RIETI Discussion Paper Series 07-E-047

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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 from the "International Comparative Survey of Firms' IT Strategies" (RIETI).

The results reveal that Japanese firms have received positive effects from "mission critical systems," which include routine business activities such as personnel management, accounting information systems, and ordering, whereas U.S. firms are effectively using "informational systems;" systems that perform intricate analyses of a firm's data, such as supporting management strategies or developing new customers. The results also show that Korean firms trail 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 on using IT as a tool to accomplish corporate strategy, indicates 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 partners for consulting on technology trends whereas a large number of Japanese firms perceive them as a means of cost reduction.

JEL Classification: L21, L15
Keywords: IT Strategy, International Comparison, Japan, U.S., Korea

1. Introduction

Due to the declining birthrate and the aging population in Japan, productivity growth is the key force for sustaining a long-term economic growth rate. The effective use of IT systems by firms is reported to be an important factor in increasing the productivity of the macro-economy. According to results from a macroeconomic comparison of IT and economic growth for Japan and the U.S., the level of IT investment in Japan is not far behind that of the U.S. (Jorgenson and Motohashi, 2005). Despite the stagnant growth rate experienced by the Japanese economy since the 1990s, Japanese firms have invested heavily in IT due to the swift progress of IT and the rapid penetration of broadband infrastructure. However, it is said that the productivity effects of IT are limited compared with those of U.S. firms. According to a firm-level analysis on IT network use and the productivity of Japanese and U.S. firms, the productivity effect of network use is twice the size in U.S. firms compared with their Japanese counterparts (Atrostic et al., 2005). Although IT systems are an effective tool for increasing the managerial performance of firms, the effects of IT systems differ substantially depending on their 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 underperformance.

Based on this background, RIETI conducted an "International Comparative Survey of Firms' IT Strategies." In addition to Japanese and U.S. firms, where clear productivity differences for 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, type of business activity, and size of the firm. For example, the use of IT differs greatly between a small-sized, electronics components firm 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 in these areas that the firms perceive as being important for their 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 cost, as well as expediting the delivery time of its products. On the other hand, for a large retail firm 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 circumstances each faces. 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 in achieving a firm's important management goals, the survey also covers the level of IT system deployment (e.g. IT investment per sale 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 in order to investigate the importance placed by firms, from the context of their organization, on achieving their 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, thus a section on IT outsourcing was included.

The remainder of the paper is organized as follows. 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 in order 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 for research.

2. Overview of the Survey

The survey targeted listed companies in Japan, the United States, and Korea. Therefore, its focus is to reveal how IT is being used for managerial strategies in relatively large firms. The topics of the survey were "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 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 the chief information officer (CIO) and the decision-making process on 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 on IT investments, the respondents chosen were executives of a firm who are in charge of corporate IT strategy or at levels above the manager level of the IT division, who have a large influence on the decision-making process of the executive in charge of IT strategy. In cases when these chosen respondents could not be reached, the firm was dropped from the sample. The survey was conducted on listed corporations of Japanese, U.S., and Korean firms, and the industrial classifications were manufacturing, distributors (retail, wholesale), financial sector (banks, securities firms, 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. The Internet survey for Japanese firms took place February 23-March 9, 2007, and the mail survey was conducted March 7-21, 2007. U.S. and Korean firms were surveyed February 19-March 20, 2007. The final sample size of the firms with responses was 317 for Japan, 200 for the U.S., and 300 for Korea.

Tables 1 and 2 report the characteristics of the sample by industry and firm size (sales). The distribution of industrial classifications shows that the ratio of manufacturing firms is around 40% for Japanese and U.S. firms, but higher in Korea, recording 60%. The U.S. sample has a high proportion of firms in the financial sector, while the Japanese sample has a greater portion of wholesale and retail. The distribution of the amount of sales which was converted to U.S. dollars revealing that Japanese and U.S. firms have roughly the same size distribution, whereas the Korean sample includes a greater portion of smaller firms.

(Table 1), (Table 2)

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 the manufacturing, commerce, and distribution sectors, whereas Japanese firms possess a high ratio for the finance/insurance and information services industries. The IT expenditure ratio of Korean firms is lower in all industries except for others, and their level of IT intensity is lower compared with Japanese and U.S. firms.

(Figure 1)

3. 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 management is conducted using the survey data. The following descriptive regression model is used throughout 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 (five 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 greater incentive to deploy complex IT systems. Although this survey was targeted toward listed companies in Japan, the U.S., and Korea, and the sample distribution of industrial classification was structured based on a common guideline, the sample characteristic between Korean and Japanese/U.S. firms is different, as observed in Tables 1 and 2. Equation (1) controls for these differences in the sample characteristics, in order to check the cross-country differences statistically.

(1) Deployment of IT Systems

First, Table 1 reports the results regarding the deployment of IT systems. Models 1 to 11 show the results of the level of IT system deployment based on types of business

[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%.

(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 3)

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 prepackaged software, it is necessary to customize the software and to adjust the firm's business process to match the software upon the deployment of the system. When deploying ERP systems, a greater portion of U.S. firms "Adjust the system to match business" or "Adjust business to match the system," whereas a greater portion of Japanese firms "Jointly adjust both system and business," and these differences regarding the choices of adjustments are statistically significant. Finally, regarding SCM systems, the deployment ratios 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 a relatively small number of firms are jointly utilizing ERP systems to increase efficiency at the whole company level.

(2) 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 or not there is an IT strategy (medium- to long-term [around 3 years] IT systems investment planning), and its relation to management strategies. Model 1 in Table 4 shows the results of the estimates of a

Probit model of whether or not there is an IT strategy, and Model 2 reports the estimates of a Multinomial Logit model regarding the relation between the IT strategy and management strategy. First, there is no large difference between Japanese and U.S. firms in whether or not a firm has an IT strategy, but a greater portion of Korean firms have indicated that they do not have an IT strategy. In regard to the relation between IT strategy and management strategy, a large number of U.S. firms indicated that their IT strategy vividly reflects their management strategy, but at the same time, a large portion of firms responded that the link between these strategies is weak. In other words, for Japanese firms, the "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 4)

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 strategies on a five-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 response 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 an 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. With 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 with low scores for the contribution of IT in items perceived as being non-important management strategies. Therefore, in order to estimate the contribution of IT for each of the different types of management strategy, 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 variable[2] is -5 to 5.

First, the results of the importance of the different types of management strategies show 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 compared 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" were indicated as being relatively important, whereas "Increasing customer satisfaction of current customers" and "Cost reductions of the indirect division" were reported as relatively low in importance. With 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 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."

(3) Internal IT Organization

In this section, the results regarding the Internal IT organization of the firm, such as the role of the CIO or the relation between the IT division and the IT-user divisions, will be presented. Table 5 presents the results of the regression analysis. Model 1 is whether or not there is a CIO (Probit), Model 2 is whether or not the CIO is a full-time executive (Probit), and Model 3 reveals the career of the CIO (Multinomial Logit model

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

with “from the IT division” as the base category). First, there is no statistical difference between Japan and the U.S. on whether or not there is a CIO (defined as an executive in charge of IT systems), but fewer Korean firms report having a CIO. The results indicate that a larger portion of U.S. firms have full-time CIOs in charge of IT systems compared with their 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 large portion of CIOs are externally recruited. In Korean firms, there is a low portion of CIOs from the business division.

(Table 5)

Models 4-11 present the results of the importance of the duties of the CIO. Eight types of work conducted by the CIO and the importance of these duties were evaluated on a five-point scale. In order to mitigate the response bias due to the subjective nature of the questionnaire, the scores for each of the eight types of duties were subtracted from the average score of importance for all 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 present an Ordered Probit model that compares whether the IT division or the IT-user division is in a 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 or categories, such as “Proposal of new systems” and “Planning new systems.”

(4) Relations with Outsourcing Firms

Finally, the results of the relations between IT outsourcing firms are presented in Table 6. First, Models 1-4 show the results of the regression of how firms decide various specifications regarding IT outsourcing. A Multinomial Logit model for Equation (1) was estimated to find whether firms “Order after what is being outsourced has been clearly decided” or “Clearly decide step-by-step after the outsourcing activity begins,” using

"Decide what to outsource consulting with the outsourcing firm" as the base category. In U.S. firms, the results show that the ratio of "Order after what is being outsourced has been clearly decided" or "Clearly decide step-by-step after the outsourcing activity begins" is higher for "Firm-wide mission critical systems." Therefore, a greater portion of Japanese firms "Decide what to outsource consulting with the outsourcing firm." The results for Korean firms show a similar pattern to U.S. firms, reporting that a large portion of firms "Order after what is being outsourced has been clearly decided" for all categories. The portion of Japanese firms that "Decide what to outsource consulting with the outsourcing firm" is large compared with Korean firms as well.

(Table 6)

Models 5-12 cover eight statements regarding IT systems outsourcing. The survey respondents evaluated the validity of the statements on a five-point scale. Once again, in order to control for the response bias due to subjective evaluations, the score for each item was subtracted from the average score to measure the distance from the mean for the dependent variable, and a Double Bind Tobit model of Equation (1) was estimated. A large portion of U.S. firms indicated that "Outsourcing firms are advisors of information technology trends" or they "Order after what is being outsourced has been clearly decided," whereas a small portion of firms reported that "The system deployment did not proceed as stated in the contract and resulted in high cost" or "Outsourcing is necessary to achieve cost reductions." In Korean firms, a large portion "Clearly specify the outsourcing activity and avoid it becoming black-boxed," while a small portion of firms indicated that "The system deployment did not proceed as stated in the contract and resulted in high cost" or "Outsourcing is necessary to achieve cost reductions," similar to U.S. firms.

4. Discussions

A detailed survey regarding IT use and the effects of IT investments by Japanese firms is conducted in the ICT Workplace Survey performed by the Japanese Ministry of Economy, Trade and Industry (METI). The results of this survey indicate that Japanese firms have been successful in increasing the effectiveness of their 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). In addition, comparing the IT investment patterns of Japanese and U.S. firms,

U.S. firms have invested heavily in areas that strengthen the competitiveness of the firm, such as systems that support decision-making and analyze the environment that the firm is facing (JEITA, 2007). The results of the survey of this study are consistent with what has often been indicated regarding Japanese firms' IT use.

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 toward 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 routine 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 1970s and is a classic form of IT use by firms. On the other hand, recently, great attention is paid toward 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 1970s, exemplified by concepts such as management information systems (MIS) and decision support systems (DSS), but it was in the 1990s 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. In the 2000s, the concept of business intelligence (BI) has been put forward to offer a user-friendly environment and enable access to non-IT specialists in the management and planning divisions of the firm.

The results of the contribution of IT systems to the 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 types of benefits 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 3 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" are 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 ERP systems in firms that are deploying SCM systems. SCM systems enable firms to increase operational efficiency with ordering, production planning, and inventory management for the line of product in which 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 toward operational aspects to increase business efficiency, 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 1980s, and there is a relatively long history of IT system deployment, but the surge of IT investments by Korean firms started in the 1990s (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 the information literacy of employees needed to effectively use IT systems for management.

Looking at the results of Table 3 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 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 firm activities, 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 contributions 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 and managerial strategies are not consistent, implying that, most likely, a relatively large 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 its IT systems. In order to use IT not only as a tool to rationalize routine business activities but also as a tool to implement corporate strategy, the role of the chief information officer (CIO) becomes important. The lack of a CIO is indicative of a firm's low concern for the strategic use of IT. The ratio of firms that have CIOs (executive class) is approximately the same in Japanese and U.S. firms, but it is a little low in Korean firms. The heads of the IT divisions of most Korean firms are not executives, and these firms exhibit a relatively low perceived importance in linking IT systems with corporate management.

Compared with Japanese firms, U.S. firms do not show much difference in the ratio of whether or not there is a CIO, but there is a big difference in the CIO's position and role. In Japanese firms, CIOs hold joint appointments in non-IT-related divisions that are responsible for business operations, whereas a greater portion of U.S. firms have CIOs with full-time positions. Regarding their background, a large portion of Japanese CIOs come from the general affairs/finance division whereas a high proportion of U.S. CIOs are externally recruited. 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 "Running the system stably/security" and "Promoting information sharing in the firm" as 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 to focus

on fundamental areas of the job such as facilitating information sharing in the firm. In contrast, CIOs 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 CIOs in Korean firms is low compared with Japanese firms, and the firms' awareness of IT systems and the relation to corporate management is quite low. Regarding CIOs' backgrounds, 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 far as duties of the CIO, many firms responded that internal adjustments of IT systems are a priority. In addition, a key feature regarding the relation between the IT and the user divisions of a 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 individually involved in internal system deployment, chances are quite 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' perceptions of the importance of incorporating IT systems for corporate strategy are the highest, followed by Japanese firms, and finally by Korean firms.

Finally, regarding the relationship with outsourcing firms for the development of IT systems, compared with U.S. and Korean firms, there is a clear tendency for Japanese firms to not clearly decide what to outsource beforehand, but instead to finalize the decision upon consultation with the outsourcing firm. In addition, a large number of firms reported a cost burden due to the system development process proceeding not according to the terms of the contract. But this is likely due to the outsourcing activity starting before the terms of the contract are finalized, and the terms of the agreed upon contract being ambiguous. There are no substantial differences between U.S. and Korean firms regarding the relationship with outsourcing firms, but the aforementioned points are characteristically different unique points of Japanese firms. It is often stated that the ratio of produced prepackaged software is low and the ratio of custom software is high in the Japanese software industry compared to the U.S. (Tanaka, 2003; Motohashi, 2005). Compared with the customization of prepackaged software, the production of custom software requires meeting specific individual user needs. In this case, it becomes arduous to clearly state the terms of the contract ex ante due to the complexity of the terms of the outsourcing activity. Therefore, these differences in the terms of the contract may have affected the results, which indicate the ambiguous responsibility between the outsourced and outsourcing firms.

A large number of U.S. firms reported that the relation with the outsourcing firm is that of an "Advisor regarding the technology trends of IT," whereas a large portion of Japanese firms indicated their perception of outsourcing firms as a way of reducing costs. These results indicate that there is a strong tendency for Japanese firms not to treat outsourcing firms as a strategic partner, but rather as one means of achieving cost reduction. Although a large number of firms employ individuals that have had experience in their general affairs and finance divisions, only a limited number of firms are effectively utilizing external resources and possessing the vision to deploy state-of-the-art systems in the world of IT where technological progress is taking place at an unprecedented pace, in an attempt to effectively use IT for corporate management.

The large number of Japanese CIOs holding joint appointments in other departments and Japanese firms beginning outsourcing before the terms of the outsourcing activity are clearly stated are trends highly related to the typical 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 two-division model of management and its subordinate organization. In this analysis, in addition to the information affecting entire firm (system shock), sharing of the information affecting 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 divisions in addition to firm-wide information (a horizontal hierarchical system) is complementary with Japanese economic institutions (tacit rules), which includes a stable employer, employee 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 (which operates using only firm-wide information and information of its own division) 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 externally recruit specialists as CIOs, 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, CIOs 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 and IT-user divisions, 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 CIOs with other executive positions indicates their low perception of the role of IT for corporate management, 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 the business.

However, since the responsibilities of the IT and IT-user divisions is ambiguous in the Japanese firm system, there is a potential risk of the adjustment 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 heightened 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 growing. 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 in the firm. The results reveal the importance of "internal information sharing" as a CIO's duty is consistent with these trends of U.S. firms.

5. Conclusions and future research questions

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 data from 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 routine 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.

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

Finally, it is essential to effectively outsource IT systems for corporate management due to the swift advancement of IT, but U.S. firms treat outsourcing firms as partners that advise on technological trends, whereas a large number of Japanese firms perceive them as a means of cost reduction. Furthermore, it is found that outsourcing costs of Japanese firms become unexpectedly high since the exact outsourcing activity is not finalized beforehand, and that there are also delays in the ordering.

One caveat is that this analysis compared the use of IT systems in the three countries, but does not address which country's method is superior. Therefore, the most important direction of future research is to perform 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 CIOs, Korean firms are not likely to view the utilization of 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 that Korean firms may 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.

It is found that Japanese firms treat the relationship with IT outsourcing firms as a means of cost reduction, and also a large number of firms experience a delay in project termination and indicate unexpected costs. One reason for this is that the ratio of custom software in the Japanese software market is high, and the situation is different to the U.S. where it is common to build a system for its business by combining different types of pre-packaged software. From the perspective of the IT vendor, where the activity is actually outsourced, since the development of custom software is its main job, it is said that the productivity of the Japanese software industry is at low levels (Minetaki and Motohashi, 2007). This also may have an effect on lowering the efficiency of IT investments on the user side. Therefore, the U.S. model, centered on pre-packaged software, may be increasing the productivity of both vendor and user, resulting in a win-win relationship. This is an important point in relation to the productivity effects of IT at the macroeconomic level, and we would like to continue with the analysis to investigate the effects of relations with IT outsourcing firms on the firm performance of IT-user firms.

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Table 1: Sample size by industrial classification

	Japan		U.S.		Korea	
Less than 10M USD	9	(2.8%)	17	(8.5%)	22	(7.6%)
10M USD～50M USD	15	(4.7%)	32	(16.0%)	104	(36.1%)
50M USD～100M USD	14	(4.4%)	25	(12.5%)	62	(21.5%)
100M USD～500M USD	207	(65.3%)	103	(51.5%)	91	(31.6%)
500M USD～	72	(22.7%)	23	(11.5%)	9	(3.1%)
Total	317		200		288	

Table 2: Sample size by firm size

	Japan		U.S.		Korea	
Manufacturing	142	(44.8%)	70	(35.0%)	178	(59.3%)
Finance	28	(8.8%)	41	(20.5%)	19	(6.3%)
Distribution	41	(12.9%)	12	(6.0%)	17	(5.7%)
Transport, communications, and	33	(10.4%)	32	(16.0%)	42	(14.0%)
Other	73	(23.0%)	45	(22.5%)	44	(14.7%)
Total	317		200		300	

Figure 1: IT expenditure/Sales ratio (%)

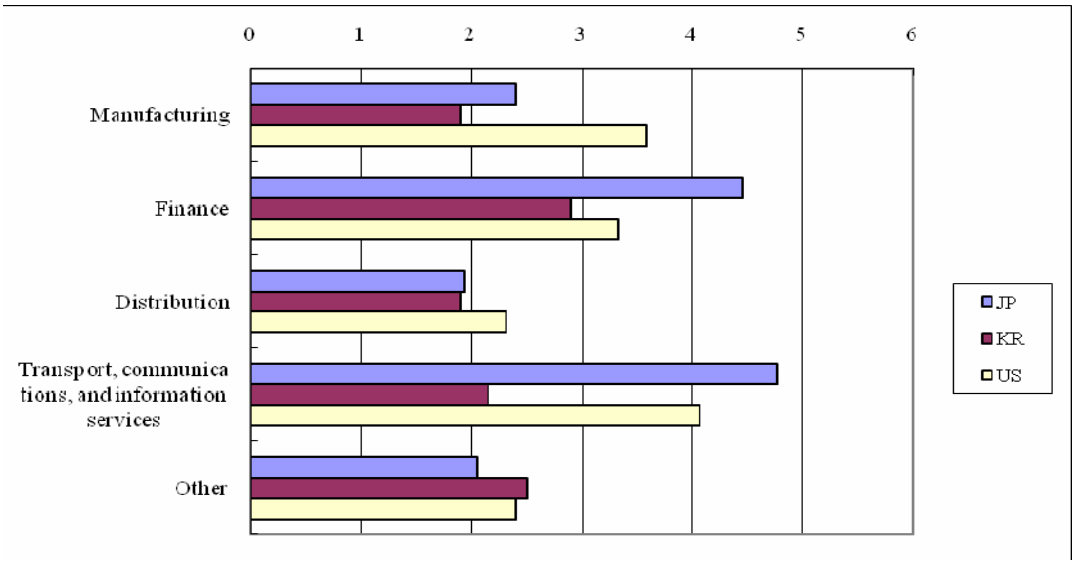

Table 3: Deployment of IT systems

		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 manamgent 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"
Note2: 1(Perfectly collaborating) 2(Partly collaborating) 3(Independently run)
Absolute value of z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 4: 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 mangement strategies (Note)				
	Clear role in the management strategy	0.915	(2.10)**	0.596	(1.47)
	Weak relatation 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)	Stregthening 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 offce 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)	Stregthening 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 offce 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 nevertheess consistent"
Absolute value of z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 5: 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)
	Impotance of the duty as the CIO				
(4)	Internal cordinations of IT systems	0.032	(0.48)	0.141	(2.05)*
(5)	Planning new servicess	−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 quesion: 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%

Table 6: Relation with outsourcing firms

		U.S.		Korea	
	The relation with outsourcing firms (Note)				
(1)	Development of firm-wide mission critical systems such as financial accounting				
	Order after the outsourcing activity is clarified	0.980	(3.30)**	0.918	(3.96)**
	Clafify step-by-step after the outsourcing activity begins	1.186	(2.97)**	0.258	(0.69)
(2)	Business division specific systems (SCM, Sales support etc.)				
	Order after the outsourcing activity is clarified	0.703	(2.51)*	0.815	(3.45)**
	Clafify step-by-step after the outsourcing activity begins	0.484	(1.26)	-0.127	(0.34)
(3)	Improving the current system/updating				
	Order after the outsourcing activity is clarified	0.278	(1.05)	0.894	(4.01)**
	Clafify step-by-step after the outsourcing activity begins	0.259	(0.68)	-0.772	(1.82)
(4)	Running and protecting the firm-wide system				
	Order after the outsourcing activity is clarified	0.404	(1.40)	0.801	(3.52)**
	Clafify step-by-step after the outsourcing activity begins	0.252	(0.61)	-1.047	(2.29)*
(5)	Clarify the specification the outsourcing activity and avoid becoming black-boxed.	-0.107	(1.31)	0.193	(2.37)*
(6)	The solution providers of the system are outsourcing firms	-0.024	(0.31)	0.075	(0.95)
(7)	The system development did not proceed as stated in the contract and resulted in more c	-0.231	(2.97)**	-0.396	(5.09)**
(8)	Outsourcing firms are partners of business reform	-0.041	(0.59)	0.093	(1.34)
(9)	Outsourcing firms are advisors of the technology trends of IT	0.262	(3.86)**	0.093	(1.37)
(10)	Outsourcing is necessary for cost reductions	-0.292	(4.13)**	-0.248	(3.50)**
(11)	Clearly indicate the nature of the outsourcing activity beforehand within the firm	0.435	(5.64)**	0.079	(1.02)
(12)	There are often times of directly accepting the proposals of the outsourcing firm	-0.004	(0.05)	0.102	(1.39)

Note: The base category is "Decide the outsourcing acitivity upon consultation with the outsourcing firm"
Absolute value of z statistics in parentheses
* significant at 5%; ** significant at 1%