

A COMPARATIVE ANALYSIS OF JAPANESE, U.S., AND KOREAN FIRMS ON IT AND MANAGEMENT

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ABSTRACT

In this paper, the contribution of Information Technology (IT)-use to management performance is compared between Japanese, U.S., and Korean firms, based on an analysis using data of the “International Comparative Survey of Firms’ IT Strategies”. This survey has been conducted by RIETI (Research Institute of Economy, Trade and Industry) for listed companies in Japan, the United States, China and Korea.

Statistical analysis of this data reveals that Japanese firms have received positive effects from “Mission Critical Systems,” which includes regular, daily businesses such as personnel management, accounting information systems, and ordering, whereas U.S. firms are effectively using “Informational Systems,” systems that perform intricate analyses of the firm’s data, such as supporting management strategies or developing new customers. The results also report that Korean firms are behind Japanese firms in deploying IT systems with the exception of Enterprise Resource Planning (ERP) systems.

The section on the internal IT organization of the firm, which reveals the importance placed by firms in using IT as a tool to accomplish corporate strategy, indicate that U.S. firms place the highest importance, followed by Japanese firms, and finally by Korean firms. With regard to the relation with outsourcing firms of IT systems, U.S. firms are treating outsourcing firms as a partner to consult technology trends whereas a large number of Japanese firms perceive them as a means for cost reduction.

INTRODUCTION

Due to the declining birth rate and the aging population in Japan, productivity growth is the key force to sustain the long term economic growth rate. The effective use of IT systems by firms is reported to be an important factor to increase productivity of the macro economy. According to a macroeconomic comparison of IT and economic growth of Japan and the U.S., the results reveal that the level of IT investments in Japan is not far behind the level of the U.S. (Jorgenson and Motohashi, 2005). Despite the stagnant growth rate experienced by the Japanese economy since the 1990’s, Japanese firms have invested heavily in IT due to the swift technological progress of IT and the rapid penetration of the broadband infrastructure. However, it is said that the productivity effects of IT are limited compared with U.S. firms. According to a firm-level analysis on IT network use and productivity of Japanese and U.S.

firms, the results report that the productivity effects of network use is twice the size in U.S. firms compared with Japanese counterparts (Atrostic et al., 2005). Although IT systems are an effective tool to increase managerial performance of firms, the effects of IT systems differ substantially depending on its utilization. In order to achieve greater productivity effects of IT, it is important to understand how firms actually use IT and reveal the obstacles leading to under performance.

Based on the above background, RIETI conducted the “International Comparative Survey of Firms’ IT Strategies.” In addition to Japanese and U.S. firms where clear productivity differences of IT are reported, this survey also investigates the use of IT in Korean firms, where rapid progress is being observed in the IT sector. The method to measure the level of IT-use of firms is problematic, since the level of IT-use depends on various factors including the industry, the type of business activity, and the size of the firm. For example, the use of IT differs greatly between a small-sized firm of electronics components supplying its products to a large firm, and a large retail firm. In this study, the priority for the firm’s managerial strategies is first investigated, and the level of IT- use is compared based on how IT has contributed to achieve these items that the firms perceive as being important for its managerial strategies. For example, an important management goal for a small-sized electronics component supplier may be to provide a variety of products at low costs, as well as expediting the time to deliver its products. For a large retail firm on the other hand, increasing the frequency of visits by its current customers or raising the unit amount of its purchases may be an important management goal. As these examples indicate, the firm’s managerial priorities differ depending on the specific circumstance faced by individual firms, but by investigating the contribution of IT systems to achieve each firm’s managerial priorities, it is possible to measure the widely disparate IT-use by firms, based on a common metric.

In addition to the contribution of IT to achieve the firm’s important management goals, the survey also covers the level of IT system deployment (e.g. IT investment per sales and the coverage of IT systems based on types of businesses), the organizational arrangement of the IT division, and how outsourcing of IT is being conducted. The question on the organization of the IT division was included to investigate the importance placed by firms, from the context of its organization, to achieve its managerial goals using IT. In addition, due to the rapid technological progress and highly specialized skills needed to develop IT systems, the effective utilization of outsourcing often becomes a key to success, which is the reason for including a section on IT outsourcing.

The remainder of the paper is organized as follows. First, the next section explains the

contents of the survey. Section 3 reports the results of the comparative analysis of IT and management for Japanese, U.S., and Korean firms. Since the results of the survey are affected by the industrial sector and the size of firms, a descriptive regression was conducted to control for these effects to reveal the cross-country differences. Section 4 provides an inference of the reported results. In order to find implications for the differences in IT-use by Japanese firms compared with U.S. and Korean firms based on the results obtained in Section 3, it is important to clarify the differences in the environments faced by firms along with economic institutional differences of these countries. In this section, explanations are provided regarding the results of Section 3, focusing on the differences between Japanese and U.S. firms. Finally, Section 5 summarizes the findings of the paper and provides future directions of research.

Overview of the survey

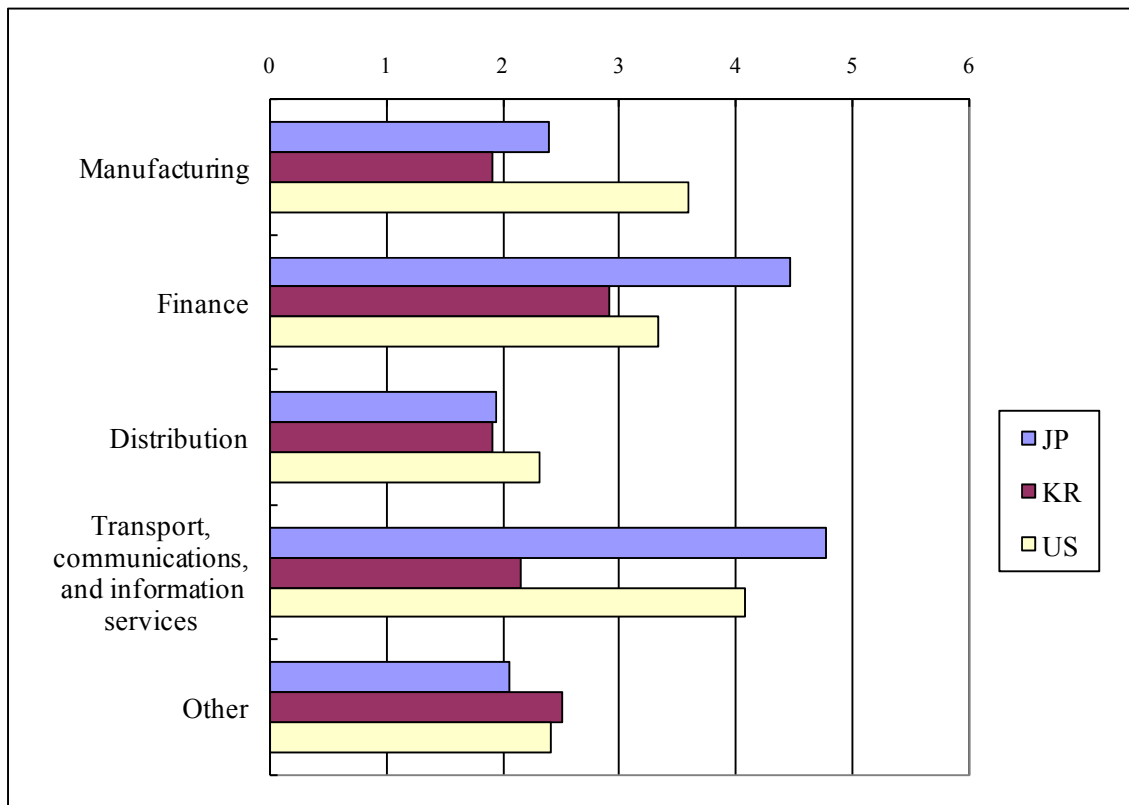
The survey was targeted for listed companies in Japan, the United States, and Korea. Therefore, the focus of the survey is to reveal how IT is being used for managerial strategies in relatively large firms. The topics of the survey was on “Deployment of IT systems,” “The relation between IT investments and management strategies,” “Internal IT Organization,” and “Outsourcing of IT systems.” The survey items of “Deployment of IT systems” include the level of deployment of IT systems classified by the type of business and how Enterprise Resource Planning (ERP) systems and Supply Chain Management (SCM) systems are implemented. “The relation between IT investments and management strategies” includes 12 items that the firm perceives as being important for its managerial strategy such as “Development of new products,” and “Adjusting to market needs,” and the contribution of IT systems to achieve these management goals is investigated. “Internal IT Organization” includes questions related to the role of CIO and the decision-making process of IT investments, and “Outsourcing of IT systems” surveys topics such as the relationship with the outsourcing partner firm and the type of businesses that are outsourced (Refer to RIETI(2007) for details).

The survey was conducted via the Internet and by mail for Japanese firms, and by phone for U.S. and Korean firms. Since the survey includes a number of questions regarding the corporate decision-making process of IT investments, the respondents were chosen to be executives of the firm that are in charge of corporate IT strategy or classes above the manager level of the IT division that has a large influence on the decision-making process of the executive in charge of IT strategy. In the cases that these chosen respondents could not be reached, the firm was dropped from the sample. The survey was conducted to listed corporations of Japanese, U.S., and Korean firms, and the industrial classification were manufacturing, distributors (retail, wholesale), financial sectors (banks, securities firm,

insurance), transportation/communications and information services (excluding transport), and others. In the telephone survey conducted in the U.S. and Korea, the sample was adjusted so that the industry distribution was approximately half manufacturing and the rest others.

Figure 1 shows the graph of the three country comparison classified by industrial classification of IT expenditure (including hardware, software, and system outsourcing fee) per sales.¹ In the U.S., the IT expenditure ratio is highest for manufacturing, commerce, and distribution sectors, whereas Japanese firms possess a high ratio for finance/insurance and information services industries. The IT expenditure ratio of Korean firms is lower in all industries except for others, and the level of IT intensity is lower compared with Japanese and U.S. firms.

Figure 1: IT expenditure/Sales ratio (%)



Results of the comparative analysis on it and management

In this section, a comparative analysis of Japanese, U.S., and Korean firms regarding IT and

¹ The survey questioned the IT investment ratio qualitatively as 1. Less than 1%, 2. Between 1%-3%, ... The average was computed using 0.5% for less than 1%, 1.5% for Between 1%-3%, 4% for Between 3%-5%, 7.5% for Between 5%-10%, and 10% for Above 10%. The country ranking for each industry does not change even if we use 15% for Above 10%.

management is conducted using the survey data. The following descriptive regression model is used throughout in this section:

$$VAR = \alpha + \beta_1 dummyUS + \beta_2 dummyKR + \beta_3 dummyINDUSTRY + \beta_4 dummySIZE + \varepsilon \quad (1)$$

VAR is the variable of interest for the comparison of Japanese, U.S., and Korean firms, and the explanatory variables of the regression are U.S. dummy (Japan as the base category), Korean dummy (Japan as the base category), industry dummy (5 classifications on Table 1), and size dummy (5 classifications on Table 2). The variable of IT and management is affected by industrial classification and firm size. For example, inventory management is not an issue for firms in the financial sector, and large firms would naturally have a higher incentive to deploy complex IT systems. Equation (1) controls for these differences in the sample characteristics, in order to check the cross country differences statistically.

Deployment of IT Systems

First, Table 1 reports the results regarding the deployment of IT systems. Models 1 to 11 shows the results of the level of IT system deployment based on types of businesses (Probit), Model 12 is on ERP adoption (Probit), Model 13 is on complementary business process reform conducted in conjunction with the adoption of ERP (Multinomial Logit), Model 14 is on SCM adoption (Probit), and finally Model 15 is on the level of data linkage between ERP and SCM systems (Ordered Probit). The results of the regression for Equation (1) are shown in the table excluding U.S. dummy (β_1) and Korean dummy (β_2).

Table 1: Deployment of IT systems

		U.S.		Korea	
(1)	Personnel/wage management	-0.794	(3.96)**	-0.099	(0.45)
(2)	Accounting transactions	-0.025	(1.33)	-0.023	(1.27)
(3)	Internal information management/Document management	0.010	(0.23)	-0.063	(1.53)
(4)	Management strategy support	0.213	(4.48)**	0.054	(1.12)
(5)	Market analysis/Developing customers	0.252	(5.21)**	-0.025	(0.52)
(6)	Customer relationship management/Sales support	0.000	(0.01)	-0.050	(1.21)
(7)	Production planning/production process	0.131	(3.07)**	-0.006	(0.14)
(8)	Inventory management	0.039	(1.04)	0.001	(0.03)
(9)	Design support/Information management of technology	0.168	(3.60)**	-0.105	(2.25)*
(10)	Ordering management	-0.028	(0.72)	-0.121	(3.02)**
(11)	Distribution management/Scheduling of product delivery	0.095	(2.04)*	-0.008	(0.17)
(12)	Adoption of ERP System	-0.007	(0.06)	0.380	(3.05)**
(13)	ERP Adoption (1)				
	Adjust business to ERP	0.740	(2.46)*	-0.554	(1.76)
	Adjust ERP to business	0.651	(2.16)*	0.395	(1.44)
(14)	Adoption of SCM system	-0.292	(2.33)*	-0.537	(4.10)**
(15)	Data Linkage of ERP and SCM (2)	-1.369	(3.66)**	-0.247	(0.57)

Note 1: The base category is "Adjust both business and ERP"

Note 2: 1 (Perfectly collaborating) 2 (Partly collaborating) 3 (Independently run)

Absolute value of z statistics in parentheses

* significant at 5%; ** significant at 1%

First, regarding the deployment of IT systems based on the type of business, U.S. firms have a higher deployment ratio in areas such as “Management Strategy Support,” “Market Analysis/Building Customer Relations,” “Production Planning,” “Planning Support/Information Management of Technology,” and “Distribution Management,” whereas the ratio is lower in “Personnel and Wage Management,” compared with Japanese firms. In Korean firms, the deployment ratio is low in areas such as “Planning Support/Information Management of Technology” and “Ordering Management.” Next, regarding the deployment of ERP systems, there is no statistical difference between Japanese and U.S. firms, whereas the deployment ratio is higher in Korean firms. Since an ERP system is a prepackaged software, it is necessary to customize the software as well as adjusting the firm’s business process to match the software upon the deployment of the system. When deploying an ERP system, a higher portion of U.S. firms “Adjust the system to match business” or “Adjust business to match the system,” whereas a higher portion of Japanese firms “Jointly adjust both system and business,” and these differences regarding the choices of adjustments are statistically significant. Finally, as regard to SCM systems, the deployment ratio of U.S. and Korean firms are relatively lower compared with Japanese firms. However, the results reveal that the level of data linkage between ERP and SCM systems is higher for U.S. firms. Although SCM systems are being widely deployed in Japan, the results indicate that only relatively few firms are jointly utilizing with ERP systems to increase efficiency at the whole company level.

Management Strategies and the Contribution of IT

This section reports the results on management strategies and the contribution of IT. The survey first questioned whether there is an IT strategy (A medium to long-term (around 3 years) IT systems investment planning) or not, and its relation with management strategies. Model 1 in Table 2 shows the results of the estimates of a Probit model of whether there is an IT strategy or not, and Model 2 reports the estimates of a Multinomial Logit model regarding the relation between IT strategy and management strategy. First, there is no large difference in whether a firm has an IT strategy or not between Japanese and U.S. firms, but a higher portion of Korean firms have indicated that they do not have an IT strategy. As regard to the relation between IT strategy and management strategy, a large number of U.S. firms indicated that IT strategy vividly reflects management strategy, but at the same time, a high portion of firms responded that the link between these strategies is weak. In other words, Japanese firms’ “IT Strategy is not stated vividly in its management strategy, but nevertheless matches its management strategy.” In Korean firms, the proportion of firms that responded “There is a weak relationship between the two strategies” was higher compared with Japanese firms.

Table 2: Management Strategy and the Contribution of IT

		Importance as a management strategy			
		U.S.		Korea	
(1)	Whether there is an IT strategy	-0.047	(0.35)	-0.370	(2.93)**
(2)	The relation between IT and management strategies (Note)				
	Clear role in the management strategy	0.915	(2.10)**	0.596	(1.47)
	Weak relation between the two strategies	2.102	(1.74)*	2.726	(2.40)**
Importance as a management strategy					
(3)	New products, services, and businesses	0.062	(0.85)	0.103	(1.42)
(4)	Strengthening the competitiveness of core businesses	-0.134	(1.98)*	-0.100	(1.48)
(5)	Quick response to market needs	-0.144	(2.42)*	-0.044	(0.74)
(6)	Developing new customers	0.278	(3.93)**	0.066	(0.93)
(7)	Increasing customer satisfaction of present customer	0.124	(1.96)*	-0.166	(2.64)**
(8)	Market analysis/marketing	0.019	(0.30)	0.283	(4.51)**
(9)	Expediting product development	-0.121	(1.78)	-0.048	(0.71)
(10)	Enhancement of sales capability	-0.437	(6.56)**	-0.065	(0.97)
(11)	Cost reductions of back office divisions	-0.001	(0.02)	-0.276	(3.83)**
(12)	Inventory cost reductions	-0.082	(0.98)	0.015	(0.18)
(13)	Rearrangement of the supply chain	0.200	(2.42)*	0.242	(2.93)**
(14)	Internal information sharing	0.241	(3.18)**	-0.015	(0.19)
Contribution of IT					
(15)	New products, services, and businesses	0.301	(4.53)**	0.118	(1.78)
(16)	Strengthening the competitiveness of core businesses	0.242	(4.11)**	0.146	(2.48)*
(17)	Quick response to market needs	-0.120	(2.04)*	0.203	(3.44)**
(18)	Developing new customers	0.063	(1.01)	0.032	(0.52)
(19)	Increasing customer satisfaction of present customer	0.098	(1.72)	0.124	(2.17)*
(20)	Market analysis/marketing	-0.038	(0.60)	0.150	(2.36)*
(21)	Expediting product development	0.104	(1.66)	0.067	(1.07)
(22)	Enhancement of sales capability	0.022	(0.36)	0.047	(0.77)
(23)	Cost reductions of back office divisions	-0.269	(3.87)**	-0.439	(6.25)**
(24)	Inventory cost reductions	-0.288	(4.14)**	-0.209	(3.00)**
(25)	Rearrangement the supply chain	-0.075	(1.03)	0.043	(0.60)
(26)	Internal information sharing	-0.069	(0.88)	-0.326	(4.17)**

Note: The base category is "Not clearly stated in the management strategy, but nevertheless consistent"

Absolute value of z statistics in parentheses

* significant at 5%; ** significant at 1%

To evaluate the contribution of IT to various types of management strategies, the respondent firms indicated the importance of the 12 types of management strategies, such as "Development of new products, services, or businesses" or "Strengthening the competitiveness in core businesses," and the contribution of IT to these management strategies on a 5-point scale. Since individual firms' responses to these subjective evaluations would cause biases for the regression, these response biases were first controlled. Each firm's average responded score was computed for the 12 types of questions that were surveyed, and the average score for each individual firm was subtracted from its responses for each of the 12 items in order to measure the distance from the average score. By applying this method, an index could be created for the individual firm's relative importance for each of the 12 surveyed items. In addition, this method also controls for the bias caused by firms that generally reported high scores and those that indicated low scores due to the subjective nature of the survey.

Equation (1) was estimated for the regression of the different types of management strategies of firms, but the variable indicating the importance of management strategy was also included

as an independent variable in the regression of the contribution of IT. As regard to the contribution of IT, the respondents were asked “How much do you think IT investments have contributed to each of the following items?” but it is natural for firms to respond low scores for the contribution of IT in items that the firm perceives as being a non-important management strategy. Therefore, in order to estimate the contribution of IT for each of the different types of management strategies, the degree of marginal importance of the specific management strategy should be controlled for in the regression. Finally, a Double Bind Tobit model was used for the regression, since the range of the dependent continuous variable² is -5 to 5.

First, the results of the importance of the different types of management strategies indicate that U.S. firms indicate that items such as “Development of new customers,” “Increasing customer satisfaction of current customers,” “Reconsidering the supply chain,” and “Information sharing in the firm” are more important with respect to Japanese firms, whereas “Increasing the competitiveness of core businesses,” “Responding to market needs,” and “Enhanced sales ability” are lower in importance. For Korean firms, items such as “Market analysis/marketing” and “Reconsidering the supply chain” was indicated as being relatively important, whereas “Increasing customer satisfaction of current customers” and “Cost reductions of the indirect division” has been reported to be relatively low in importance. As regard to the contribution of IT to these different managerial goals in U.S. firms, the contribution is high for “Development of new products, services, or businesses” and “Strengthening the competitiveness in core businesses,” whereas low contributions are reported for “Quick response to market needs,” “Cost reductions of the indirect division,” and “Reduction in inventory costs.” In Korean firms, the contributions are high for “Strengthening the competitiveness in core businesses,” “Quick response to market needs,” “Increasing customer satisfaction of current customers,” and “Market analysis/marketing,” whereas the relatively low contributions are reported for “Cost reductions of the indirect division,” “Reduction in inventory costs,” and “Information sharing in the firm,” compared with Japanese firms. These results indicate that Japanese firms report a high contribution for cost reductions, such as “Cost reductions of the indirect division” and “Reduction in inventory costs,” whereas the contribution is low in areas that relate to increased sales, such as “Development of new products, services, or businesses” and “Increasing the competitiveness of core businesses.”

Internal IT Organization

² More precisely, it is a discrete variable with intervals of length 1/12, but it is thought be reasonable to approximate it as a continuous variable.

In this section, the results regarding the Internal IT organization of the firm, such as the role of the Chief Information Officer (CIO) or the relation between the IT division and the IT-user divisions, will be presented. Table 3 presents the results of the regression analysis. Model 1 is whether there is a CIO or not (Probit), Model 2 is whether the CIO is a full-time executive or not (Probit), and Model 3 reveals the career of the CIO (Multinomial Logit model with “from the IT division” as the base category). First, there is no statistical difference on whether there is a CIO (defined as an executive in charge of IT systems) or not between Japan and the U.S., but less Korean firms report of having a CIO. The results indicate that a larger portion of U.S. firms have full-time CIO’s who are in charge of IT systems compared with Japanese counterparts, and the difference is statistically significant. With regard to the past career of the CIO, U.S. firms report that a low portion of CIOs’ careers are from divisions such as general affairs and finance, and a high portion of CIO’s are recruited from outside. In Korean firms, there is a low proportion of CIO’s from the business division.

Table 3: Internal IT Organization

		U.S.		Korea	
(1)	CIO or no CIO	-0.004	(0.09)	-0.101	(2.10)*
(2)	Whether the CIO is a full-time executive	0.381	(5.88)**	0.053	(0.73)
(3)	Career background of the CIO (Note 1)				
	From the management planning division	-0.632	(1.71)	-0.082	(0.26)
	From the general affairs/finance divisions	-1.488	(3.06)**	-0.603	(1.66)
	From the business operation division	0.146	(0.36)	-1.082	(2.19)*
	Recruited from outside	3.036	(5.63)**	0.909	(1.47)
	Importance of the duty as the CIO				
(4)	Internal coordinations of IT systems	0.032	(0.48)	0.141	(2.05)*
(5)	Planning new services	-0.145	(1.95)	-0.001	(0.02)
(6)	Business process reform	-0.046	(0.66)	-0.133	(1.88)
(7)	Grasping the trends of cutting-edge technology	0.098	(1.54)	0.077	(1.18)
(8)	Choosing outsourcing firms	-0.426	(5.41)**	0.118	(1.45)
(9)	Running the system stably/security	0.204	(3.06)**	-0.057	(0.84)
(10)	Analyzing the effects of deployed systems	0.068	(1.20)	-0.034	(0.59)
(11)	Promoting internal information sharing	0.208	(3.10)**	-0.112	(1.62)
	Relation between the IT division and the IT-user divisions (Note 2)				
(12)	Allocating IT staffs	-0.142	(1.29)	-0.206	(1.86)
(13)	Proposing new systems	-0.144	(1.35)	-0.509	(4.70)**
(14)	Designing new systems	0.167	(1.55)	-0.306	(2.75)**
(15)	Deciding the IT budgets	-0.080	(0.74)	-0.379	(3.37)**
(16)	Quantifying the effects of IT investments	0.128	(1.19)	-0.379	(3.44)**

Note 1: The base category is “from the IT division.”

Note 2: 3 levels of choices for this question: 1 (IT division is important), 2 (Equally important), 3 (user division is important).

Absolute value of z statistics in parentheses

* significant at 5%; ** significant at 1%

Models 4-11 present the results of the importance of the duties of the CIO. 8 types of work conducted by the CIO and the importance of these duties were evaluated on a 5-point scale. In order to mitigate the response bias due to the subjective nature of the questionnaire, the scores for each of the 8 types of duties were subtracted from the average score of importance for all the duties, and this computed value was used as the dependent variable in Equation (1)

for the Double Bind Tobit model. First, compared with Japanese firms, U.S. firms indicate “Stable operation of the system/security” and “Facilitating information sharing of the firm,” as being highly important, while “Selecting outsourcing firms” is perceived to be of low relative importance. Not much difference is found between Japanese and Korean firms, but “Adjustment of IT systems of the firm” is more important in Korean firms. Finally, Models 12-16 is an Ordered Probit model that compares whether the IT division or the IT-user divisions is in position to exercise leadership in Japanese, U.S., and Korean firms for different types of businesses. There are no statistical differences between Japanese and U.S. firms, but Korean firms have indicated that the IT division has the initiative in a number of categories such as “Proposal of new systems” and “Planning new systems.”

Discussions

A detailed survey regarding IT-use and the effects of IT investments by Japanese firms is conducted by the Japanese Ministry of Economy Trade and Industry’s (METI’s) ICT Workplace Survey. The results of this survey indicate that Japanese firms have been successful in increasing the effectiveness of its businesses by introducing accounting information systems or reducing inventory costs by implementing inventory management systems, but only a small portion of firms have been able to use IT to increase sales, for example by developing new customers (METI, 2005).

Referring back to the results regarding the differences in the types of areas that IT systems are deployed in Japanese and U.S. firms, the ratio of system deployment of Japanese firms is high in areas directed towards back office divisions such as personnel/wage management, whereas deployment is behind in “Informational systems” such as managerial strategy support, market analysis/developing new customers, design support/information management of technology. “Mission critical systems,” or systems that increases efficiency of daily business operations such as management of ordering and systems for the back office divisions, are a typical type of system that rationalizes business processes. This type of IT-use has been implemented since the advent of general-purpose computers in the 1970’s and is a classical way of IT-use by firms. On the other hand, recently there is great attention in using “Informational systems” to perform intricate analysis regarding management decision-making and market analysis using data collected by the “Mission critical systems.” The idea of using information systems to facilitate managerial strategies has been around since the 1970’s, exemplified by concepts such as Management Information Systems (MIS) and Decision Support Systems (DSS), but it is in the 1990’s that these systems became of practical use due to the sharp increase of memory and processing capability of computers. Data warehouses have been created in order to integrate information that has previously been

dispersed around the firm, and data mining techniques have enabled firms to extract critical information from the data warehouse to facilitate corporate strategy. Since the 2000's, the concept of Business Intelligence (BI) has been put forward to offer a user-friendly environment and enable access to non IT specialists of the management and planning divisions of the firm.

The results of the contribution of IT systems to corporate strategy of Japanese and U.S. firms are also consistent with the differences in the area of IT system deployment. In Japanese firms, the positive effects are relatively large in areas related to mission critical systems, such as "Cost reductions of the indirect division" or "Inventory cost reductions," whereas the type of benefit realized in U.S. firms are related to informational systems, as indicated by effects such as "Development of new products, services, and businesses" or "Strengthening the competitiveness of core businesses." Now, Japanese firms have revealed a positive effect for "Quick response to market needs," but this effect could correspond to either an effect by mission critical systems due to operational benefits, such as quick responses, realized by intimate collaboration with partner firms, or informational systems due to increased speed of product development to meet consumer needs. As Table 1 indicates, Japanese firms are relatively ahead in deploying Supply Chain Management (SCM) systems, but behind in areas related to new product development such as facilitation of design and information management of technology, so the positive effects of "Quick response to market needs" more likely represents benefits by mission critical systems.

Compared with Japanese firms, the ratio of SCM system adoption in U.S. firms is low, but there is a stronger collaboration with Enterprise Resource Planning (ERP) systems in firms that are deploying SCM systems. SCM systems enable firms to increase operational efficiency of ordering, production planning, and inventory management for the line of product that SCM is used, but whether this information will be shared at the firm-wide level depends on the collaboration with ERP systems. If SCM systems are deployed alone, efficiency will increase for the specific line of product or a particular division of the firm, but it is not possible to use this information for corporate decision-making or to develop new areas of business. This result provides further evidence that Japanese firms' IT investments are geared towards operational aspects to increase efficiency of business, but IT is not often used to facilitate management's decision-making which leads to strengthening the competitiveness of the firm.

What are the characteristic features of Korean firms? Japanese firms have invested heavily in IT since the 1980's, and there is a relatively long history of IT system deployment, but the surge of IT investments by Korean firms started in the 1990's (Kanamori and Motohashi,

2007). Having a relatively short history of IT adoption has some merits and detriments. On the positive side, there are no legacy systems, such as mainframe computers or interorganizational networks based on private lines. Japanese firms have incurred a large cost in the legacy migration process, to transit from applications implemented on old systems to new, open systems, using client/server machines and the Internet, but Korean firms do not have to worry about this burden. On the other hand, Korean firms do not have the stock of skills needed for different areas of businesses and information literacy of employees which is needed to effectively use IT systems for management.

Looking at the results of Table 1 with this background in mind, Korean firms are behind Japanese firms in deploying IT in areas such as “Design support/information management of technology” and “Ordering management.” The adoption of SCM systems is also behind indicating that IT is not being utilized in areas related to the actual business operations, such as the planning division and factories. However, the ratio of ERP adoption is high. ERP software is a type of system that unifies and manages information of different types of activities of the firm, such as personnel/wage, ordering, and inventory management, and Korean firms are active in the unification and management of the firm’s internal information. The contribution of IT are high in areas such as “Strengthening the competitiveness of core businesses,” “Quickening responses to market needs,” and “Increasing satisfaction of current customers,” and low contributions are reported in areas such as “Indirect cost reductions” and “Inventory cost reductions.” Compared with Japanese firms, the results of Korean firms are similar to U.S. firms in that the reported contributions are high in areas that use informational systems to achieve these benefits. However, compared with Japanese firms, Korean firms’ IT strategy and managerial strategy are not consistent, implying that most likely, a relatively high portion of Korean firms reported positive effects from informational systems since there is only a limited amount of stock regarding the effective use of mission critical systems. It is important to note once again that the contribution of IT in this study is measured relative to the evaluations of the 12 surveyed items.

Next, we turn to the IT organization of the firm, which supports the use of IT systems by the firm. In order to use IT not only as a tool to rationalize individual daily businesses but also as a tool to implement corporate strategy, the role of the Chief Information Officer (CIO) becomes important. Firms that do not have CIO’s are indicative of having a low concern for the strategic use of IT. The ratio of firms that have CIO’s (executive class) is approximately the same in Japanese and U.S. firms, but it is a little low in Korean firms. The head of the IT division of most Korean firms are not executives, and there is a relatively low perceived importance in linking IT systems with corporate management in Korean firms.

Compared with Japanese firms, there is not much difference in the ratio of whether there is a CIO or not in U.S. firms, but there is a big difference in the position and role of the CIO. In Japanese firms, CIO's hold joint appointments in non-IT related divisions that are responsible for business operations, whereas a higher portion of U.S. firms have CIO's with full-time positions. As regard to the background of the CIO's, a large portion of Japanese CIO's come from the general affairs/finance division whereas a high proportion of U.S. CIO's are recruited from outside. With regard to the importance of the type of job involved, a large number of Japanese firms responded that "Choosing the outsourcing firms" is important, while a higher number of U.S. firms indicated that "Running the system stably/security" and "Promoting information sharing in the firm" as important priorities. As these results indicate, the CIO in U.S. firms is regarded as an independent post and specialists are recruited from outside the firm to run the IT systems stably and focusing on fundamental areas of the job such as facilitating information sharing in the firm. In contrast, CIO's in Japanese firms often hold joint appointments with other divisions related to general affairs or finance, and the role of the CIO is rather ambiguous compared with U.S. firms.

As pointed out earlier, the ratio of CIO's in Korean firms is low compared with Japanese firms, and the firms' awareness for IT systems and its relation to corporate management is pretty low. As regard to the background of the CIO, there is no category that is statistically significant implying that the ratio of the base category, which is originally from the IT division, is high. As regard to the important duty of the CIO, many firms responded that internal adjustments of IT systems as a priority. In addition, a key feature regarding the relation between the IT division and the user division of the firm is that the IT division takes the initiative for most of the surveyed categories including proposals of new systems, planning, and deciding IT budgets. In Korean firms, since IT specialists are involved in internal system deployment independently, chances are pretty low that there is a clear vision in effectively using IT for management at the corporate level. Summarizing the points indicated regarding the results, it may be said that U.S. firms' perception for the importance of incorporating IT systems for corporate strategy is the highest, followed by Japanese firms, and finally by Korean firms.

The reason for a large number of Japanese CIO's to hold joint appointments in other departments and Japanese firms to begin outsourcing before the terms of the outsourcing activity are clearly stated is highly related to the characteristics of the Japanese firm and its surrounding economic institutions. Aoki (1986) conducted an analysis of the comparative advantages of different types of organizational forms, using a 2 division model of the management and its subordinate organization. In this analysis, in addition to the information that affects the entire firm (system shock), sharing of the information that affects individual divisions (individual shock) across the different divisions of the firm depends on the

complementarity of the types of work of the different divisions and the size of the relative weight of the individual shock with respect to the system shock. It is said that sharing information of the individual divisions across the divisions in addition to the firm-wide information (a horizontal hierarchical system) is complementary with Japanese economic institutions (tacit rules), which includes a stable employer and employees relations and a long-term relationship with trading partners. On the other hand, the pattern of organization (distributed information system) that does not share division-specific information (the type that operates using firm-wide information and information of its own division only) is complementary with the U.S. economic institutional system where there is an active flow of human resources and funds through the channel of external markets (Aoki and Okuno, 1998).

The results of this study revealed that U.S. firms often recruit specialists as CIO's from outside, utilizing the active external labor market. Therefore, it is natural for firms to clarify the qualifications of the CIO and their role in the firm beforehand, and offer them full-time positions to perform their duty. On the other hand, CIO's in Japan are often appointed from within the firm, and the CIO often has other job duties as well. In the previous model, if we treat the management division as the CEO and the two subsidiary divisions as the IT division and the IT-user division, it could be thought that the IT division of U.S. firms is run independently, led by the CIO, as an information distributed system, whereas the form of Japanese firms is close to a horizontal hierarchy system, with a higher degree of coordination between the divisions. Communication of tacit information and reaching of agreements is possible since interdivisional communication based on specific contexts forms, due to the long-term employment conditions. Japanese firms jointly appointing CIO's with other executive positions indicates the low perception of the role of IT for corporate management in Japanese firms, but at the same time, it could also be interpreted as an attempt to reform business processes using IT, together with the actual divisions that are operating business.

However, since the responsibilities of the IT division and the IT-user divisions is ambiguous in the Japanese firm system, there is potentially a risk of the adjustments costs becoming very high if there are inconsistencies in the tacit agreements that were reached between the divisions. In addition, since conducting interdivisional communication inevitably slows down the flow of information and the decision-making process, it becomes difficult to effectively use state of the art IT systems and obtain good results (Motohashi, 2006). The reason that the use of "Informational systems" in Japanese firms is behind those of the U.S. could be associated with the active interdivisional communication seen in Japanese firms. Since information sharing was already active, the incentive to "visualize" the internal movements of the firm using IT is low. However, due to the increased intensity of global competition and the complexity of business domains, it is increasingly important to execute corporate

decisions based on a wider information base. Due to these changes in the environment, the risk of using internal tacit information as the source for corporate decision-making is increasing. Therefore, it may be that Japanese firms have to incorporate some aspects of “Information distributed systems” regarding IT-use, in order to expedite the information flow of internal, explicit knowledge. On the other hand, U.S. firms are increasingly using IT effectively as an information sharing tool of the firm. The results revealing the importance of “Internal information sharing” as a CIO’s duty is consistent with these trends of U.S. firms.

CONCLUSION

In this paper, a comparative analysis regarding IT use and the contribution of IT to management strategies was conducted for Japanese, U.S. and Korean firms using the data of the “International Comparative Survey of Firms’ IT Strategies” (RIETI). The results reveal that, in Japanese firms, the effects of IT are large for “Mission critical systems,” systems that increase the efficiency of daily business operations such as personnel, wage, accounting, and ordering management, whereas U.S. firms are using “Informational systems,” systems that performs complex analysis using the firm’s data such as managerial strategy support, market analysis, and new customer development systems. In Korean firms, the deployment of IT is generally behind Japanese firms with the exception of ERP systems.

With regard to the internal IT organization which is a key in promoting the use of IT systems in firms, U.S. firms’ CIO’s have a full-time position with a clear role including running the system stably and facilitating internal information sharing, whereas Japanese CIO’s often have a career experience in the general affaris/finance divisions and are jointly appointed with other positions. In addition, it is found that a large portion of Korean firms do not have executives in charge of IT. Therefore, U.S. firms has the highest awareness of using IT as a strategic tool to improve corporate management, followed by Japanese firms, and finally by Korean firms.

One caveat to keep in mind is that this analysis compared the use of IT systems in the three countries, but does not address which country’s method is better than the other. Therefore, the most important direction of future research is to perform an analysis to find the relation between the IT-use of firms and firm performance. Korean firms have a relatively short history of IT-use, and the deployment of IT systems is generally behind those of Japanese and U.S. firms. Referring to the portion of firms that have CIO’s, it is not likely that Korean firms have the perception of utilizing information systems as a strategic tool. However, the IT investment ratio at the macroeconomic level is increasing sharply to Japanese levels (Kanamori and Motohashi, 2007), and there is a possibility of Korean firms to rapidly

improve their management of IT by using their strength of not possessing legacy systems. The results also indicate that there is big difference in the method of IT management comparing Japanese and U.S. firms. The background economic institutional differences (tacit rules regarding the law and economic transactions) in these two countries may be one reason for these results. There may be an advantage for the U.S. firm system to effectively use IT, due to the swift technological process in this field, but we would like to analyze and examine whether the Japanese or U.S. system has a comparative advantage regarding IT management and firm performance.

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