0.81			Information characteristics				
11	0.70			1		0.73		
12	0.63			2		0.81		
13	0.69			3		0.70		
14		0.84		4				0.81
15		0.73		5				0.86
16		0.87		6				
17		0.80		7				
Eigen value	8.9	1.7	1.4		6.0	2.0	1.4	1.1
% of variance	52.3	10.2	8.4		38.5	12.5	9.0	6.6

\* Factor loadings below 0.4 were not presented.

**Table 3.** Summary statistics of research variables

Variables	Mean	Standard deviation	Minimum	Maximum	Alpha
Level of AMT	3.5	1.7	1.0	7.0	-
MAIS strategic alignment	2.3	0.8	1.0	4.0	-
Information scope	2.7	0.9	1.0	5.0	0.78
Information timeliness	3.1	1.2	1.0	7.0	0.79
Information integration	4.5	1.3	1.0	7.0	0.86
Alignment facilitation	4.6	1.1	1.0	6.3	0.93
Quality and dependability of supply	5.2	0.8	3.2	7.0	0.92
Cost reduction	5.1	0.9	2.6	7.0	0.91
Increased flexibility	4.8	0.7	2.4	6.8	0.88
Return on assets (ROA, %)	19.5	18.8	-25.0	58.8	-
Return on sales (ROS, %)	18.5	14.4	-21.8	66.9	-

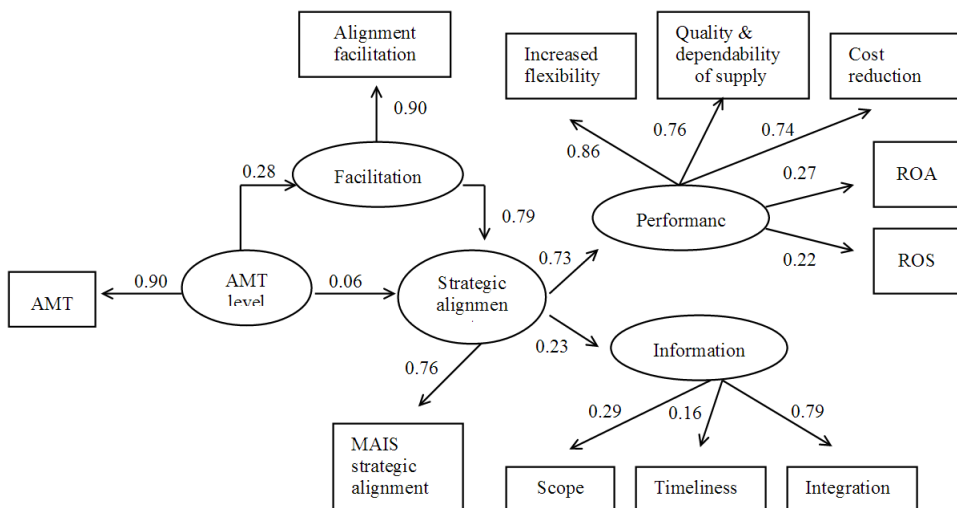
in Table 3.

**B. Analysis of Causal Relationships**

This study employed a structural equation modeling technique to analyze causal relationships among research variables. AMOS 11.0 was utilized as the analytical tool to estimate the measurement and theoretical models. As theorized, distinct causal paths from AMT level, alignment facilitation and MAIS strategic alignment predict alternative outcomes with

respect to both organizational performance and information characteristics. Figure 1 displays both the theoretical model corresponding to the hypotheses and the measurement model. Figure 1 also presents individual structural path estimates.

The observed  $\chi^2$  for the theoretical model was 149.83 (df=53, p=0.00). Although the significance (p-value) of  $\chi^2$  indicates relatively poor fit between the model and the sample data, goodness of fit cannot be judged by  $\chi^2$  value alone. Since the p-value of  $\chi^2$  is sensitive to sample size, the ratio of  $\chi^2$  to degrees of freedom ( $\chi^2$  value/degrees of freedom) can be



**Figure 1.** Structural Path Estimates

employed as a fit index (Arbuckle and Wothke, 1999). A  $\chi^2$  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  $\chi^2$  to degrees of freedom was 2.8. Other indices of fit for the theoretical model are GFI= 0.87, AGFI= 0.82, NFI= 0.78, IFI= 0.80, CFI= 0.89, and RMR= 0.07. Although GFI above 0.9 indicates a very good fit, GFI around 0.8 also indicates an acceptable fit (Ping, 1993). Therefore, the theoretical model in Figure 1 is judged to provide a moderate fit for the observed co-variances.

Hypothesis 1 suggested that AMT level positively affects the degree of MAIS strategic alignment. However, contrary to this prediction, the path estimate between AMT level and MAIS strategic alignment is non-significant (0.06,  $p>0.4$ ). Thus, Hypothesis 1 is disconfirmed. Hypothesis 2 is supported by a significant and positive relationship (0.28,  $p<0.1$ ) between AMT level and alignment facilitation. Hypothesis 3 concerns the outcome resulting from the impact of alignment facilitation. Consistent with

Hypothesis 3, the path predicting a relationship between alignment facilitation and MAIS strategic alignment is significant and positive (0.79,  $p<0.00$ ). Hence, high levels of AMT require well-coordinated alignment facilitation and, subsequently, well-coordinated alignment facilitation positively contributes to the attainment of high degrees of MAIS strategic alignment.

Hypotheses 4 and 5 proposed direct effects of MAIS strategic alignment on information characteristics and organizational performance. Hypothesis 4, predicting a positive impact of MAIS strategic alignment on information characteristics, is supported by a corresponding path estimate of 0.23 ( $p<0.1$ ). Thus, under high degrees of MAIS strategic alignment, broad-scope and integrated types of information must be provided. The path estimate representing Hypothesis 5 (0.73,  $p<0.00$ ) is also consistent with the prediction suggesting that the degree of MAIS strategic alignment positively contributes to improvement of performance. Table 4 shows these path estimates.

**Table 4.** Path coefficients of the theoretical and measurement models

Model	Path flow	Regression weights			Standardized
		Estimate	C.R.	p value	regression weights
Theoretical model	Facilitation → AMT level	0.16	1.82	0.06	0.28
	Strategic alignment → AMT level	0.02	0.74	0.40	0.06
	Strategic alignment → Facilitation	0.51	7.95	0.00	0.79
	Information → Strategic alignment	0.13	1.67	0.09	0.23
	Performance → Strategic alignment	0.69	5.81	0.00	0.73
Measurement model	AMT → AMT level	1.0*			0.90
	Alignment facilitation → Facilitation	1.0*			0.90
	MAIS strategic alignment → Strategic alignment	1.0*			0.76
	Scope → Information	1.0*			0.29
	Timeliness → Information	1.19	1.26	0.20	0.16
	Integration → Information	6.19	1.69	0.09	0.79
	Quality & dependability of supply → Performance	1.0*			0.76
	Cost reduction → Performance	1.08	7.09	0.00	0.74
	Increased flexibility → Performance	1.02	7.97	0.00	0.86
	ROA → Performance	8.28	2.51	0.01	0.27
	ROS → Performance	5.23	2.07	0.03	0.22

\*: Regression weight was set in 1

### C. Fit among AMT, Facilitation, and Strategic Alignment

In structural equation modeling, the causal relationship between the level of AMT and MAIS strategic alignment was not confirmed. Thus, we examine the effects of the fit among AMT, facilitation, and strategic alignment on organizational performance. Through this examination, we can show that if the level of AMT is high, both well-arranged facilitation and a high degree of strategic alignment can lead to improved performance. As it were, we indirectly analyze the relationships between AMT, facilitation, and strategic alignment to attain high performance.

Van de Ven and Drazin (1985) outlined three approaches to analyze data based on alternative definitions of fit. They include: Selection, interaction, and systems. Researchers have been critical of the selection and interaction approaches, arguing that they only provide partial depictions of relationships between variables of interest. The systems approach takes a holistic view of fit by considering internal consistency among multiple variables. In this study, a systems approach is employed because there are various combinations of the level of AMT, facilitation, and the degree of strategic alignment to enhance or decrease organizational performance. In the current study, cluster analysis was adopted as the systems approach to fit analysis. Cluster analysis provides clusters of companies that are similar in levels of AMT, conditions of facilitation, and degree of strategic alignment. In the cluster analysis, this study used the hierarchical agglomerative method for forming the clusters. As the sorting or linkage rules, Ward’s method was chosen. We also used the squared Euclidean distance as the proximity measure.

Based on the values of the level of AMT, facilitation,

and the degree of MAIS strategic alignment, cluster analysis was performed to produce clusters of organizations. Additionally, the average organizational performance was 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 to 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. In Table 5, the distance coefficient increases greatly at two points - between the sixth and seventh clusters and between the fourth and fifth clusters. This implies that the five-cluster and seven-cluster solutions may be appropriate points for analysis. However, the seven-cluster solution is a little large in terms of the number of clusters. The five-cluster result provides sufficient data to examine the variations in performance, which were caused by the various combinations of the AMT level, facilitation and strategic alignment. Therefore, the five-cluster solution was used in the analysis.

The mean ranks of variables within each cluster are presented in Table 6, along with Kruskal-Wallis test results ( $\chi^2$  values) for each clustering variable. The  $\chi^2$  values show that statistical differences exist for individual variables across clusters. In the case of C3, the level of AMT is the highest (i.e., ranked first), and both the score of facilitation and the value of strategic alignment are also high (i.e., ranked first). Thus, C3 is solid in terms of organizational performance. By contrast, in C5, although the level of AMT is relatively high (i.e., ranked second), the value of facilitation and the degree of strategic alignment are lower (i.e., ranked fourth). In terms of facilitation,

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

Stage	118	119	120	121	122	123	124	125	126
Coefficient	50.6	57.2	64.3	77.3	90.8	118.3	154.2	250.1	376.3
Increasing rate	-	13.0%	12.4	20.2	17.4	30.2	30.3	62.1	50.4
No. of cluster	9	8	7	6	5	4	3	2	1

**Table 6.** Mean ranks of research variables within clusters

Variables	Clusters	Five clusters					$\chi^2$
		C1 (n=31)	C2 (n=28)	C3 (n=21)	C4 (n=27)	C5 (n=19)	
Level of AMT		17.5(5)	46.9(3)	67.9(1)	28.9(4)	62.7(2)	56.8 <sup>a</sup>
MAIS strategic alignment		44.0(2)	43.5(3)	52.3(1)	9.2(5)	12.5(4)	35.5 <sup>a</sup>
Facilitation		38.3(3)	48.8(2)	59.2(1)	8.9(5)	12.5(4)	41.9 <sup>a</sup>
Quality & dependability of supply		35.6 (3)	46.8 (2)	56.1 (1)	11.3 (5)	23.8 (4)	28.9 <sup>a</sup>
Cost reduction		34.2 (3)	45.3 (2)	61.3 (1)	18.7 (4)	16.7 (5)	28.6 <sup>a</sup>
Increased flexibility		32.3 (3)	45.5 (2)	59.5 (1)	17.8 (5)	19.4 (4)	27.0 <sup>a</sup>
ROA		38.2 (2)	37.0 (3)	41.2 (1)	37.0 (3)	27.4 (5)	1.8
ROS		40.9 (2)	32.4 (4)	41.0 (1)	38.2 (3)	27.8 (5)	3.5

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

the difference between C3 and C5 was examined using the Mann-Whitney test and found to be significant at the 1% level. In terms of the degree of strategic alignment, the difference between C3 and C5 was also significant (i.e., the difference was examined using the Mann-Whitney test). As a result, the organizational performance of C5 seems to decrease. In terms of organizational performance, the differences between C3 and C5 were examined using the Mann-Whitney test and found to be significant at the 1% and 5% levels. These results confirm that at a high level of AMT, a high degree of MAIS strategic alignment along with well-coordinated facilitation can increase the firm's performance. Hence, to achieve increased performance, high levels of AMT must lead to well-arranged facilitation as well as a high degree of MAIS strategic alignment.

In the case of C1, the level of AMT is very low compared with the scores of facilitation and strategic alignment. The difference between AMT level for C1 and C4 was examined using the Mann-Whitney test and found to be significant at the 10% level. However, the rankings of strategic alignment and facilitation are considerably higher. In terms of strategic alignment and facilitation, the differences between C1 and C4 were significant at the 1% level. Because of the misfit among AMT level, degree of strategic alignment and facilitation, the organizational performance of C1 is likely to be a little low. From

these results, it is likely that under a low level of AMT, if the degree of MAIS strategic alignment is excessively high and the facilitation is very well-arranged, then the performance of a firm may decrease. The AMT level of C2 is a little lower than that of C3 (i.e., the difference was significant at the 5% level). In the degree of strategic alignment and the facilitation, the scores of C2 are slightly lower than those of C3 (i.e., the differences were significant at the 10% level). In C2, there are proper matches among AMT level, strategic alignment, and facilitation. Thus, the organizational performance of C2 is moderately high (i.e., ranked second). From these results, we can put forth the following conclusion: according to the level of AMT, the proper degree of strategic alignment and proper conditions of facilitation must be attained and maintained together to achieve a high degree of organizational performance.

## V. Conclusion and Discussion

### A. Research Conclusion

This study focused on the strategic alignment of such sub-IS as MAIS. Using structural equation modeling, this study examined the causal relationships among AMT level, degrees of MAIS strategic alignment,

alignment facilitation, information characteristics of MAIS, and organizational performance. The results showed that there is no significant causal relationship between AMT level and MAIS strategic alignment. However, through cluster analysis, we confirmed that at a high level of AMT, a high degree of MAIS strategic alignment along with well-coordinated facilitation can increase the firm's performance. In addition, we found that the level of AMT significantly and positively influences alignment facilitation. A significant causal relationship between alignment facilitation and MAIS strategic alignment was also found.

From these results, we can suggest that under high levels of AMT, well-coordinated alignment facilitation is required and, consequently, it contributes to the increase of the degree of MAIS strategic alignment. The relationships between MAIS strategic alignment and information characteristics of broad-scope and integration were found to be significant and positive. Hence, according to the results, it is concluded that under high degrees of MAIS strategic alignment, MAIS must provide broad-scope and integrated types of information. These types of information are required to support the formulation and implementation of business strategy and the realization of strategic goals. The causal relationship between MAIS strategic alignment and organizational performance was significant and positive. Thus, it is proposed that under high levels of AMT, a high degree of MAIS strategic alignment positively contributes to the improvement of production performance.

## **B. Practical Implications and Future Research Efforts**

From the results of this study, we can suggest some practical implications. First, in adopting high levels of IS strategic alignment to improve a firm's performance, contextual variables, such as external environments and AMT, which affect the degrees of IS strategic alignment, must be considered. If contextual variables of a firm do not require high levels of IS strategic alignment, a firm generally

pursues defensive strategies based on high efficiency and cost effectiveness, and thus, a high degree of IS strategic alignment in the firm, which provides opportunities for strategic IS applications, may be a costly luxury. Second, under high degrees of AMT, complementary sets of MAIS strategic alignment, alignment facilitation, and information characteristics of MAIS have to be totally prepared. If one of these elements is not properly developed, this misfit impairs and reduces the synergistic effects of AMT and MAIS. Third, to develop the alignment facilitation of a firm, interactions, communications, and coordination between IS department and other departments must be frequently occurred. Shared understanding and recognition about strategic goals of a firm among employees of IS department and other departments are needed to construct a high degree of alignment facilitation. Finally, in manufacturing firms, to employ a high level of AMT is the strategic decision of a firm. Thus, the changes of MAIS according to the adoption of AMT have to be strategically planned and executed in advance.

This study only considered the level of AMT as a contingency variable that affects MAIS strategic alignment. There are many other contextual variables, such as environment and organizational culture, which may influence the degree of IS strategic alignment. In future research, various contingency variables have to be included simultaneously to determine the key contingency variable that explains the variations in the degree of IS strategic alignment. In measuring the level of AMT, we used the seven-stage model. The seven-stage model can be considered as an objective measurement. However, if the seven-stage model is the subjective measure of AMT level, its scale is near to ordinal scale, and, thus, it cannot be utilized in parametric analyses techniques. Although, in prior studies, the seven-stage model has been used in parametric analyses techniques, there is a problem in the use of the seven-stage model. It is the limitation of our research to utilize the seven-stage model. In future study, objective measurement to measure the AMT level must be developed.

The dimensions of organizational performance, which are influenced by sub-IS strategic alignment,

may differ according to the type of sub-IS that is aligned with the business strategy. Therefore, in investigating the impact of sub-IS strategic alignment, various types of sub-IS must be empirically examined while considering the relevant performance dimensions. If the positive effects of the strategic alignment of a particular sub-IS on specific performance dimensions are proven, ways to improve specific dimensions of organizational performance through the strategic alignment of IS can be proposed. In future research, to empirically examine various types of MAIS information such as planning and control, and non-financial performance information that are required under high levels of AMT is also needed. Because of a little small sample size, in the results of this study, the power or significance level was not high. These are limitations of this study. Along with small sample size, the low response rate is also the limitation of this study.

## Acknowledgement

This study was supported by 2016 Kyungpook National University (2016 KNU) Bokhyeon research fund. I am greatly appreciative of the financial support of 2016 KNU Bokhyeon research fund.

## References

- Agarwal, D. (1997). *An empirical investigation of the impact of advanced manufacturing technology on business performance*. Ph.D. dissertation, The City University of New York.
- Alina, D., & Daniel, R. (2013). Strategic alignment and misalignment of knowledge management systems: A social representation perspective. *Journal of Management Information Systems*, 29, 103-126.
- Arbuckle, L., & Wothke, W. (1999). *AMOS 4.0 User's Guide*. Small Waters Corporation.
- Banker, D., Bardhan, R., & Chen, T. (2008). The role of manufacturing practices in mediating the impact of activity-based costing on plant performance. *Accounting, Organizations and Society*, 33, 1-19.
- Bouwens, J., & Abernethy, M. (2000). The consequences of customization on management accounting system design. *Accounting, Organizations and Society*, 25, 221-241.
- Budiman, S., & Wijaya, T. (2016). Communication pattern of Indonesian parents-children and its role in buying decision. *Global Business & Finance Review*, 21(1), 102-108.
- Chen, L. (2010). Business-IT alignment maturity of companies in China. *Information & Management*, 47, 9-16.
- Choe, J. M. (2004). The consideration of cultural differences in the design of information systems. *Information & Management*, 41, 669-684.
- Choe, J. M. (2016). The relationships among strategic performance measurement systems, IS strategic alignment, and IT infrastructure for knowledge management. *Global Business & Finance Review*, 21(1), 56-72.
- Cohen, F. (2008). Contextual determinants and performance implications of information systems strategy planning within South African firms. *Information & Management*, 45, 547-555.
- Das, S. R., Zahra, S. A., & Warkentin, M. E. (1991). Integrating the content and process of strategic MIS planning with competitive strategy. *Decision Sciences*, 22, 953-982.
- Fullerton, R., Kennedy, A., & Widener, K. (2013). Management accounting and control practices in a lean manufacturing environment. *Accounting, Organizations and Society*, 38, 50-71.
- Gates, S., & Germain, C. (2015). Designing complementary budgeting and hybrid measurement systems that align with strategy. *Management Accounting Quarterly*, 16, 1-8.
- Hair, J., Black, B., Babi, B., & Anderson, R. (2005). *Multivariate data analysis*. 6<sup>th</sup> edition, Prentice Hall.
- Honggowati, S., Aryani, A., & Rahmawati, R. (2015). Value relevance of financial and non-financial information to investor decision. *Global Business & Finance Review*, 20(2), 95-104.
- Jermias, J., & Gani, L. (2004). Integrating business strategy, organizational configurations and management accounting systems with business unit effectiveness: A fitness landscape approach. *Management Accounting Research*, 15, 179-200.
- Jorgensen, B., & Messner, M. (2010). Accounting and strategizing: A case study from new product development. *Accounting, Organizations and Society*, 35, 184-204.
- King, W., & Teo, T. (1997). Integration between business planning and information systems planning: Validating a stage hypothesis. *Decision Sciences*, 28, 279-308.
- Kober, R., Ng, J., & Paul, J. (2007). The interrelationship between management control mechanisms and strategy. *Management Accounting Research*, 18, 425-452.
- Korea Production Committee (2013). *The report about the state of automation in Korean manufacturing firms*. Korean Production Committee, Seoul.

- Leidner, E., Lo, J., & Preston, D. (2011). An empirical investigation of the relationship of IS strategy with firm performance. *Journal of Strategic Information Systems*, 20, 419-437.
- Meredith, J. R., & Hill, M. (1987). Justifying new manufacturing systems: a managerial approach. *Sloan Management Review*, 28, 49-61.
- Milgrom, P., & Roberts, J. (1995). Complementarities and fit strategy, structure, and organizational change in manufacturing. *Journal of Accounting and Economics*, 19, 179-208.
- Mithas, S., & Rust, T. (2016). How information technology strategy and investments influence firm performance: Conjecture and empirical evidence. *MIS Quarterly*, 40, 223-245.
- Nianxin, W., Huigang, L., Weijun, Z., Yajiong, X., & Jinghua, X. (2012). Resource structuring or capability building?: An empirical study of the business value of information technology. *Journal of Management Information Systems*, 29, 325-367.
- Ping, R. A. (1993). The effects of satisfaction and structural constraints on retailer exiting, voice, loyalty, opportunism, and neglect. *Journal of Retailing*, 69, 320-352.
- Preston, S., & Karahanna, E. (2009). Antecedents of IS strategic alignment: A nomological network. *Information Systems Research*, 20, 159-179.
- Rao, H. S., & Bargerstock, A. (2011). Exploring the role of standard costing in lean manufacturing enterprises: A structuration theory approach. *Management Accounting Quarterly*, 13, 47-60.
- Sabherwal, R., & Jeyaraj, A. (2015). Information technology impacts on firm performance: An extension of Kohli and Devaraj. *MIS Quarterly*, 39, 809-836.
- Sim, K. L., & Killough, L. N. (1998). The performance effects of complementarities between manufacturing practices and management accounting systems. *Journal of Management Accounting Research*, 10, 325-346.
- Tallon, P. (2011). Value chain linkages and the spillover effects of strategic information technology alignment: A process-level view. *Journal of Management Information Systems*, 28, 9-41.
- Teubner, R. A. (2007). Strategic information systems planning: A case study from the financial services industry. *Journal of Strategic Information Systems*, 16, 105-125.
- Tillema, S. (2005). Towards an integrated contingency framework for MAS sophistication: Case studies on the scope of accounting instruments in Dutch power and gas companies. *Management Accounting Research*, 16, 101-129.
- Van de Ven, A. H., & Drazin, D. (1985). The concept of fit in contingency theory. *Research in Organizational Behavior*, 7, 333-365.
- Wagner, L., Moll, J., & Newell, S. (2011). Accounting logics, reconfiguration of ERP systems and the emergence of new accounting practices: A socio-material perspective. *Management Accounting Research*, 22, 181-197.
- Wiersma, E. (2008). An exploratory study of relative and incremental information content of two non-financial performance measures: Field study evidence on absence frequency and on-time delivery. *Accounting, Organizations and Society*, 33, 249-265.
- Wu, S. P., Straub, W., & Liang, T. (2015). How information technology governance mechanisms and strategic alignment influence organizational performance: Insights from a matched survey of business and IT managers. *MIS Quarterly*, 39, 497-518.