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## **THE RELATIONSHIP BETWEEN IT CAPABILITY AND FIRM PERFORMANCE IN DIFFERENT E-BUSINESS MODES**

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### **ABSTRACT**

Based on the technology typology view, this study propose three e-business modes: process-oriented EB, relationship-oriented EB, and knowledge-oriented EB. Then, they can be referred to different industry types (e.g., manufacturing, financial industry, and service, respectively). Further, the effects of IT capability on firm performance in these EB modes are compared. The preliminary empirical results shows that IT capability-enabled firm performance is more significant in process-oriented EB and not significant in relationship-oriented EB. The findings encourage firms to re-think different IT strategy according to the characteristics of their EB modes rather than only adopt a more general strategy (e.g., the development of IT capability).

*Keywords:* E-business (EB) Mode, IT Capability, Firm Performance, Technology Typology View.

### **INTRODUCTION**

Although many researchers have deeply studied in E-business (EB)-related topics, they usually relied on the SCM-ERP-CRM architecture (e.g., [4, 11, 14]) and focus on manufacturing. However, E-business in other industries (e.g., financial services) should also be pay attention and the technologies that they use can reflect the differences between manufacturing and other industries [35]. In addition, Motiwalla et al. [24] also focus on the industry analysis of EB effectiveness and found out that there are indeed some performance differences of EB adoption between industries. These all shows that EB has been applied in various industries (not only in manufacturing). We should use a wider viewpoint to take care of EB in various industries and clarify the differences between them to derive the corresponding IT strategy.

For this reason, this study is based on Thompson's [33] three technology typologies (i.e., long-linked technologies, mediating technologies, and intensive technologies) to propose three e-business modes (i.e., process-oriented EB, relationship-oriented EB, and knowledge-oriented EB) according to the jobs that these technologies mainly address. In addition, these EB modes can represent different industry types (e.g., manufacturing, financial industry, and service, respectively) [7, 18]. The characteristics of these e-business modes are also further discussed in this study. Among them, the process-oriented EB (e.g., ERP) is most often studied, but the alternate two modes are relatively seldom mentioned [13]. If these EB modes can be reviewed thoroughly, we can understand the mechanism of EB value in different industries (i.e., a contingency (context) analysis [31]).

On the other hand, many researchers have adopted the resource-based view and believed that the development of superior IT capability is an important IT strategy for firms to strengthen their IT value (e.g., [2, 5, 29, 30]). However, the effectiveness of IT capability-enabled firm performance has been challenged and re-thought in recent years [6, 25, 26]. This study attempts to adopt the viewpoint of E-business modes to explain this phenomenon. Further, IT capability-enabled firm performance in the three EB modes will be compared. Similar to the industry-level moderators-related IT value studies (e.g., [1, 9, 15]), IT-enabled influences in different industries are also an important question that many researchers and practitioners want to know.

Overall, this study has two main objectives. We first propose and define three different E-business modes and their corresponding job types and industries are extended. Second, the effects of IT capability on firm performance in different EB modes are compared. We attempt to use them to explain the contradiction phenomenon of IT capability-enabled performance in recent years.

### **BACKGROUND**

#### **IT Capability-enabled Firm Performance**

Studying the link between IT and firm performance has been an interesting subject for IS researchers [17, 31]. Many researchers adopted the resource-based view to believe that the variation of performance was due to IT capabilities [19, 22]. Further, firms are encouraged to develop superior IT capabilities to gain IT-enabled firm performance. The argument of IT capability-enabled firm performance was also confirmed by Bharadwaj [2], Bhatt and Grover [5], Ravichandran and Lertwongsatien [29], and Santhanam and Hartono [30]. However, this argument has been challenged in recent years [6, 16, 25, 26]. Chae et al. [6] found out that the significant level of IT capability-enabled firm performance may be not significant in recent years due to the highly standardized and homogeneous IT resources. Then, firms may be difficult to get differentiation performance from these IT resources. However, seldom study uses a viewpoint of contingency to concern the fitness

conditions of IT capability, although this viewpoint has been highlighted in IT value literature in recent years (e.g., [17, 31]).

### IT Value in Various Industries

Although many researchers deeply contribute to the concept of IT capability, they usually use a whole viewpoint to examine the mechanism of IT capability (e.g., [5, 29]). That is, the contexts or contingency factors (i.e., moderator) are seldom considered. Many studies mention that the characteristics of industries are an important factor that may moderate the effects of IT strategy on firms' success [8, 9, 23]. For example, Im et al. [15] and Dehning et al. [10] both adopted event study method to examine the stock price reaction of IT investment announce in different industries. Their findings show that the payoff of IT investment in various industries may be different. In addition, Lee et al. [18] also found out that industry type will moderate the effects of IT outsourcing strategy dimensions on outsourcing success. However, seldom studies focus on the relationship between industry type and IT capability-enabled performance. We believe that the argument that firms should develop IT capability to strengthen their competitiveness is a more general concept. The viewpoint of fitness may be added to examine the effectiveness of the development of IT capability. For example, if IT capability is developed in a high routinization environment, the effectiveness IT capability will be more significant. Otherwise, if IT capability is developed in a project-based or knowledge-based environment, the effectiveness of IT capability will be limited due to the worse conditions of fitness. That is, non-structure jobs (relative to structure jobs) are relatively difficult to be addressed by information technology. Therefore, the fit conditions of IT capability should be further studied.

## RESEARCH FRAMEWORK

Thompson's [33] proposes three different technology typologies: long-linked technologies, mediating technologies, and intensive technologies. Further Chatman and Jehn's [7] and Lee et al.'s [18] base on Thompson's [33] technology typology view to classify three types of industries.

First, long-linked technologies focus on "prescribed ordering of tasks" [7, 18]. They are the most typical and traditional mode of information systems. Their primary activities are a sequential value-added process. These processes are highly routinized and have been totally embedded in the information systems according to standard operating procedures (SOP). Gottschalk (2006) also mentioned that ERP and SCM can best represent this technology typology. Further, we believe that they also can be referred to "process-oriented e-business mode". That is, these technologies mainly help firms to deal with process-related jobs. Then, these firms gain IT-enabled performance by improving their process effectiveness or process performance [23]. Finally, these technologies are visible in industries characterized by assembly, e.g., manufacturing [7, 18].

Second, mediating technologies focus on "categorizing clients and inputs and standardizing processes for each category" [18]. For example, financial industries (e.g., bank and insurance) can be referred to this typology [7, 18]. The platform model can be used to analyze this type of industries. It serves as a mediator for customer linkage (e.g., debtors and creditors). SOA (service-oriented architecture) and CRM may be the most appropriate systems for this modes [13]. From the viewpoint of e-business mode, these technologies mainly provide relationship-related assistance for firms and can be referred to "relationship-oriented e-business mode".

Third, intensive technologies attempt to "address project-specific demands, requiring extensive customization and problem solving" [18]. According to these descriptions, KM and DSS are the most appropriate systems to address these jobs [13]. Compared to process-oriented jobs and relationship-oriented jobs, these jobs are low routinization and required more human operation. Today's technology capabilities are relatively difficult to totally embed them into information systems. Further, from the viewpoint of e-business mode, intensive technologies can be referred to "knowledge-oriented e-business mode". Many service-related industries (e.g., consulting firm and hospital) can be classified as this mode [7, 18]. They don't produce any products or maintain many client relationships to be mediators. But they focus on their professional knowledge to provide problem solving service for their customers.

Based on Thompson's [33] three technology typologies, three different e-business modes (i.e., process-oriented EB, relationship-oriented EB, and knowledge-oriented EB) are derived according the job characteristics that these technologies address. The comparison of these modes are summarized in Table 1. Further, Lee et al. [18] believed that the level of routinization of jobs will moderate the success of IT outsourcing because highly routinized jobs are easy to articulate their IT need and then the outsourcing contracts are relatively easy to execute. Similar to their argument, we also believe that these three e-business modes represent a continuum ranging from process-oriented EB through relationship-oriented EB to knowledge-oriented EB. If the level of routinization of jobs that EB mainly addresses is high, their fitness for IT capability is higher. That is, the modes of E-business will strengthen or weaken the relationship between IT capability and firm performance and the research hypothesis is proposed as the following.

**Research Hypothesis: E-business modes will moderate the effects of IT capability on firm performance. Specifically, IT capability-enabled firm performance will be more significant in process-oriented e-business mode (e.g., manufacturing).**

Table 1. The Comparison of Three E-business Modes

E-business Mode	Process-oriented Mode	Relationship-oriented Mode	Knowledge-oriented Mode
Technology Typology [33]	Long-linked Technology	Mediating Technology	Intensive Technology
Routinization of Jobs [7,18]	High	Medium	Low
Example of Information Systems [13]	ERP/SCM	CRM/SOA	KMS/DSS
Example of Industries [7,18]	Manufacturing	Financial Industry (e.g., bank and insurance)	Service (e.g., consulting firm and hospital)

## EMPIRICAL STUDY

This study follows Bharadwaj [2] and Santhanam and Hartono's [30] methodology to use InformationWeek as our sample source. InformationWeek is an important magazine that surveys the use of IT among U.S. companies [4, 21] and its IT leader rankings are recognized by many top IS journals (e.g., MIS Quarterly and Management Science) to represent firms with superior IT capability. Bharadwaj [2] and Santhanam and Hartono's [30] also adopted InformationWeek's lists and believed that these leader firms combine IT-related resources to create the whole IT capabilities and can be used as the sample of the firms with superior IT capabilities. These leader firms' performance are indeed better than the other firms without superior IT capabilities according to their empirical studies. Therefore, the top 250 IT leader list from InformationWeek from 2006 to 2011 is used as this study's leader sample. By the initial comparison with the Compustat database (which provides firm performance data), each of the 408 firms has been listed on the top 250 at least once in the six years.

Further, the 408 leader firms are classified into different E-business modes according to their industry characteristic (NAICS code). Manufacture-related industries are classified as the process-oriented mode, financial-related industries (e.g., bank and insurance) are classified as the relationship-oriented mode, and service-related industries (e.g., consulting firm and hospital) are classified as the knowledge-oriented mode. Their sample sizes are 147 firms (36%), 172 firms (42%), and 89 firms (22%), respectively. In addition, the firms that are not on the leader list (the 408 firms) in the Compustat are regarded as the firms without superior IT capabilities [2, 30]. These firms are further matched to the leaders according to their industry codes and used to examine the difference between the two groups (i.e., leader groups and control groups).

Finally, as for the measurement of firm performance, return on assets (ROA) and return on sales (ROS) are adopted in this study. These indicators have been commonly used in previous studies [9, 20]. Therefore, we use the two indicators to measure these samples' firm performance.

## RESULTS

Bharadwaj [2] and Santhanam and Hartono's [30] test method is followed. The independent parameter test (Wilcoxon Rank Sum Test) is used to examine the year-by-year differences between the leader groups and the control groups. The results are shown in Table 2. The results show that the effects of IT capability on different EB modes are inconsistent. For example, the effects on process-oriented mode are all significant from 2006 to 2009. The effects on relationship-oriented mode are not supported in all years. The effects on knowledge-oriented mode are slightly significant (only in 2009 and 2010). Overall, IT capability-enabled firm performance in different E-business modes are different. That is, E-business modes moderate the relationship between IT capability and firm performance. The empirical results preliminarily support our argument. Further, the results also show that IT capability-enabled firm performance in process-oriented mode is the most significant.

Table 2. The results of the independent parameter tests

Year	E-business Mode								
	Process-oriented			Relationship-oriented			Knowledge-oriented		
	N	ROA	ROS	N	ROA	ROS	N	ROA	ROS
2006	134	0.0143 **	0.0748 *	163	(0.1723)	(0.1377)	78	0.1205	0.1979
2007	139	0.0857 *	0.0873 *	161	(0.0095) ***	(0.0506) *	77	0.2133	0.2251
2008	139	0.0129 **	0.0062 ***	161	(0.2389)	(0.0252) **	77	0.1319	0.1929
2009	137	0.0029 ***	0.0037 ***	153	(0.4279)	(0.1682)	78	0.0061 ***	0.0707 *
2010	134	0.1979	0.1455	151	(0.0681) *	(0.0164) **	75	0.0200 **	0.0202 **

2011	130	(0.4455)	(0.2878)	149	(0.0572) *	(0.0055) ***	70	0.1379	0.1674
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Note: The value indicates the single tailor p-value of the independent parameter test. In addition, significance is indicated at: \* 10%; \*\* 5%; \*\*\* 1%, and () represents the negative influence.

## DISCUSSION

The preliminary empirical findings shows that IT capability-enabled firm performance is more significant in process-oriented EB than in relationship-oriented EB and in knowledge-oriented EB. The results are similar to Lee et al.'s [18] findings that mention outsourcing success just in industries using long-linked technologies. This shows that industries characterized by process-oriented mode have highly intensive routinization jobs. These jobs can be became SOPs and embedded in IT systems well. Therefore, IT capabilities are more important for firms with process-oriented EB (e.g., manufacturing). However, firms with the other two modes indeed should re-think new IT strategy (i.e., different to the development of IT capability) to strengthen their competitiveness.

In addition, two interesting points are found from the empirical findings. First, according to our empirical findings, the effects on knowledge-oriented EB are significant in recent years (2009 and 2010). Maybe, we can infer that IT capabilities, which can address knowledge-related jobs (non-structure jobs), have progressed in recent years. For example, KMS and DSS may be more mature and can play more important roles in firms that adopt knowledge-oriented EB. Second, we also find out that the effects on relationship-oriented EB are all not positively significant. Maybe other factors also moderate the relationship. For example, the architecture of relationship-oriented EB is the most openness to maintain a large number of relationships. Further, they may be difficult to maintain their own advantages due to the homogeneity of technologies (e.g., ATM). Nevertheless, this study propose a new viewpoint to examine the moderating effects between IT capability and firm performance. Then, the argument that IT-enabled performance in various EB modes is different is indeed confirmed.

### Research Contributions

Echoing our research objectives, this study first propose three different EB modes. According to the comparisons of these EB modes, we can find out that the e-business architectures are obvious different in various industries. Specifically, the "jobs" that firms use e-business systems to address have different attributes in various industries. For example, process-oriented jobs, relationship-oriented jobs, and knowledge-oriented jobs are three different types of jobs. The previous studies usually adopted Porter and Millar [28]'s information intensive view to believe that IT value will be more significant in high information intensive industries (e.g., [12, 15]). However, their empirical findings are not all as their expectations. They only considered information-related jobs and non-information-related jobs and believed IT is more closed to information-related jobs. In this study, we believe that information-related jobs can further be classified according to the level of the routinization of jobs (e.g., process-oriented, relationship-oriented, and knowledge-oriented jobs). Specifically, IT capability is more closed to process-oriented jobs. Indeed, we also find out that the highly routinized jobs promote the effects of IT capability on firm's performance.

Next, based on our argument of EB modes, we propose a new viewpoint to explain the insignificance of IT capability-enabled firm performance in recent years. Indeed, the relationship between IT capability and firm performance in manufacturing is still strong according our preliminary empirical findings. This is also an interesting phenomenon that the previous studies never notice. If we can combine these concepts, we will more understand the IT value mechanism of different industries (e-business modes).

### Implications

First, the importance of IT capabilities should be re-thought. Specifically, IT capability-enabled firm performance is more significant in manufacturing, not in financial industry. Therefore, is the development of IT capability still a general IT strategy for all firms? Second, based on this question, we believe that the fitness conditions with IT capability-enabled performance should be explored. For example, this study attempt to propose the routinization of jobs to explain the conditions. Maybe there are another conditions can be found out in the future.

Finally, although IT capability-enabled performance is not significant in some industries according our argument, this should not encourage firms in these industries to stop their IT-related projects. This just encourages them to re-think their IT deployment strategy (i.e., different to the development of IT capability) that can indeed strengthen their competitiveness. For example, the development of IT agility, knowledge management capability, and IT innovation, which is also usually discussed by IS researchers in recent years, may be a better alternate solution for some industries. Overall, the IT strategy should be re-thought and refined for different industries.

### Limitations and Future Research

This study also has some limitations and some issues that can be extended in the future research. First, we only use manufacture-related industries, financial-related industries, and service-related industries to represent the three EB modes. Whether the samples can appropriately represent all the E-business modes must be considered. Or, some firms may have two

different EB modes at the same time. These issues should be considered rigorously in the future. However, we believe that the idea of the three different e-business modes is more important and thought-provoking.

Second, because firms with revenues exceeding 500 million dollars are considered by InformationWeek's survey and this study follow its rule, the empirical findings do not reflect the situation for small firms. Although these SMEs may use IS more effectively, this issue should also be noted as a limitation. On the other hand, due to the same issue of data source, the data of the independent variable (IT capability) is collected from InformationWeek. The data only shows the whole IT capability and cannot further distinguish between various types (items) of IT capability. If the more rigorous data can be obtained in the future, the effectiveness of the empirical study can be strengthened. In addition, this study uses only one test method to examine our argument. If more different and rigorous test methods can be used to conform the hypothesis in the future, the argument will be stronger.

Third, this study only focus on the characteristic of the three e-business modes to propose a new viewpoint that can explain the variance between industries. Maybe there are other factors (e.g., the imitation or homogeneity of IT resources [27, 34]) that also can the explain industry-level variance or the relationship between IT capability and firm performance. If these factors can be controlled or addressed well, our argument can be examined more rigorously.

Finally, this study just proposes an idea to describe E-business in different industries and test them in the scenario of IT capability-enabled performance. Can these three modes represent all e-business modes well? Or, can these three modes be further extended to another attributes? These issues are also worthwhile to be studied in the future.

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