The Impact of IT and Social Capital on Inter-firm Dynamic Capabilities: Understanding the Performance of Healthcare Delivery Network

by

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Abstract

In response to the calls for research of dynamic supply chain development and IT business value, this study examined the impact of IT and social capital on interfirm dynamic capability. Healthcare delivery networks were chosen as the example to perform the research because of their distinct feature as a part of the supply chain of healthcare industry. There is a patient flow in the network compared with traditional supply chain because hospitals often need to work with various partners in order to deliver a healthcare service. This research proposes that IT with event driven architechture (EDA) and social capital are two factors improve the interfirm dynamic capabilities in healthcare delivery network which will lead to better operations and ultimately improves the healthcare service delivery performance. A research model was developed based on information processing view to investigate the relationship between IT, social capital, interfirm dynamic capabilities, and operational capabilities. Also, the quality and financial performance was examined as the outcome of developing dynamic healthcare delivery networks. The study employed primary data from survey and secondary data obtained from Center of Medicare and Medicaid. The empirical test was conducted using PLS, seemly unrelated regression, and cluster analysis. The finding of the empirical model illuminated the need for IT with EDA, better social capital with healthcare providers in order to develop a higher interfirm dynamic capabilities for healthcare delivery network which will improve the hospitals healthcare service quality and financial performance.

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Chapter 1. Introduction

"Fortune favors prepared firms" (Wesley M Cohen & Levinthal, 1994). In today's dynamic business environment, firms are facing increasingly intensive competition, market turbulence, and ever-changing technology innovation. It is very likely that this situation is going to continue, and will be a key factor that influences firms' performance in the near future. Firms today must have an open mind toward changes and be able to quickly, efficiently and effectively deploy their resources, including technology, staff, plant, and finance to respond to sudden changes in the marketplace (Allred, Fawcett, Wallin, & Magnan, 2011; Teece, 2009). In order to do so, it is first important for firms to constantly scan, identify and explore opportunities from the environment. These opportunities can come from different sources, such as technology innovations, customer demand, or regulation alterations. Nonetheless, these opportunities require firms to have the insight of the market, industries, and even competitors actions (S. G. Winter, 2003). However, it is not enough that firms sense the opportunities from the environment; it is equally important that firms can take advantage of these chances by making the correct move quickly, such as launching a new product or updating the manufacturing procedure. This process involves improving current operation competences, assets, and technologies by reconfiguring current resources or acquiring new ones. Teece and colleagues (1997) label this capability as "dynamic capability." They suggest that firms with dynamic capabilities are able to sense and alter firms' resources quickly to respond to unexpected changes in the environment. These firms,

they say, have survived and even thrived in the business environment, which is increasingly dominated by massive changes and high uncertainties.

Since the concept has been brought out, dynamic capability has received various attentions. It has been applied to understand the importance of robust organization structures, the role of managers, and strategic management (Pavlou & El Sawy, 2011). Furthermore, dynamic capabilities provide a new method to create competitive advantages in a turbulent environment (Grewal & Slotegraaf, 2007). The word "dynamic" emphasizes the process to "renew competence so as to achieve congruence with the changing environment" (Teece et al., 1997, p. 515). Firms can stay ahead in the competition by constantly creating short-term competitive advantages. This capability is consistent with the strategic requirement that firms must alter their operations and decisions, to match the environment requirements, in order to obtain competitive advantages (Newbert, 2007; Zhu & Kraemer, 2002).

Among various business operations, supply chain management is one of the key aspects that influence firms' survival. The landscape of supply chain has been altered prominently by the turbulent environment. The uncertainties and risks brought by external environment and partners along the supply chain are greater than ever. For example, the economic crash in 2008, in the US, put many manufactures in China out of business in a very short time because they could not receive any orders from their offshore customers. Transitionally, supply chain management aims at efficiency optimization by emphasizing on the forecasting and monitoring of the environmental variation (Holweg, Disney, Holmström, & Småros, 2005). The goal is to create a stable supply chain that can grant competitive advantage for firms (Hart, 1995). However, as the turbulence and the volatility increases, changes become less and less predictable, and the overall competitive advantages of firms' supply chain strategy are decreasing because of this fast

changing pace of the market (J. B. Barney, 2012). Furthermore, the goal of forecasting and monitoring variation is to reduce the uncertainty along the supply chain. Such decrease in uncertainty comes from the control of the supply chain which increases the overall rigidity. This may hinder the members in the chain to react swiftly to changes (Christopher & Holweg, 2011). Therefore, the focus of supply chain management shifts from long-term stability, to fast responding to various environmental events, creating a dynamic supply chain to accommodate the turbulent environment. A typical example is Zara's modular supply chain design that allows the firm to react quickly to changes in the fashion design and customer demand (Ferdows, Lewis, Machuca, & Laurent, 2003).

In the turbulent environment of the contemporary organization, firms tend to use IT to leverage or generate new capabilities to cope with the changes and grasp the opportunities that emerged in the turbulence. Information technology (IT) has been a valuable resource in creating business capabilities that can contribute to superior business performance (Banker, Bardhan, Chang, & Lin, 2006; Baskerville, Pawlowski, & McLean, 2000). An increasing portion of firms' investment goes to IT to attain the desired performance. Adopting a customer relationship management system to provide better customer service or to implement the vendor-monitored inventory system to reduce the cost and improve the efficiency in warehouse management are two examples (Ramdani, 2012). Within the same trend, the academic research on the relationship between IT and business performance is proliferating with the aim to gain insights into IT's business value generation. According to different levels of business operations, IT's impact on business performance could be classified into three catalogs: operational, tactical and strategic (Ramdani, 2012). Research has shown that IT could increase the business process performance such as the process efficiency and productivity (Byrd, Thrasher, Lang, & Davidson,

2006). IT also improves the tactical level performance such as customer relationship management (Jayachandran, Sharma, Kaufman, & Raman, 2005) and supply chain partnership development (Subramani, 2004). On the strategic level, IT creates sustainable competitive advantages for the firm, such as IT enabled organizational agility (Lu & Ramamurthy, 2011; Overby, Bharadwaj, & Sambamurthy, 2006; Sambamurthy, Bharadwaj, & Grover, 2003; Weill, Subramani, & Broadbent, 2002). The various IT's benefit lead to the next research question this research aims to answer:

Although research of supply chain management and dynamic capabilities has been developed tremendously over the past decades, the overlap between these two research fields is still very little (Defee & Fugate, 2010). Most supply chain management research focuses on the operational capabilities that directly relate to the firms' performance, for example, lean production, just-in-time management, and flexible supply chain design (Ferdows et al., 2003; Fugate, Mentzer, & Stank, 2010). As just mentioned above, the competitive advantage is shrinking in today's hypercompetitive and dynamic environment. Thus, in supply chain management research, it is also important to figure out the dynamic capabilities that enable firms to renew their current supply chain capabilities or to create new ones (Defee & Fugate, 2010).

The major research body of dynamic capabilities focuses on the internal dynamic capabilities and uses new product development as a context to demonstrate them (Eisenhardt & Martin, 2000; Pavlou & El Sawy, 2011; Teece et al., 1997). As the environment evolves, the boundaries of firms are blurring. Single firms focus on their own centric dynamic capabilities, and fail to acknowledge the contribution of partnership along a supply chain. Therefore, it is important to understand the dynamic capabilities at the inter-organizational level. In current literature, few papers have been found in this area, and most of them are conceptual (Defee &

Fugate, 2010). Furthermore, studies highlight the importance of dynamic capabilities (Arend & Bromiley, 2009; Barreto, 2010; Pavlou & El Sawy, 2011; Teece, 2009), but few of them put effort in understanding what factors might facilitate the development of the dynamic capabilities. Thus, this research aims to fill in this research gap by proposing a model of interfirm dynamic capabilities and its antecedents and empirically testing it within the context of the healthcare delivery system.

Research Question Development

In order to achieve the research goal, this research adopts the theory of information processing view (IPV) to investigate the relationship between IT and interfirm dynamic capabilities, as well as identifies other factors that will impacts the development of interfirm dynamic capabilities in healthcare delivery network. In the healthcare industry, the service operations have changed significantly during the past decade (de Vries & Huijsman, 2011). Patient logistics, clinic pathways, electronic healthcare records, and other technologies have been developed in order to increase the quality of healthcare delivery, which helps the healthcare providers to stay competitive in the sector (Aptel & Pourjalali, 2001; de Vries & Huijsman, 2011). Supply chain management in the healthcare industry has been considered as a fragmented area. The complexity of technologies, multiple players, and the dynamic environment of the industry requires the supply chain management practice to develop partnership relationships between different healthcare providers. Thus, developing interfirm dynamic capabilities is necessary to enhance the supply chain performance in order to improve the healthcare service quality. The application of supply chain management in the healthcare industry not only relates to the product movement along the supply chain such as the medical devices and pharmaceuticals, but also the flow of patients between various healthcare providers (de Vries &

Huijsman, 2011). This is the unique feature of the healthcare supply chain, and such flow requires collaboration among these providers. Therefore, this research focuses specifically on this part of the healthcare supply chain and investigates the application of interfirm dynamic capabilities under this situation.

Dynamic capabilities represent firms' ability to sense and respond to changes in the environment in a timely manner (Teece et al., 1997). In order to do so, firms have to stay alert to environmental signals and react effectively. This means that firms need to follow the trends in the market, track technological innovations, identify and evaluate current and potential competitors, maintain efficient connections with suppliers, make correct decisions, and act quickly according to those decisions. The accomplishment of these tasks heavily relies on accurate, reliable, and timely information. Such information provides managers with a more comprehensive picture of the business environment which helps them obtain insights of relevant organizational and environmental changes (Thomas, Clark, & Gioia, 1993). The clarity and appropriateness of the information also influence the decision making process as to the proper reaction to such changes. It has been suggested that a firm's ability to collect accurate and reliable information and process it in a timely fashion are associated with higher sensing and responding capability to environmental changes (Kuvaas, 2002; Milliken, 1990). Therefore, it is necessary to study the dynamic capabilities from the information processing view (IPV) (Galbraith, 1974; Kohli & Grover, 2008; Kuvaas, 2002).

According to the IPV of the firm, an organization could be considered as an imperfect information processing system because of incomplete information and its limited information processing capacity (IPC) (Galbraith, 1974). Incomplete information, due to limited IPC, results in poor decision making. This poor decision making will, of course, impact firms' performance

(Galbraith, 1974). There are two factors that contribute to the incomplete information: uncertainty and equivocality. Uncertainty is created by inadequate knowledge and information (Karimi, Somers, & Gupta, 2004). Equivocality is created by the ambiguity of the information (R. L. Daft & Macintosh, 1981; Tushman & Nadler, 1978). When the uncertainty and equivocality are increased, firms need to collect additional data to reduce the vagueness or take extra effort to clarify the misunderstanding in the information. This means information processing requirement (IPR) is increased.

The uncertainty and equivocality are impacted by the environment and the task characteristics (R. Daft & Lengel, 1986). Within a turbulent business environment, it is clear organizational decision making and operation are processes governed by great uncertainty and equivocality (Melville & Ramirez, 2008). When the tasks are less routinized and depends on each other, the information flow are more complicated which increases the uncertainty and misunderstanding in the information transmission process. Because of these issues, organizations are continuously developing strategies and refining their organizational structures to increase the ability to process the information and reduce the uncertainty and equivocality (Kohli & Grover, 2008). Such ability is called IPC and it needs to meet the IPR gengerated by the environment and task charateristics (Galbraith, 1974; Kohli & Grover, 2008). High IPC indicates the ability to collect and process external and internal signals and, thus, provide alerts to managers (Kuvaas, 2002). With sufficient information, managers are able to recognize the importance of the signals from both internal and external environments and take actions accordingly (Seo & La Paz, 2008). Thus, we argue that dynamic capabilities can be considered a form of IPC possessed by firm, aiming at addressing the information process requirement generated by the environment and tasks.

Q1: Does the fit between IPC and IPR increase supply chain performance?

IPV suggests IT adoption and lateral relationship creation are two main strategies to improve the IPC in firms (Galbraith, 1974). IT can improve IPC by increasing firms' capability of collecting, storing, analyzing, and disseminating data. For example, it has been demonstrated that IT such as resource planning systems can provide integration between various stakeholders in an organization and increase the accuracy, reliability, and timeliness of the information in tasks, such as forecasting and planning (Banker et al., 2006; Baskerville et al., 2000). Pavlou and El Sawy (2010) find that IT such as project management systems and cooperative work systems allow organizations to be agile and able to move into new competitive positions in very short periods of time. Both of these examples illustrate the contribution of IT in providing relevant information or enhancing information sharing when high IPC are needed by the adopting organization. Therefore, the second research question this research intends to answer is:

Q2. Does the use of IT improve the IPC for a supply chain?

Lateral relationships are the relationships that cut through the organization's structure horizontally and vertically (Galbraith, 1974). Instead of sending messages through the hierarchical structure to exchange information, lateral relationships form a channel where business units can pass communications more directly to each other. The direct information flows in lateral relationships improve the IPC by reducing the unnecessary information flow up and down the hierarchy and allowing for more efficiency and effectiveness in the decision-making process. This encourages the likelihood of peers exchanging information directly and being able to solve problems and enable joint decision making at their own levels. For example, an IT implementation team that includes personnel from both the IT function and the business

user group typically leads to better understanding of the system and the potential business value it will bring (Henderson & Venkatraman, 1993; Luftman, 2004).

In Galbraith's study (1974), seven methods are suggested to generate lateral relationships: direct contact, liaison role, task forces, teams, integrating roles, managerial linking roles, and matrix organization structure. The core idea embedded in these methods is the enhancement of communication, information sharing, and collaboration. It is evident that these seven methods approach lateral relationship creation from the angle of professional connection development. Other than this professional connection, there is another type of connection that also can create relationships across authorities: social connections. Social connections are also an enabler of information sharing and collaboration, as well as an important information source (Nahapiet & Ghoshal, 1998). Research labels these social connections and the resources embedded in them as "social capital" (Inkpen & Tsang, 2005; Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). Research suggests that information sharing, relationship development, and communications among partners are all enablers of a fast responding supply chain by improving the data accuracy and market sensitiveness (Braunscheidel & Suresh, 2009) and they can be enhanced by network relationships and the trust among partners (Du, Lai, Cheung, & Cui, 2012). Thus, the third research question this research aims to seeking answer for is:

Q3. Does social capital among supply chain members improve the IPC?

In summary, this research proposes that IT and social capital are two factors contribute to interfirm dynamic capabilities. Interfirm dynamic capabilities will lead to better supply chain operations and this result will be impacted by the environment and the characteristics of the supply chain.

Possible Contribution of the Research

The primary contribution of this research lies in the empirical assessment of the business value of IT and social capital. Kohli and Grover (2008) call for the research of IT based co-creation of value. They suggest that in a high dynamic environment, the boundary of the firm is blurring, and the collaborations among firms are increasing. In many cases, multiple parties are involved in the process of generating business value, for example, offshore outsourcing, supply chain integration, and joint information product development. Within this trend, IT plays important roles such as breaking the geographical barrier in collaboration, expanding the inter-firm networks, and enabling real-time communication and information exchange (Subramani, 2004). In their research, Kohli and Grover (2008) label this process of realizing business value via a sustainable collaboration process among various organizations with the support of IT as IT based co-creation value. They point out the academic and practical significance of this IT's alternative role and call for research in this stream. This research aims at responding to this call for research by understanding the impact of IT with event-driven architecture (EDA) on the interfirm dynamic capabilities via the IPV.

Social capital has been applied in understanding various organization behaviors and performances, such as information exchanging and knowledge management (Leana & Van Buren, 1999; Seibert, Kraimer, & Liden, 2001). However, little research has been found analyzing social capital's impact on supply chain management at firm level. This research is going to extend the business value of social capital by investigating its impact on interfirm dynamic capabilities.

In addition to this major contribution, there are other contributions of this research. First, this research applies the IPV in the study of dynamic capability and IT business value instead of

the traditional RBV. It considers the IPC is embedded in interfirm dynamic capabilities, aims at processing the information generated by the turbulent environment, and can be leveraged by the IT applications implemented and social capital a firm possesses. Following this argument, this research also points out that dynamic capabilities need to match the IPR in order to reach the best performance.

Second, this research contributes to the literature of IPV. Current applications of IPV are focused on organizational structure design, the formal lateral relationships, and business performances (Hultink, Talke, Griffin, & Veldhuizen, 2011; Shockley, Roth, & Fredendall, 2011; Tushman & Nadler, 1978), few studies take a look at the role of informal lateral relationships, such as social relationships. This research fills in this blank by including social capital in the creation of IPC and extended the application of IPV to business capability development.

Third, this research contributes to the literature of supply chain management. Although certain studies already suggest different capabilities in forming a dynamic supply chain, few of them are empirically tested or identify antecedents that will contribute to the development of those capabilities (Beske, 2012; Bode, Wagner, Petersen, & Ellram, 2011; Christopher & Holweg, 2011; Defee & Fugate, 2010). This research fills in the gap by proposing a framework of dynamic capabilities at the inter-organizational level and suggests two antecedents (IT application and social capital) will impact the development of interfirm dynamic capabilities. Furthermore, this research also includes the impact of the environment and the task characteristics in the process.

The remainder of the dissertation is structured as follows: Chapter 2 includes a review of the literature in IPV. Conceptualizations of IT business value, interfirm dynamic capabilities, and social capital are then discussed and lead to the development of the conceptual model for this study. Based upon the conceptual model, hypotheses are presented. Chapter 3 delivers the description of the methodology and data analysis. The results are presented and assessed in Chapter 4. Finally, the discussion, limitations, and opportunities for future research are discussed, and conclusions are offered in Chapter 5.

Chapter 2. Literature Review

As described in Chapter 1, firms inhabit an increasingly dynamic environment, where stresses like constant technical innovation and increased market complexity all force firms to continuously alter their operations in order to survive. The environmental dynamism is amplified for a supply chain with the involvement of partners' actions. Thus, it is important to create a supply chain that can quickly make adjustments according to the changes in the environment. Dynamic capabilities have been suggested as an effective way to address the environmental dynamism by enhancing firms' ability to create new operational capabilities or reconfigure current ones. This research argues that interfirm dynamic capabilities is an enabler for the development of a dynamic supply chain.

This research is grounded in the IPV. IPV suggests that firms need to carefully collect relevant and quality information, accurately analyze the information, and properly utilize the information to optimize the performance of business processes (Galbraith, 1974; Tushman & Nadler, 1978). This statement indicates the critical role of information processing in improving business capabilities. High IPC has been found to be related to high market awareness and faster response to market needs (Fairbank, Labianca, Steensma, & Metters, 2006), better sensitivity to random changes (Tuggle & Gerwin, 1980), reductions in supply chain cycle times (Hult, Ketchen, & Slater, 2004), and more effective decision making and implementation of those decisions (Kuvaas, 2002), and better overall firm performance (Tuggle & Gerwin, 1980).

Therefore, this research argues that dynamic capabilities are a form of IPC at aims at addressing the information generated from the environment.

IPV suggests that there are two ways to increase the IPC: through IT investment and lateral relationship creation (Galbraith, 1974). Research in IT investment reveals IT can assist in increasing IPC by providing high quality information, facilitating communication and collaboration among organizational stakeholders, and supporting the integration of business processes (Gattiker & Goodhue, 2004). Lateral relationships are the relationships that cut through the organizations' authority structures; they can be formal or informal relationships, including social network (Galbraith, 1974). Following this argument, this research proposes that interfirm dynamic capabilities can be leveraged by the IT implemented along the supply chain and the social capital among the members.

In summary, this research studies the relationships among IT, social capital, and dynamic capabilities and their effects on operational capabilities and firm performance, using IPV as the theoretical foundation. This Chapter presents a thorough literature review of these constructs, the relationships among them, and their association with firm performance.

Information Processing View

Originally, the IPV emerged for organizational structure design. This theory is based on Simon's (1957) assumption that the human cognitive limit is an inevitable constraint for any activities that involve information. However, information is necessary for all kinds of organizational operations from daily routines to strategic decision making. Thus, it is important for organizations to cope with this limitation, and it can be done through the design of the organizational structure. Since the IPV was introduced, it received significant attention from the academy other than for organization design. A literature review has been conducted to

summarize the works that have been published in management and the information system management field. Table 1 shows the summary of the literature review.

Table 1.

Summary of IPV Literature Review

Author(s)	Type of research	Finding/Contribution	Journal
Galbraith (1974)	Conceptual	• Greater uncertainty is related with greater IPR of decision makers. • Organizations need to adopt coordination mechanisms, design hierarchy, and set up goals that can address the uncertainty. • Slack resources, self-contained tasks can reduce the IPR. • Lateral relationship creation and vertical information systems can increase the IPC.	Organizational Effectiveness Center and School
Poole (1978)	Conceptual	• Information is equivalent to the power in the organization. • Low availability and uniformity of the information will lead to the increasing in network linkages, amount of feedbacks through the network, and more flexibility in amounts, types, and reporting of information. • Low availability and uniformity and independence of information also leads to higher devotion of resources to information related activities.	Academy of Management Review
Tushman and Nadler (1978)	Conceptual	• The Task characteristics (complexity and interdependence), task environment and interdependence will increase the uncertainty faced by the organization, and thus increase IPR. • The organization structure design (degree of organismic) and the coordination and control mechanism (rules and programs, hierarchy, joint planning and formal information system and lateral relations) influence the IPC of the organization. • The match between IPR and IPC will reach the effectiveness of the organization.	Academy of Management Review
Tushman (1978)	Empirical	• The project effectiveness is a function of matching communication pattern with the information processing demand of the project work.	Academy of Management Journal

		• Task characteristics and interdependence (IPR) are important determinants of the communication patterns (IPC). High performing project links with more intra-project communication. • Focused communication has higher IPC than widespread and diverse patters of oral communication.	
Tushman (1979)	Empirical	• In high performing subunits of an organization, communication patterns are contingent on the nature of the unit's work: task environment and the task characteristics. • Research projects in a turbulent environment tend to have more decentralized pattern of intra-project communications than those in a more stabilized environment. • Service projects in a turbulent environment tend to have more centralized pattern of intra communication. • In a changing environment, the extra-project communication is reduced because the aim of minimizing information overloads or threat.	Academy of Management Journal
Tuggle and Gerwin (1980)	Conceptual	• Organizational choice of strategy is impacted by the information available to problem solvers and decision makers. • Firms perform better when information and resources are more sufficient. • Firms perform better with higher sensitivity to random changes in market environment. • The more unpredictable of the environment, the worse perform of the firms when they are sensitive to change due to the lack of slack resources.	Management Science
Daft and Macintosh (1981)	Empirical	• IPR includes two parts: 1) uncertainty: the amount of information that needs to be gathered and interpreted, 2) equivocality: multiplicity of meaning that could be interpreted from information • Within an organization, amount is represented by the task variety (frequency of unexpected and new situation that occur in the process), equivocality is reflected by the task analyzability (how individuals can respond to the problem). • Organization response: gathering additional data to reduce uncertainty and adding personnel or reduce hierarchy to reduce equivocality	Administrative Science Quarterly

		(information sharing, rules and plans, meetings, and flexible communications).	
Morrow (1981)	Research Note	• Contingency or information processing approach needs further investigation. • The communication research has lack of attention compared with other organizational research topic. • Inter-organizational communication has been neglected from previous studies.	Academy of Management Journal
Lucas Jr and Turner (1982)	Empirical	• Information processing plan should coordinate with corporate strategy and serve as a guild line for the development of the information system. • Information system can serve as a method to process information. • The greatest benefit of IT result from IT and corporate strategy alignment and managing information processing activities effectively.	Sloan Management Review
Ito and Peterson (1986)	Empirical	• The task difficulty and inter-unit interdependence (IPR) positively relate to the boundary spanning activities, participation of the unit member in decision making, and high autonomy of business unit member (IPC). • Boundary spanning activities mediates the influence of task difficulty on decision making participation and autonomy.	Academy of Management Journal
Daft and Lengel (1986)	Conceptual	• There are two forces of drives IPR: uncertainty and equivocality. • There are three sources of uncertainty and equivocality in organizations: technology or task variety and analyzability, interdepartmental relationship, and the environment. • Information sufficiency reduces uncertainty and information richness reduces equivocality, and it can be realized through the design of coordination and control structure, for example, meeting, integrators, planning, reports, formal MIS, and rules.	Management Science
Thomas and McDaniel Jr (1990)	Empirical	• CEO's understanding of the environment and situations depend on the top management teams' capacity to gather, process, and convey information. • Organizations' structural context influence IPC and such IPC affects the top management teams' capability of sensing the environment and control the decision making process.	Academy of Management Journal

Stevenson and Gilly (1991)	Empirical	• Formal procedure such as rules and structure design are inefficient in transmission of information. • Informal relationships, such as unplanned interactions and horizontal interactions, are more effective in handling ambiguous problem, which means it is effective in reducing the equivocality of the information. • Networks among managers can reduce equivocality.	Academy of Management Journal
Smith, Grimm, Gannon, and Chen (1991)	Empirical	• Firms with many marketing and customer service employees will be early responders and more likely and faster responders than those with low externality. (High IPC) • The structure complexity is not helpful in responding to environmental complexity. (Low IPC) • Richer information is critical in fast responding.	Academy of Management Journal
Burns and Wholey (1993)	Empirical	• The adoption of matrix management can be explained via IPV. • Matrix management indicates high IPC. • Higher diversity hospitals (task diversity and organizational slack) are more likely to adopt matrix management because of the high IPR.	Academy of Management Journal
Haleblian and Finkelstein (1993)	Empirical	• Top management team size and the CEO dominance contribute to the IPC of the organization. • Large top management teams and those with less dominant CEOs are more profitable in a turbulent environment with high discretion. • Top management teams in a low discretion environment are not related to the organizational performance. • It is important to match IPC with IPR.	Academy of Management Journal
Thomas and Trevino (1993)	Empirical	• The multi-organizational arrangement in healthcare industry depends on the design of an adaptive cross-firm information processing system that can accommodate the environment. • Formal analysis and social interaction are both necessary in the decision making process even within the inter-organizational context. • Structures and procedures that aim at creating lean-information processing mechanism cross organizations are effective in reducing uncertainty	Journal of Management Studies 1993

		• Social interactions between organizations are effective in reducing equivocality and establish shared meaning.	
Zeffane and Gul (1993)	Empirical	• Task variety increases the amount of information that needs to be processed whereas the task analyzability increases the timeliness of the information. • Structure of the organization impacts the information openness and accuracy to managers and employees. • Information accuracy and openness are results from the interaction of participants in the information processing activities. • Greater participation and formalization encourage information openness.	Information Processing and Management
Keller 1994 Keller (1994)	Empirical	• When facing a non-routine technology, such as radical innovation, the R&D team needs to be designed to enhance IPC. • Communication media need to match the uncertainty and ambiguity of the task in order to influence the R&D project performance. • Largely face to face communication medium can improve R&D project quality when non-routines technology emerged.	Academy of Management Journal
Hartman, Lundberg, White, and Barnett (1995)	Empirical	• In an organization, certain planning methods are preferred than others in various environmental volatility situations. • Different processes will have different IPC and those with higher ones are received wider than those are not.	Journal of Business Research
Leifer and Mills (1996)	Conceptual	• The uncertainty and equivocality influence the design of the control strategies in organizations. • Objective control reduces flexibility and adaptability in order to address uncertainty and equivocality. • Self-management and normative mechanism increase the capability to deal with uncertainty and equivocality but it increases the probability of control loss. This negative effect can be compensated by enhancing commitment, trust, and bonding among employees.	Journal of Management

Henderson and Fredrickson (1996)	Empirical	• IPC increases the complexity of CEO's job; they should be paid not only by performance but also by the IPR for them. • The R&D activities, capital investment activities, and the number of business managed by CEO all generate IPR and are positive relates to CEOs' rewards system. • The diversifiers tend to pay more for CEO than conglomerates because the skill requirement. • Larger top management team is associated with higher cash and total compensation only in conglomerates.	Academy of Management Journal
Sanders and Carpenter (1998)	Empirical	• Internationalization increases the IPR of the firm. • Internationalization has significant effects on firms' choice of corporate governance arrangements: the governance structure needs to maximize the information availability to top management teams and board. • Internationalization positively impacts the size of top management team positively and negatively influence the duality of the team. • The size and composition of the board of directors are also associated with the degree of internationalization. • Internationalization relates to the CEO pay: long-term and amount.	Academy of Management Journal
Bergh (1998)	Empirical	• When uncertainty changes, firms need to restructure their product portfolio in order to lower information processing cost and raise internal synergies to reach higher financial performance. • To manage cost effectively, firms need to reduce source of the uncertainty or implement internal coordination mechanisms that can improve information quality. • Acquisition of related business provides higher information quality than it is available outside the company. Acquisition of unrelated business reduces the risk of focusing on only few products.	Journal of Management
Flynn and Flynn (1999)	Empirical	• Self-contained tasks reduce information processing amount. • Environmental management strategies in the manufacturing process reduce the variety in the process that reduces the IPR. • Lateral relationships increase the IPC by allowing the decision making happening at all levels in the organizational hierarchy.	Decision Science

		• Strategies dealing with the manufacturing environment complexity reduce IPR and increase the IPC at the same time, which lead to the improvement of manufacturing performance.	
Wang (2003)	Empirical	• A fit between IPC and IPR increase the organizational performance. • The role of IS and the design of the organization need to match IPR imposed by environment. • Higher degree of centralization and formalization together with appropriate information system can address high IPR when it is generated by uncertainty not equivocality.	International Journal of Information Management
Hult, Ketchen, and Slater, (2004)	Empirical	• Information processing includes knowledge acquisition, information distribution and shared meaning development, these activities improve the overall information gathering, processing and acting on data process. • Supply chain can be considered an information processing and interpretation system • All supply chain members need the same information; thus information distribution is helpful to shape the shared meaning along supply chain. • Shared meaning reduces supply chain cycle time, and it could be enhanced by the knowledge acquisition and information distribution.	Academy of Management Journal
Gattiker and Goodhue (2004)	Empirical	• ERP increases IPC via its impact on the coordination and administrative efficiency. • The interdependence and differentiation among sub-units increase the IPR thus positively relate to the benefits obtained from ERP.	Information & Management
Premkumar, Ramamurthy, and Saunders (2005)	Empirical	• Companies in lowest uncertainty environment use non-computer technology to support the minimal IPR. • Companies operate in higher uncertainty environment tend to adopt the technology that facilitates greater interactions and information exchanges to address the uncertainty, for example, EDI. • Lack of fit between IPC and IPR can lead to low performance. As the product complexity (uncertainty) gets high, the information structure (equivocality) gets low; companies invest significantly in developing tight communication and relationship. More advanced IT is also adopted	Journal of Management Information Systems

		to facilitate real-time communication and information exchange, such as Web-based IT, EDI is not enough. • Other factors such as IT infrastructure, organizational policies, volume of procurement all contribute to the IRP that lead to different decisions in using IT when the uncertainty from the tasks is similar.	
Fairbank, Labianca, Steensma, and Metters (2006)	Empirical	• IT's benefits can be explained via IPV. • IT can improve organizational efficiency by creating the vertical information channels. • Organizations that aim at innovations and try to respond more quickly to the market need(higher IPR) to use IT to enhance the contact with the customer in order to understand customer needs and market trend. • The vertical information flow that brings information to top-managers slows down the decision making process. IT can facilitate the limitation of vertical information flow, in other words, reducing IPR. • IPV focuses on the effectiveness instead of efficiency.	Journal of Management Information Systems
Kwon, Oh, and Jeon (2007)	Conceptual	• The impact of organizational restructuring on the efficiency and integrity of information processing networks is determined by various factors such as size of the restructure, the reconnection strategy, and the structure of the information processing network itself. • For a relatively small scale workforce deduction, a centralized information processing network is more robust, whereas in a large, massive scale downsizing, a decentralized network structure can provide stronger net that can minimize the damage brought by the change. • The centralized information processing network have a high integrity. The decentralized information processing network have a high ability in dealing with random reassignment.	Journal of Management Information Systems
Mani, Barua, and Whinston (2010)	Empirical	• Analyzability, variety, and interdependence explain significant variance in IPR of the outsourcing process. Governance structure, relationship processes, and technologies are accounted for the most variance of IPC of the outsourcing process. • The choice of IPC is dependent on IPR of the BPO processes. Performance of the outsourcing process is a function of fit between IPR and IPC.	MIS Quarterly

		• The effectiveness of investment in partnership structures is contingent on the natural of the tasks. It is beneficial when the task is complex and with high interdependencies and is costly when task is simple and modular. • The misfit between IPR and IPC results in higher level of dissatisfaction with the performance.	
Bode, Wagner, Petersen, and Ellram (2011)	Empirical	• The impact of the supply chain disruption, the dependence on partners, and the firm's supply chain disruption orientation motivate the firm to take action such as bridging and buffering to reduce the uncertainty in the supply chain activities. • Supply chain disruption orientation means the general awareness and consciousness of concerns about the opportunities to learn from supply chain disruptions, and it has the highest impact on the action of buffering and bridging. • The choice of buffering and bridging is governed by past experience. It means that the prior experience has a large impact on the IPC because it affects the interpretation of the environmental event thus leads to the calibration of firms' response decision.	Academy of Management Journal
Hultink, Talke, Griffin, and Veldhuizen (2011)	Empirical	• The information quality is crucial in leveraging the NPD performance. • Besides the information quality, the relevance of the information is also important. This means to reduce the unnecessary information flow, keep all the needed knowledge flowing in the organization.	IEEE Transactions on Engineering Management
Shockley, Roth, and Fredendall (2011)	Empirical	• Product and service mix increase the IPR encountered by shoppers in a retail store and it affects the way how the store operates. • Empowered employee's task can lead to higher IPC to handle various customer requirements.	Decision Science
Turner and Makhija (2012)	Empirical	• Organizational structure influences individual IPC and can affect organizational ability to develop IPC. • The organic structure enables more individual IPC. Organic structure allows employees to have the flexibility to search information, develop a	Strategic Management Journal

		common understanding regarding the knowledge they use, and integrate/synthesize information.	
Puranam, Raveendran, and Knudsen (2012)	Conceptual	• It is the epistemic interdependence instead of simply the task dependence generates the IPR. • Information processing is needed when there are coordination problems between agents that carry out the tasks. • The design of the organization need to address such IPR through modifying the epistemic interdependence and enabling the formation of predictive knowledge between agents • Complexity of the environment can be considered a factor limits the formation of architectural knowledge or predictive knowledge. • Architectural and predictive knowledge accumulates over time in a stable environment. Thus, the task interdependence will have less influence on organizational structure in a stable environment.	Academy of Management Review

According to IPV, there are two features of the information which impact the human cognitive limit: uncertainty and equivocality (R. Daft & Lengel, 1986; R. L. Daft & Macintosh, 1981; Tushman & Nadler, 1978). Uncertainty is created by inadequate knowledge and information (Karimi et al., 2004). Equivocality is created by the ambiguity of the information (R. Daft & Lengel, 1986; R. L. Daft & Macintosh, 1981). Within a turbulent business environment, it is clear that the organizational decision making and operation are processes governed by great uncertainty and equivocality (Melville & Ramirez, 2008). Galbraith (1974) suggests that this cognitive limit restricts managers' ability to complete tasks, and as uncertainty and equivocality increase, organizations have to alter their task completion processes because of the various unforeseen changes and misunderstanding. During this process, managers are constantly seeking additional information or resources to complete or take extra effort to clarify the situation; both of which increase the amount of activities related to information processing (R. L. Daft & Macintosh, 1981; Galbraith, 1974; Tushman & Nadler, 1978). Thus, a higher level of uncertainty and equivocality is associated with higher IPR.

The literature of IPV indicates that in an organization, IPR is a function of task characteristics and the task environment, which is the comprehensive domain that the organization is embedded in (Cooper & Zmud, 1990; Tornatzky & Fleischer, 1990; Tushman & Nadler, 1978). The variety in the task and its environment describes the frequency that unexpected and new situations occur in the process, in other words, it reflects the degree of uncertainty. The analyzability of the task and environment illustrates how employees can interpret and react to the problem, thus it indicates the degree of equivocality (R. L. Daft & Macintosh, 1981). Typically, organizations seek to establish routines that facilitate task accomplishment. These two forces drive organizations continuously to revise established

routines in favor of new routines, which are built upon more complete and clearer information (Cooper & Zmud, 1990).

IPC is an organization's ability to address the IPR (R. L. Daft & Macintosh, 1981; Kohli & Grover, 2008; Kuvaas, 2002). The goal of IPC is to facilitate business operations by providing the right information in a timely manner. This definition indicates that IPC is encompassed with two parts: information processing and IPR reduction. Information processing relates to a firm's ability to act on the information collected, including the organization and exploitation of the information, as well as the ability to use it supporting business operations (Galbraith, 1974). IPR reduction means firms are able to reduce the uncertainty and equivocality of the information, which is usually fulfilled by increasing the information sufficiency and information richness (Daft & Lengel, 1986). Information sufficiency relates to firms' ability to detect and gather enough information from internal and external environments to support decision making. Information richness is the ability to clarify the meaning and explore the value of the information that goes beyond simply collecting a large amount of information. Such richness is usually achieved by conversations and shared understandings between decision makers.

A firm's IPC is represented by its current organization's structure and process design. The structure and process of an organization determine the decision making process, it also helps with the information and knowledge dissemination (Galbraith, 1974). Therefore, literature argues that different designs of organization's structure and process indicates different IPC. For example, when an organization's structure is highly formalized with low distribution of power and control, it generates more vertical communication and requires large amounts of information movement between hierarchies, which increases the possibility of information distortion and delay for any decision making activities. Such organizational structures will have low IPC. If the

organization has a flat structure, decentralized power, and high coordination mechanism, there will be less information transportation before it reaches decision makers. Also, such structure increases the communication between subunits that will reduce the equivocality and uncertainty in the information. This organizational structure will have high IPC.

A firms IPC needs to match the IPR it needs to address in order to generate the optimum performance (Galbraith, 1974). On one side, lack of IPC will lead to poor decision making in both efficiency and effectiveness, which will in turn negatively impact firms' performance. On the other side, over developed IPC will increase firms' cost in processing information, which is not beneficial for firms' performance either. Therefore, firms need to carefully design their structure and process to address the IPR. When the IPC is constrained and no longer adequate to mitigate uncertainty and equivocality, the organization will seek out ways to enhance it (Daft & Lengel, 1986). The two main strategies to increase IPC are IT investment and lateral relationship creation (R. Daft & Lengel, 1986; Galbraith, 1974). Figure 1 describes the relationship between IPR and IPC, and their drivers based on IPV.

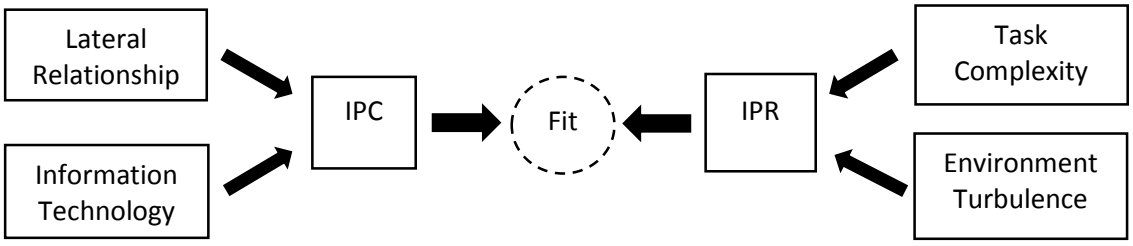


Figure 1. Summarize of IPV

IT can help a firm effectively collect and process information generated from the task and its environment, as well as make all the information accessible for managers. Literature asserts that, within an organization, formalized information systems, and particularly ones that are IT-based, are the most complex and costly but provide the highest capacity to facilitate the

organization's information processing (Fairbank et al., 2006; Premkumar, Ramamurthy, & Saunders, 2005).

Investment in IT has been suggested as a key mechanism to increase organizations' IPC by enhancing the ability to process information (Melville & Ramirez, 2008; Premkumar et al., 2005). Especially in today's environment, where organizations often face the problem of information overload. Firms can collect large amounts of data from various resources in various formats, for example, the texts, videos, and pictures from social networks. It is important to increase firms' ability to clean, organize, and analyze the data and provide useful information to managers. IT applications, such as big data, have the function to retrieve and process unstructured data, which improve firms' ability to process information. Based upon these suppositions, many researchers have proposed IT applications through which to enhance an organization's IPC (Melville & Ramirez, 2008; Premkumar et al., 2005)

Lateral relationships describe the connections that cut cross organizational structures and hierarchies (Galbraith, 1974). This moves the relevant personnel to the point where the problem appears, which reduces the information flow within the organization, and thus saves time in responding to the problem (Galbraith, 1974). Lateral relationships also can limit equivocality because its key role is to help reduce the barriers among various professions and departments, even organizations. Early lateral relationships creation aims at forming such linkage for decision making, such as joint decision making teams. This type of lateral relationship now is usually included in the organizational structure design and becomes part of the IPC. When this type of lateral relationship is not enough to address the IPR generated by the environment and the tasks, it is important to create additional lateral relationships to increase the IPC, such as inter-departmental and inter-organizational interactions and communications (R. Gulati, Lawrence, &

Puranam, 2005). This improves the shared understanding and reduces the confusing and vagueness in the information by increasing communication and collaboration among the different parties involved in decision making and implementation processes (Tushman & Nadler, 1978). As a result, the IPR is reduced. Hence, firms can process information and make decisions in a more effective way, including responding to environmental changes (Galbraith, 1974; Smith, Grimm, Gannon, & Chen, 1991). Therefore, lateral relationship creation is another way to increase firms IPC.

This literature review provides initial insights of how IPV is used in management research. IT, coordination mechanisms, organizational structure, and relationship network are all suggested reducing uncertainty and equivocality of the information, and thus enhance the IPC (Fairbank et al., 2006; Gattiker & Goodhue, 2004; Haleblian & Finkelstein, 1993). Also, the literature emphasizes the importance of matching IPC with IPR of the process in order to achieve the optimum performance (Bode et al., 2011; Kwon, Oh, & Jeon, 2007; Mani, Barua, & Whinston, 2010). This contingency feature of IPV is used to investigate the design of organization structure or control mechanism (Shockley et al., 2011), the adoption of different IT solutions (Gattiker & Goodhue, 2004; Premkumar et al., 2005), the performance of organizations (Wang, 2003), and the impact of environment and process characteristics on these activities (Bode et al., 2011; Sanders & Carpenter, 1998). This research extends the application of IPV to the development of dynamic capabilities by arguing dynamic capabilities can be considered as a form of IPC because it is a set of lateral relationships aim at addressing the IPR generated from the turbulent environment.

The literature review clearly shows that most of the IPV studies focus on formal relationship design, such as cross-function teams, and development and how they are related to

the enhancement of IPC or reduction of IPR; only a few of them address social relationships such as connections and friendship among members in different departments. Furthermore, Mani and colleagues (2010) extend the study of Galbraith by proposing that cognitive conflicts also need to be considered in order to enhance the IPC. Cognitive conflicts emerge because of the lack of communication and shared understanding which can delay the process of decision making (Gulati et al., 2005). They propose the relationship structure, in addition to the lateral process, as a strategy to increase the IPC. As illustrated in the previous literature review, shared vision, which has been known to reduce cognitive conflicts, is a dimension of social capital (Nahapiet & Ghoshal, 1998). Thus, this research asserts that social capital can address lateral relationship creation and conflict reduction at the same time, which in turn increases the IPC of the firm.

Furthermore, although a large amount of research has investigated the organizational structure and coordination mechanism creation using IPV, little research has been done at the inter-organizational level. It is equally important that the organizations obtain a well-designed coordination mechanism with their partners in order to act on information quickly. Thus, this research aims at filling these two gaps by investigating the relationship between IT application, social capital, and inter-firm dynamic capabilities. The details of how they are related to each other are illustrated in the later sessions.

IT and Business Performance

In a turbulent environment, in order to catch up with the market changes and stay competitive, there are two critical capabilities organizations seek from IT: sensing capability and responding capability (El Sawy & Pavlou, 2008). These two capabilities are summarized from Boyd's (1987) concept of OODA loop (Figure 2) that describe the four key activities related to firms' survival. Firms with a faster and more effective OODA loop are more responsive towards

changes in the environment (El Sawy & Pavlou, 2008). *Observe* means the discovery and recognition of relevant information or identification of various information sources in the environment, and *orient* means capturing and organizing the signals in the proper format. These two activities together form the sensing capability which allows firms to identify business opportunities from environmental turbulence. *Decide* refers to the development of response to the signal and *act* is the execution of the plan. These two activities together form the responding capability which grants firms' reaction towards the identified opportunities.

Sensing and responding capability can be enhanced with EDA infrastructure, which is an emerging IT paradigm for designing even-based applications that aim at addressing complex event streams for real-time enterprises (Luckham, 2011; Taylor, Yochem, Phillips, & Martinez, 2009). EDA includes the mechanism that detects and disseminates asynchronous business event messages in real time and the loose coupling design of IT components which increases the flexibility of the information system in configuration or reconfiguration (Taylor et al., 2009). EDA is, by design, more normalized to unpredictable and asynchronous environments; therefore, it is widely adopted by modern IT systems and applications which aim to support organizations survival and success in a turbulent environment, including the healthcare (Taylor et al., 2009). Thus, in order to understand the business value of the IT with EDA, this research classifies it according to the capability it supports: sensing and responding. A literature review is conducted to understand how the IT can support these two capabilities based on the OODA loop (observe, orient, decide and act).

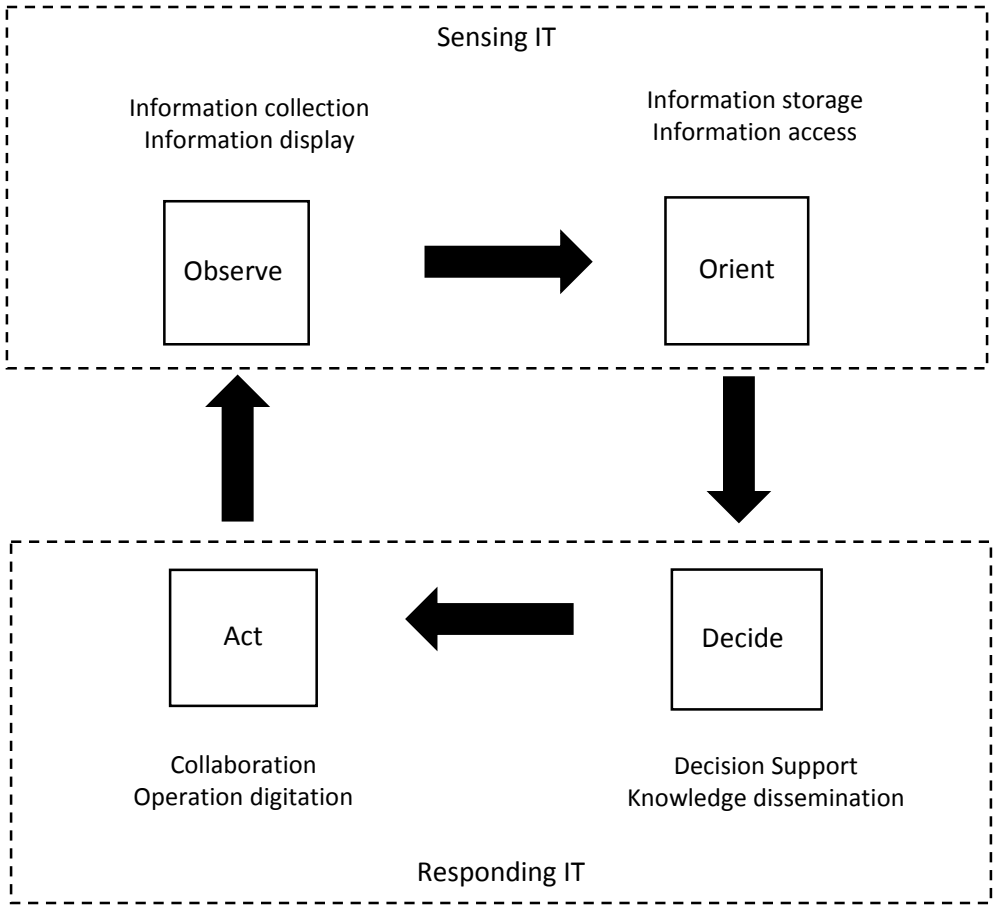


Figure 2. OODA Loop and IT Support in Each Activity

Sensing IT

Sensing capability reflects an organization's ability to detect environmental signals, make some sense out of them, and then arrange and disseminate them so that the best decisions can be made (Overby et al., 2006). It includes the activities of observing and orienting towards those environmental signals as stated in the previous paragraph. Information is a time sensitive by-product of all the processes in today's business world, and it is a basic component for understanding the environment (Chi, Ravichandran, & Andrevski, 2010). It is important to harness it for capturing the changes. As the environment gets more turbulent, the information becomes more complex and complicated. For example, with the sources of available information on the rise (e.g. social network), data's format and type are diversifying. These facts increase

firms' difficulty to filter and utilize data in monitoring the environment. Therefore, the capability that supports the observing activity is providing real-time visibility of the environment (Houghton, El Sawy, Gray, Donegan, & Joshi, 2004). This environmental visibility requires exchanging, collecting and integrating information from different resources. Orienting requires firms to take what has been observed and understand its potential impact on their business quickly. Such requirement means firms need to analyze the data that has been collected and investigate those changes that have been detected and transfer them into opportunities that firms can take advantage of or problems firms need to address to improve the business. Thus, the capability that supports orienting activities is data organizing and access. Managers need to be able to access the collected information and understand the situation.

Research indicates that IT with EDA infrastructure is a critical component in forming the above mentioned capabilities. EDA design enables the IT with a high level of accuracy and speed in detecting and forecasting the changes created by the environment turbulence, and thus enhance firms' capability to observe and orient towards the environmental changes. This research hereby defines sensing IT as information oriented, aiming at collecting and managing information in order to support the observing and orienting activities.

Sensing IT can enhance firms' ability to generate a comprehensive picture of the competitive situation by increasing the speed of data gathering, and expanding the source of information. Applications such as web-based technologies, EDI, organization memory IS, or recommendation systems provide firms with the capability to capture data as it is generated in all kinds of situations, business transactions, web documents and consumer behavior (Joshi, Chi, Datta, & Han, 2010; Sher & Lee, 2004). This *information collection* function supports the observing activity by expanding information resources and obtaining real-time data which is the

basis for any analysis necessary about the internal or external environment (Chi et al., 2010; Joshi et al., 2010). Most times, the raw information is in different formats, depending on the resources and the way it is collected. Thus, in order to make sense of the data, the basic idea is to create a clean and meaningful structure to present it. Thus, the second sensing IT's function supports observing activity is the *information display*. By transferring information into these formats, managers can highlight changes in the internal and external environment (El Sawy & Pavlou, 2008).

It was stated earlier that orienting activity requires firms' to have the ability to investigate those changes that have been detected and understand their business significance. Sensing IT can enhance this ability by supporting the *information storage* and *information access.* Mangers need to be able to "play" with the data to further apprehend signals they receive by the system and even discover more changes in the environment. The information storage feature integrates advanced data structuring and indexing functions, which is aimed at formatting, categorizing the information, and eventually forming a logical subject map that is understandable and analyzable (Joshi et al., 2010; Ong, Chen, Sung, & Zhu, 2005). Systems, such as databases, are able to provide centralized storage of various formats of data, information, as well as keep the data pool clean by detecting and eliminating outdated or useless information (Choi, Lee, & Yoo, 2010; Weber & Aha, 2003). All departments or partners could obtain synchronized information in time and receive alerts or signals about the changes detected in the information (Rainer & Cegielski, 2010). The cleaned up data is also ready for managers to perform different analysis to understand the observed changes. Therefore, the second function of the sensing IT that supports orienting is the *information access*.

The combining and integrating of sensing IT enhances corporate scanning, analysis, communication, and knowledge development capabilities that increase the speed and effectiveness in generating relevant intelligence. This enables the firm to rapidly identify various potential problems, threats, and opportunities in a competitive environment as well as disseminating such intelligence across departments. Therefore, sensing IT can short the OODA loop by enhancing the observing and orienting activities.

Responding IT

Responding capability describes firms' ability to perform proper actions after detecting the problems or opportunities from the environment. It includes the activities of deciding and acting towards those environmental signals detected from the sensing activities. Decisions need to be made (decide) and then firms have to deploy current resources or acquire new resources, such as labor, finance, and IT, in order to carry out those decisions appropriately (act).

After the changes are observed and investigated, they are translated into business problems or opportunities in the orienting process. Managers need to determine a series of actions that can address these problems or opportunities and thus respond to the environment. Often, several possible solutions are identified, and the best one is selected. Thus, it is important that firms can perform analysis to generate different scenarios and the possible outcomes in order to identify the best solution. Also, rational decisions are made based on the accumulated knowledge, experience, and information about the current situation (Grant, 1996; Simon, 1979). Similar to information, knowledge needs to be accessed by or delivered to people who need it to make decisions. More importantly, it is necessary to encourage knowledge focused conversation among knowledge workers to further refine and generate new knowledge for continuously

updating the knowledge pool (Choi et al., 2010). Thus, the capability that supports deciding activities is the solution generation and knowledge management.

Under most circumstances, the decisions are not pre-designed, but have a large variety, and their impacts cover more than one department or even external partners (Sambamurthy et al., 2003; Van Oosterhout, Waarts, & Van Hillegersberg, 2006). For example, firms could launch new products to react to the emergence of new technologies in the industry or redesign the current business process to cope with new regulations. In order to effectively take action, research suggests that firms need to communicate the decisions with the relative recipients and monitor the outcome (El Sawy & Pavlou, 2008). Effective information management in the business process increases the operational efficiency by providing timely and accurate data for strategic decision making, such as demand forecast and NPD (Hoogeweegen, Teunissen, Vervest, & Wagenaar, 1999). More often, these actions are joint activities involving different departments and even firms (Sambamurthy et al., 2003; Van Oosterhout et al., 2006). Thus, the ability to coordinate between departments and firms are also critical in the acting process.

IT applications have been suggested to support decision making and improve business actions (Byrd et al., 2006). This research defines the responding IT as a process oriented IT that creates or enhances the decision making and business operation processes. By using different algorithms, responding IT can simulate the decision making process and generate alternative solutions for managers. Systems that offer this capability include but are not limited to the expert system and case-based reasoning system (Alavi & Leidner, 2001; Heinrichs & Jeen-Su, 2003). Data mining tools also allow employees to actively search for specific information to support their daily work and decision making by using the function that the system provided (Alavi & Leidner, 2001; Joshi et al., 2010; Lindgren, Stenmark, & Ljungberg, 2003; Tiwana &

Balasubramaniam, 2001). Thus, responding IT provides the *decision support* functions that directly support managers' decision making processes.

As stated earlier, managers need knowledge to identify the best solution to the problems or opportunities found in the environment. It is important to effectively represent, share, and disseminate the knowledge. Systems such as organization memory and corporate directory help firms maintain the knowledge pool and allow users access to it when necessary (Choi et al., 2010; Joshi et al., 2010). Web technology such as RSS allows real-time synchronization of knowledge and information among related users (Nazir & Pinsonneault, 2012). Furthermore, the dissemination channel also commonly serve as an interface for knowledge users to present their opinions or feelings on the current knowledge and then integrate the feedback to keep updating the knowledge (Olivera, Goodman, & Sharon Swee-Lin, 2008). Thus, the second function of responding IT that supports the deciding activity is the *knowledge dissemination.*

Digitalization has been suggested as an effective way to increase the information visibility of the operation, which helps firms monitoring the business process. IT application can enhance firms' ability of retrieving, manipulating and disseminating of the information in daily business operations (Radhakrishnan, Zu, & Grover, 2008). This function improves the management control and monitoring of the business process. It also provides nonintrusive real-time assessments of the operation process and synchronizes them with all relevant stakeholders. Furthermore, information visibility also provides a comprehensive picture of the distribution of resources with real-time data (Houghton et al., 2004). Firms can easily understand where their resources are located and quickly deploy them for effective response to the environment (Houghton et al., 2004). Therefore, the *operation digitation* function of responding IT supports

firms' action by ensuring the responding time and operation efficiency, as well as economies of the business scope

Last but not least, various IT applications have been suggested to facilitate work flows within and between firms. For example, virtual teams enable organizations or individuals to collaboratively develop, manage or refine projects and plans (Majchrzak, Rice, Malhotra, King, & Ba, 2000). This feature provides channels for direct interactions among individuals, which eliminates the geographical and structural barriers as well as ensures the information exchange. Certain applications also simplify operation and decision making processes that involve multiple partners and makes them more efficient by supporting the documentation and workflow management in the collaboration (Chi et al., 2010). For example, firms can dynamically alter the mix of price, promotion, and products based on the component inventory level of their vendors or customers' requirements with the information system that connects firms with their supply network partners. Thus, the last function that responding IT supports firms' action is the *collaboration.*

These distinct features of responding IT together strengthen firms' ability of deciding and acting upon the opportunities and problems. Firms' innovative or value added responses to the market are collaborative actions among various business units or even among various business partners (Horvath, 2001). Such innovation or value added response depends on what knowledge each business department or partner possesses and how it is applied (Grant & Baden‐Fuller, 2004). The knowledge dissemination function makes the knowledge exchange and discussion easier. The collaboration within and across firms grants the knowledge alignment and dissemination throughout the entire supply chain. Thus, these features of responding IT provide a platform for creating effective decisions towards the environmental changes (Kleis, Chwelos,

Ramirez, & Cockburn, 2012; Radhakrishnan et al., 2008). Furthermore, the operation digitation enhances the process monitoring and information sharing among various business units. Firms can better track the implementation of the decision. Thus, this research argues that responding IT can short the OODA loop by enhancing the deciding and acting activities.

This classification of IT does not mean that there is no overlap in the IT applications. On the contrary, many IT applications offer both sensing and responding capabilities to the firm (El Sawy & Pavlou, 2008). Take digital dashboard as an example. On one side, digital dashboard provides data in a processed format which allows the management team to easily interpret the information as well as quickly perform analysis and decision making (Houghton et al., 2004). On the other side, digital dashboard also captures the firm's performance in real time, which allows all business units and even partners to obtain synchronized information which shortens the reaction time to different situations (Houghton et al., 2004). A system that includes both sensing and responding functions is called a vigilant information system (El Sawy & Pavlou, 2008).

Interfirm Dynamic Capabilities

The core of strategic management research is to study how firms can obtain long-term competitive advantages (Teece et al., 1997). One of the widely adopted theories is the resource based view of firms (RBV). RBV considers a firm as a collection of resources which are spread out within the firm's boundaries and change over time (Amit & Schoemaker, 1993; Wernerfelt, 1995). According to this conceptualization, firms that possess valuable, rare, inimitable, and non-substitutable (named as VRIN) resources can obtain a sustainable competitive advantage with quick and less replicable strategies (J. Barney, 1991; Conner & Prahalad, 1996; Nelson, Todd, & Wixom, 2005).

Teece and colleagues (1997) extend this theory by suggesting that sustained competitive advantage could also come from effective manipulation of current competencies according to changes in the business environment. They propose that under turbulent conditions, it is key to integrate, reconfigure and create resources, especial knowledge resources, to develop quick responses to keep up with the market, and they call this ability “dynamic capabilities." Such propositions not only enhance the RBV but also are in line with other grounded theories in strategic management, including behavior theory (Cyert & March, 1963), transaction cost theory (Williamson, 1981), and evolutionary theory (S. Winter & Nelson, 1982). These theories all suggest that innovative products and processes are key to firms’ survival, and they come from the incorporation of sensed and seized knowledge with the existing knowledge (Augier & Teece, 2009).

Furthermore, behavior theory considers that firms are driven by the interpretation of organizational goals; the aspirations generated from these goals, the rational expectations about the organization, and the adaptive rules to guide the actions of achieving the goals (Cyert & March, 1963). These factors together influence the decision making in the firm. Among these factors, goals reflect balanced interests among different political alliances and are constantly changed by the alliance members and recognized environmental factors. Aspirations of the goal reflect the modifications of organizations’ behavior according to the experience obtained internally from various operations and externally from comparison with competitors (Cyert & March, 1963). This robust feature of aspiration determines that decisions are timely and should be constantly alternating according to the context, which means that organizational and strategic renewal is critical for firms’ survival in the long run (Augier & Teece, 2009). The innovative response of manipulating resources is a way to keep this renewal within the dynamic business

environment. Therefore, dynamic capabilities can be considered as an extension of behavior theory in addition to the extension of RBV (Augier & Teece, 2009).

After the concept of dynamic capabilities had been introduced, it attracted many researchers' attentions. This concept is increasingly applied to study how firms can cope with the fast changing environment. As we discussed earlier, failing to respond to environmental changes could greatly hurt firms' performance (Audia, Locke, & Smith, 2000). In addition, the sustainability of firms' competitive advantage is decreasing in general because of the increasing turbulence in the environment (Wiggins & Ruefli, 2005). Thus, it is even more critical now than ever for firms to develop new processes aimed at maintaining any competitive advantages (Eisenhardt & Martin, 2000).

Definition

Once a concept is proposed, it is important to define it clearly. Different conceptualizations of dynamic capabilities have been provided in past works. Teece and colleagues (1997) define dynamic capability as "the firms' ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (p. 516). Such definition is based on several assumptions: 1) dynamic capabilities are embedded in the organizational processes and cannot be brought in externally; 2) dynamic capabilities are path dependent because their development depends on the unique situation of each firm; 3) firms need to evolve with the environment (Barreto, 2010). This conceptualization argues that dynamic capabilities are heterogeneous because of path dependence. Such a feature reflects the strategic value of dynamic capabilities because it is consistent with the essence of strategic management research: the exploration of how idiosyncratic features of individual firms contribute to the survival under specific competitive circumstances (S. G. Winter, 2003).

Eisenhardt and Martin proposed another definition of dynamic capabilities in 2000, they consider dynamic capabilities as “firms’ processes that use resources-specifically the processes to integrate, reconfigure, gain and release resources-to match and even create market change” (p. 1107). They extend Teece and his colleagues’ conceptualization by proposing that dynamic capabilities possess not only heterogeneity, but also homogeneity at the same time and use NPD to demonstrate it. The heterogeneity feature of dynamic capability reflects the unique processes firms conducted to realize each dynamic capability (Eisenhardt & Martin, 2000). Such a feature is in line with Teece and colleagues’ proposition that dynamic capability is path dependent. Homogeneity means that commonalities exist in every dynamic capability across effective firms. There are accepted ways to conduct actions towards various challenges created by the environment, such as alliances, NPD, and strategic decision making (Eisenhardt & Martin, 2000). These commonalities are also known as the “best practices."

By proposing these two features, Eisenhardt and Martin (2000) conclude that dynamic capabilities are equifinality. It means that although there are some commonalities in dynamic capabilities, firms will form different processes or routines when realizing these capabilities. Depending on the unique situation of each firm, the development of dynamic capability starts at different points and travels via different paths. According to their study, this equifinality reflects the value of dynamic capabilities in providing sustainable competitive advantage according to RBV. Drnevich and Kriauciunas’ research (2011) empirically supports this argument and finds that the heterogeneity of dynamic capability relates to greater firm level performance. Furthermore, they suggest that dynamic capabilities’ formats may vary according to the turbulence level of the market. According to Eisenhardt and Martin (2000), in a slowly to moderately evolving industry, dynamic capabilities are relatively stable and complicated, follow

a series of steps in the execution, and rely heavily on current knowledge. Thus, they appear the same as traditional routines. However, in a moderate to high velocity market, where changes are less likely to be predicted, and market boundaries are blurry, it is important for companies to quickly create situation-specific knowledge. Thus in such conditions, dynamic capabilities appear to be simple and robust, which allows managers to focus on the key issue and not be constrained by various rules, procedures, and previous experiences (Eisenhardt & Martin, 2000).

Based on these studies, Pavlou and El Sawy (2011) propose a different framework of dynamic capabilities and empirically test it under different environmental situations. In their study, they focus on the relationship between dynamic capabilities and operational capabilities and suggest dynamic capabilities to be "those capabilities that help units extend, modify, and reconfigure their existing operational capabilities into new ones that can better match the changing environment." (p. 242). They identify four dimensions of dynamic capabilities associated with the NPD process. The results show that the impact of dynamic capabilities on firms' NPD performance is mediated by the operational capabilities of NPD. It is also noticed that environmental turbulence moderates such effect. In other words, dynamic capabilities are valuable in all levels of environmental turbulence. Thus, they argue that dynamic capabilities facilitate firms' evolution with the environment by modifying and redesigning current operational capabilities. Based on these previous studies, this research defines interfirm dynamic capabilities as:

The collection of processes by which firms are collaboratively creating innovative and effective business operational processes or renew current ones with external partners together as the market changes.

This definition reflects the development of a dynamic supply chain that can effectively react to an unexpected situation by achieving new and innovative forms of competitive advantage. Similar to single firm centric dynamic capabilities, interfirm capabilities also are domestically developed and idiosyncratically based on each supply chains' unique situation and market position. It creates situation-specific knowledge, which is a valuable resource for firms.

Deconstruction of Interfirm Dynamic Capabilities

For a long time, dynamic capabilities have been considered as a highly conceptual and intangible concept that is vague, as well as both difficult to measure and apply (Nerkar & Roberts, 2004; Zahra, Sapienza, & Davidsson, 2006). It is important to transfer the abstract view of dynamic capability into a more tangible view that is operable and measureable (Arend & Bromiley, 2009). In 1997, Teece and colleagues suggested that dynamic capabilities should include the role of integrating, coordinating, learning, reconfiguring, and transforming. In 2007, he advanced this previous work by proposing a comprehensive model that could capture the operation of dynamic capabilities. He suggests that firms need to sense the environmental signals, detect the opportunities, and then understand the potential value of those opportunities and take advantage of them by taking actions, such as protecting, deploying, combining, or reconfiguring firms' various resources. Based on these two works and other literature in strategic management and decision science, Pavlou and El Sawy (2011) propose a model of dynamic capabilities with four identifiable and specific components: sensing capability, learning capability, integrating capability, and coordinating capability. However, these studies focus on domestic capabilities, whereas supply chain involves multiple firms. Thus, it is important to understand dynamic capabilities at the interfirm level. Limited research has been found in this stream. Ettlie and Pavlou (2006) propose a model for interfirm partnership dynamic capabilities

and argue that the absorptive capacity, coordination capability and collective mind are the three factors that form the interfirm dynamic capabilities. However, all these works analyze dynamic capabilities within the context of NPD; in this research, the focus is how firms can obtain a dynamic supply chain. Therefore, this research aims to identify dynamic capabilities at the interfirm level within the context of supply chain management and applies it to the healthcare industry.

Creating an adaptive or a dynamic supply chain has attracted certain researchers' attention. Various processes have been proposed by the literature to contribute to this objective. Some of these processes are overlapped with the previously identified dynamic capabilities, and some of them are unique to the situation that involves multiple firms. Dacko, Liu, Sudharshan, and Furrer (2008) suggest that dynamic supply chain capabilities include high learning capacity and strong coordination capability. Furthermore, Defee and Fugate (2010) propose a model of dynamic capabilities for supply chain and express the idea of staying alert to the environment, as well as learning and developing together with other supply chain partners in such models. Beske (2012) also confirms in his study that partner development is necessary for facilitating supply chain's response to the environment. Therefore, based on the literature for dynamic supply chain development and dynamic capabilities, this research extends the work of Ettlie and Pavlou (2006) and suggests that interfirm capabilities include *sensing capability, learning capability, coordination capability, collective mind, and partner development*. These capabilities together increase the supply chain's capability of resource reconfiguration and generation (Figure 3).

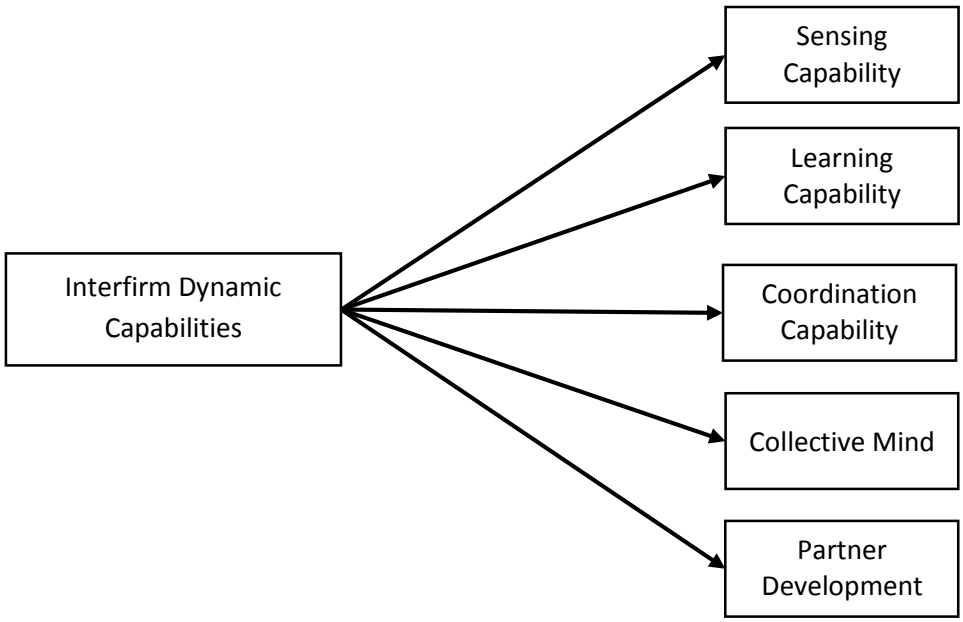


Figure 3. Interfirm Dynamic Capabilities

Sensing capability. Sensing capability reflects the ability to detect signals in the market, interpret them and understand the potential business opportunities; in other words, the ability to obtain insights of environmental changes. Literature points out that firms of the supply chain need to understand the environment they operate in and stay alert to the changes in the environment in order to enhance the overall responsiveness of the supply chain (R. Agarwal & Selen, 2009; Wei & Wang, 2010). Pavlou and El Sawy (2011) propose that this capability is realized with three routines: generating, disseminating and responding to market intelligence. Market intelligence is the general designation of the various market phenomenon, such as customer needs and preference trends, technical development, competitors' action, and resource combination (Pavlou & El Sawy, 2011). Generation and dissemination of market intelligence relates to the detection and interpretation of those events. Once opportunities are found, firms will dig deeper to understand their value and make decisions on how to take advantage of those chances; this is the process of responding to market intelligence. Different from the single firm centric sensing capability, firms in the supply chain need to keep each other informed in these

processes in order to keep the whole chain sensitive to the environment (Liu, Ke, Wei, & Hua, 2012; Shore & Venkatachalam, 2003). Disseminating information in the web of the supply chain allows for the exploration of opportunities in the detected environmental changes, which fosters the discovery of innovative responses to the environment (Defee & Fugate, 2010).

Learning capability. Learning capability refers to the ability of using market intelligence to generate new knowledge in order to direct firms' actions (Pavlou & El Sawy, 2011). This ability impacts the effectiveness and innovation of firms' decision on how to reconfigure the operational capacity. Such innovation and effectiveness are also needed in creating a dynamic supply chain (Defee & Fugate, 2010; Zahra et al., 2006). Thus, learning capability is a critical part of the interfirm dynamic capabilities. It has been suggested that the ability underlying learning and innovation is called absorptive capacity, a single firm centric ability (Wesley M. Cohen & Levinthal, 1990; Van Den Bosch, Volberda, & De Boer, 1999). It describes how firms can obtain knowledge from any external sources. However, when conducting learning activities within an interfirm context, firms have to be aware of the risk of acquiring knowledge from partners. It can create disharmony in the supply chain and even terminate the relationship (Defee & Fugate, 2010). Firms need to consider the supply chain partners as allies and avoid using these partners as the knowledge resource for their own development. Thus, in the interfirm level, the learning capability is constituted by knowledge assessment and knowledge alignment.

Knowledge assessment means the awareness and comprehension of each firm's knowledge and capabilities. Each supply player needs to understand the competence, strength, and knowledge that its peers possess in order to be positioned at the place where its resources and capabilities can be best utilized (Defee & Fugate, 2010; Grant & Baden‐Fuller, 2004). Knowledge alignment means that each member's knowledge and capabilities are synchronized

with each other while remaining differentiated from the other (Mentzer et al., 2001). Each member could focus on improving its own capability which in turn enhances the overall efficiency along the supply chain (Pagell & Wu, 2009). This process will benefit the whole supply chain by reducing the redundant capability development within the supply chain and increasing the responsiveness to market trends and customer requirements (A. Agarwal, Shankar, & Tiwari, 2007; Grant & Baden‐Fuller, 2004). Thus, this learning capability is necessary for the interfirm dynamic capabilities.

Coordination capability. Coordination reflects the synchronization of resources, task, and related information among different parties. Previous literature has suggested that innovation and reconfiguration happen when assets and tasks are properly coordinated (Quinn & Dutton, 2005; Teece, 2009). Within the firm's boundary, such synchronization means to assign the right resource to the right work (Pavlou & El Sawy, 2011). Similarly, research also emphasizes the importance of coordination in enhancing the vigorous dynamics of the supply chain (Stank, Davis, & Fugate, 2005). In a supply chain, one firm's performance may be dependent on one or even multiple partners' outputs. The coordination capability ensures the performance of each member and allows them to work together effectively to alter the operations along the supply chain (Kanda & Deshmukh, 2008; Min & Mentzer, 2004; Simatupang, Wright, & Sridharan, 2002). Failure to do so will slow down the supply chain reconfiguration process or even cause firms' operational dysfunction in the joint activities. Literature suggests that the supply chain coordination requires firms to synchronize the resources and tasks, and create transparency along the chain. Such synchronization means firms aligns each members' existing routines and reduce the unnecessary processes (Kanda & Deshmukh, 2008; Simatupang et al., 2002). In this way, firms can complement each other's work and increase the efficiency in the

process. The transparency along the supply chain is realized through information sharing between firms. The synchronization and transparency ensure each firm's functionality, which helps the implementation of the joint activities such as reconfiguring current supply chain processes and resources (Pagell & Wu, 2009). Thus, coordination is a necessary part of interfirm dynamic capabilities

Collective mind. Collective mind is the overall agreement of the supply chain operation among firms. The creation of dynamic supply chains cannot be accomplished by one or two players. When multiple firms are involved, interfirm conflicts can be caused by the inconsistent perception of the supply chain goal among members (Groznik & Heese, 2010; Ranjay Gulati & Nickerson, 2008). It can lead to disagreement and incongruent behavior which diminishes the performance of the overall supply chain and even hinders the development of each single firm (Fawcett, Ogden, Magnan, & Cooper, 2006; Rossetti & Choi, 2008). Thus, firms must develop a shared understanding of the supply chain development (Dyer, 2000; Wei & Wang, 2010). The shared understanding generates the relational structure and behavior norms which help firms recognize their role in the supply chain and understand partners' actions. Therefore, collective mind reduces the local perspective of supply chain members and directs their behavior (Beske, 2012; Defee & Fugate, 2010). Especially when facing the changes in the environment, firms know how to collectively deploy the reconfiguration towards changes. Thus, collective mind is a necessary part of interfirm dynamic capabilities.

Partner development. Partner development means that firms invest and share resources in their partners to support their capability development under agreements (Krause, Handfield, & Scannell, 1998; Krause, Handfield, & Tyler, 2007; Schilke & Goerzen, 2010). In other words, firms can pursue the desired performance by accessing resources from partners. Within the

supply chain, a firm cannot be considered independently from its partners. The reconfiguration and creation of new operational capabilities are realized through the commitment of all members in the chain and usually it is constrained by the weakest member (Beske, 2012). Thus, the cross-firm synergy is necessary to develop superior capabilities collectively (Defee & Fugate, 2010). In order to do so, all organizations in the supply chain need to develop together instead of a single or a few firms dominating the development. Partner development activities include asset and expert sharing, clarifications of goals, rules, and responsibilities, and specific investments among partners in the supply chain (Allred et al., 2011; Brekalo, Albers, & Delfmann, 2013). These activities have been suggested to increase the integration and flexibility along the supply chain (Krause et al., 2007). In a dynamic environment, the integration and flexibility of the supply chain allow the quick refinement of the operation towards the changes (Beske, 2012; Brekalo et al., 2013; Seuring & Müller, 2008). Thus, leveraging partners' capability is necessary to pursue a dynamic supply chain, and this research proposes it is the last dimension of interfirm dynamic capabilities (Agarwal et al., 2007; Beske, 2012).

Interfirm Dynamic Capabilities and Operational Capabilities

The above identified capabilities imply that interfirm dynamic capabilities are higher order capabilities enhancing or generating the supply chain operational capabilities, the lower order capability that directly relates to the supply chain performance. To better understand interfirm dynamic capabilities, this research investigates their relationship with operational capabilities.

Operational capabilities are the activities that support firms' daily operations, such as manufacturing and deliver service to customers, or making various decisions (Teece, 2009). Winter (2003) uses "making a living" for the firm to describe its function. The goal is to

optimize firms' performance without radical changes in the current processes, resources, technologies, and labor. Because such capabilities focus on exploiting effectiveness and efficiency based on the current status instead of dramatically altering it, it is called zero order capability, or ordinary capability (Collis, 1994; S. G. Winter, 2003). Different from operational capabilities, dynamic capabilities describe firms' potential to redesign the existing routines or create new ones to meet changes in the business environment, such as innovation in the healthcare delivery processes (Pavlou & El Sawy, 2011). In other words, dynamic capabilities' impacts on firms are realized through their effect on operational capabilities. It is called first order capability.

Based on the definition, the operational capabilities of the supply chain here are defined by its capability of collectively delivering a service or product to satisfy customers. This research specifically applies the model in the healthcare industry; therefore, the operational capabilities of the healthcare supply chain are represented by the service planning and control collaboration. Service planning and control collaboration means that healthcare providers are able to jointly design and deliver services together. It is realized through the clinical guidelines development and application which defines routines of the daily operation along the supply chain, such as the transition of patients and clinic information sharing between different providers (Ahgren & Axelsson, 2005).

Interfirm Dynamic Capabilities and IPC

Different from the RBV that most dynamic capabilities studies grounded in, this research studies interfirm dynamic capabilities from the IPV. Firms greatly rely on timely and accurate information to understand the market and find out business opportunities. The market intelligence is generated from the information firms collected. Without the information, firms

are “blind” and cannot catch up with the changing environment. Firms’ response towards changes is made based on knowledge, previous experience, and information. The reconfiguration of the supply chain requires the synchronization of information among the firms in time. Therefore, it is obvious that there is a strong need of quality information and heavy information transmission among supply chain members in order to stay responsive to the market.

According to the IPV, the process of developing responses to the environmental changes can be expressed as the processes of collecting, analyzing, and acting on information about the environment. When the market is turbulent, firms frequently gather and exchange information from various sources instead of relying on a single source to make decisions, which indicates the high uncertainty of the information. Also, firms’ response to the changes is often highly experiential and iterative based on real-time information, trials, prototyping, and the creation of various scenarios, which represents the high equivocality of the information (Eisenhardt & Martin, 2000). Furthermore, in a supply chain, the operations are more complicated than those within a firm because they involve various parties in the process. Such complexity in the supply chain operations also generates additional information flow and increases the uncertainty and misunderstanding in processing the information. It is apparent, based on these features of supply chain in a turbulent environment, that firms need to work together to develop high IPCs to address the IPR. Following this argument, IPC is embedded in dynamic capabilities and aims at addressing the IPR generated by the turbulent environment and the complexity of the supply chain tasks. All the dynamic capabilities identified above can be considered as designed processes that cut cross firm boundaries which can enhance the information processing of the supply chain and reduce uncertainty and equivocality in the information.

Sensing capability is designed routines to collect and disseminate market intelligences which aim at describing the environment to the managers. Also, sensing and dissemination activities determines the sufficiency of the information, therefore, impact the level of uncertainty in the decision making process along the supply chain. High sensing capability will increase the information sufficiency, therefore, lead to better decision making. The learning capability reflects the knowledge and experiences improvement through working with supply chain partners. As stated in the IPV literature review, knowledge can reduce the human cognitive limit in decision making (Hult et al., 2004). Therefore more knowledge and experiment about the partners and supply chain will improve firms' effectiveness in making supply chain related decisions. Coordination capabilities indicate the level of synchronization along the supply chain. Higher synchronization means the information is shared among partners in higher accuracy and shorter time. Also, coordination increases the conversation among partners, therefore, reducing the equivocality in the information. Thus, coordination among the supply chain partners reduces the time and effort in decision making. Collective mind is the mutual understanding among partners. High collective mind reduces the conflicts and misunderstanding in interpreting the information, therefore, increasing information processing effectiveness along the supply chain and improving the decision making process. Partner development is the sharing of knowledge and experience with partners along supply chains. Different from learning capability, it is the knowledge and experience improvement in partners. Higher partner development means the better improvement of knowledge and experiences for partners, which improves the effectiveness in their supply chain related decision making process.

Overall, the interfirm dynamic capabilities reflect the lateral relationships across firms which will improve the availability of the information and knowledge in decision making. These

relationships also define the interaction and communication among members in the supply chain, which will determine the information sufficiency and richness in reducing the IPR. Higher interfirm dynamic capabilities indicate higher abilities in information processing and IPR reduction. Therefore, we argue that interfirm dynamic capabilities are a form of IPC that can address the IPR generated by the turbulent environment as well as the tasks. Such IPC will improve firms' decision on alternating the supply chain operations to cope with the changes.

Social Capital

The concept of social capital originally comes from the study of the development of communities in the city. Jacobs (1961) suggests that strong personal networks which build trust and collaboration would greatly facilitate the sustainability and functioning of the neighborhoods. The early research of social capital focuses on understanding the individual level social phenomenon and the development of human capital, such as family, community life, child development, and education (James S Coleman, 1988; J.S. Coleman, 1994; Loury, 1977). Later its application extends to other areas such as organizational and management research and becomes an important part of it (Kostova & Roth, 2003; Molina-Morales & Martínez-Fernández, 2010). The core idea of social capital theory is that resources embedded in the informal relationship networks could facilitate the conduction of various social activities.

Social capital is considered a form of "capital." Capital is an asset that could benefit its owner (Lin, Cook, & Burt, 2001). Research suggests that resources embedded in the social network are sustainable with maintenance and could eventually profit the owner or a group at large (Bourdieu, 1986). The wide application of social capital concepts in understanding various social and organizational phenomenon indicates that it can be used for multiple purposes, such as career development, education advice, and information access, which means that it is

"appropriable" (Adler & Kwon, 2002)(Adler & Kwon, 2002). Furthermore, social capital can be an alternate or supplement of other resources to generate the desired outcome. Although it is not as liquid as economic capital, social capital also could be converted into other forms, such as culture capital and economic capital (Bourdieu, 1986).

As the value of social networks being realized by researchers, the development of research also extends from the individual to the collective level, and researchers consider that there is a "collective-owned capital" embedded in the relationships that can benefit all the members in the network (Bourdieu, 1986). Social capital theory points out the concept that entities with the proper social connection will bring benefits to themselves or to the organization they belong to (Oh, Chung, & Labianca, 2004). Such application of study implies two fundamental assumptions: 1) the constructs of social capital are similar across different levels, and 2) the relationships between social capital and other constructs, such as knowledge and information exchange, are similar across different levels (Payne, Moore, Griffis, & Autry, 2011).

Definition

Reviewing the literature, this research notices that a large part of the social capital research focuses on social network structures, such as the strength of the network tie, the actors' position in the network, or the outreach of the connections. Network ties have been found to enhance the access to information about innovation (Burt, 1987; Rogers, 1995). Another part of the research focuses on how social relationships, instead of social structure, benefit the actors. These studies argue that social capital lies in the social relationships which bring people the positive attitude and belief about others on the other end of the connection. This positive attitude and belief promote an environment with trust and reciprocity (Fukuyama, 1995; Putnam, 1995). Adler and Kwon (2002) support this argument by highlighting that social capital could benefit

organizations by increasing the solidarity that indicates higher trust and cohesiveness among individuals and different business units. Literature suggests social capital can appear in various forms with some common features: 1) it is embedded in the social network, 2) it affects the activities of members in the network, and 3) it is an attribute not only to the individual who possessed the relationship but also to the group at large.

This research follows Nahapiet and Ghoshal's (1998) conceptualization and considers social capital as "*the social relationship network together with the various resources embedded within it.*" Such resources can come from the trust and network tie that feature the network (Figure 4). For example, the connection between two departments may begin because of task requirements and individuals who feel conformable about each other may start to interact with each other. As the interaction continues, trust may be built, and people will start to share information, knowledge and other resources with each other (Nahapiet & Ghoshal, 1998).

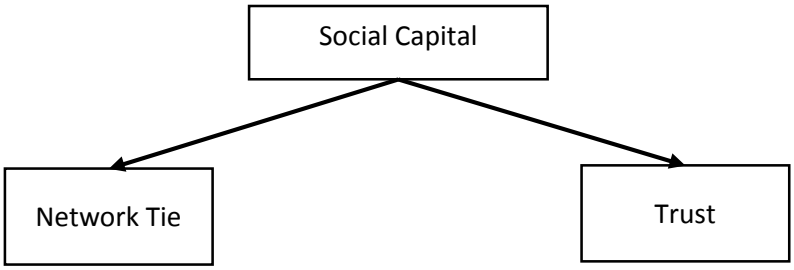


Figure 4. Social Capital

Network tie. Nahapiet and Ghoshal (1998) suggest that the foundations of social capital are the existence of network ties among peers and their configurations. According to Carpenter, Li, and Jiang Hayes (2012), it describes the specific ties reflecting interaction and interdependence among entities, such as friendship, kinship, and knowledge exchanges (Kilduff & Tsai, 2003; Phelps, Heidl, & Wadhwa, 2012). Network tie is the basis for the social capital

because, without it, the social capital cannot be developed (Adler & Kwon, 2002; Tsai & Ghoshal, 1998). As discussed previously, the absence of the tie will create a structure hole in the network; therefore, any actors that could connect to those who are not connected with other peers could obtain the unique advantage of accessing those resources embedded in the relationship (Burt, 1992).

According to Carpenter and colleagues (2012), network structure appears in different forms for different levels: the single node, the pair relationship, and the entire network. In the node level, network structure is presented by the centralization of the network. It illustrates the concentration of connections which show the position of the actor in the network, such as the importance and constraints of the actor (Carpenter et al., 2012). Usually it is described by the centrality of the actor (Kilduff & Tsai, 2003). At the dyadic level, network structure is the connection between the two actors, such as the frequency of the connection and how long it can last. It is illustrated by the strength of the tie. At the network level, network structure is the overall status of the connections in the network, such as the number of connections and closeness of the connection (Moliterno & Mahony, 2011). It is similar to dyadic level network structure but in a collective form, thus, it is presented by the strength of the tie and density of the network. This research focuses on the dyadic level relationship; therefore, the strength of the network tie is used to study the network structure of social capital.

The major benefit of the network tie comes from accessing the information and the privileged ownership of resources (Phelps et al., 2012). Strong ties within a group usually bring all members close to each other, which leads to better group effectiveness by improving collaboration (Levin & Cross, 2004; Oh, Labianca, & Chung, 2006). The outreach of interfirm social network allows firms to obtain new knowledge and skills (Podolny & Page, 1998; Powell

& Smith-Doerr, 1994) as well as to exchange information (Uzzi, 1997). Even within the organization, the network connects among different units could benefit the organization as a whole by increasing the information diffusion and transferring among the units (Hansen, 1999). This means that the social network can reduce the equivocality and enhance information flow within and between firms. Therefore, the strong network tie can be advantageous when the meaning of information is vague (Hansen, 1999). Hence, it is important to understand the connections between firms and their peers in the social network when study the relationship between social capital and interfirm dynamic capabilities.

Trust. According to the definition of social capital in this research, relationships are considered one resource for social actions (Adler & Kwon, 2002; Baker, 1990; Carpenter et al., 2012; Nahapiet & Ghoshal, 1998). Nahapiet and Ghoshal (1998) suggest the relationship dimension of social capital relates to the type of connection that exists between actors in the network that could influence their attitude and behavior, such as the emotional bond between an individual and a certain group or company. It is different from the strength of the tie, as the strength of the tie reflects the feature of the interpersonal connections among entities, whereas relationship describes how affective these interpersonal connections are on the peers' behaviors (Bolino, Turnley, & Bloodgood, 2002). Research has shown that the core of social relationship is the trust that each actor possesses towards others (Uzzi, 1996). It is based on the assessment of others' goodwill and kindness and the risk of believing in them (Inkpen & Tsang, 2005). Hence, this research uses trust to demonstrate the relationship among firms

A party or individual will be less protective about their assets to those that they consider to be trustworthy. Such trust and emotional attachment will reduce the hesitation and resistance to opening to that person, which enhances communication and interaction. This can yield further

engagement in social exchange and collaboration (Nahapiet & Ghoshal, 1998; Putnam, 1995). For example, people tend to share sensitive information only to those whom they trust. A higher level of trust also implies the openness to uncertainty that can be caused by the other party (Nahapiet & Ghoshal, 1998). This comfort with taking risks to a certain extent increases the cohesion and flexibility within the group (Bolino et al., 2002). This will lead to cooperative behavior and mutual support which facilitates actors' social actions, such as cooperation and knowledge sharing (Tsai & Ghoshal, 1998; Uzzi, 1997). Furthermore, trust could also encourage the diffusion of sensitive and rich information among the networks (Krackhardt & Hanson, 1993). These benefits have been suggested as indicators of high IPC. Thus, it is necessary to include trust in understanding the impact of social capital on interfirm dynamic capabilities.

Social Capital and Its Business Value

As previously mentioned, social capital is possessed by actors in the network; it changes when the actors change in the structure. Therefore, social capital is unique and cannot be traded easily. For example, the emotional bond is different from one person to another and cannot be passed on. Consider it from the organizational angle, each organization's social capital is unique and cannot be copied or substituted simply, thus the benefits it brings are also exclusive. This is in accordance with the VIRN attributes of a resource according to the RBV, therefore, social capital can be considered as a contributor to the sustainable competitive advantage of the company. Such feature attracts many researchers' attentions. Scholars have drawn on the social capital literature to address numerous research questions across a wide range of organizational and managerial contexts on both the individual and collective levels.

At the individual level, researchers have argued that access to new sources of knowledge is an important direct benefit from social capital (Adler & Kwon, 2002; Phelps et al., 2012). It also

could enhance knowledge transfer by increasing social interactions (Nahapiet & Ghoshal, 1998; Phelps et al., 2012). In the organizational level, collective social capital means that firm employees are connected with external parties socially beyond the professional relationship. This conceptualization offers a new way to analyze firms even cross-firm activities in surviving in a competitive environment.

Research has found that social interactions improve firms' performance especially within the inter-organizational context (Thomas et al., 1993). Research finds that organizations' social capital with external actors can increase the firms' chances to survive after a major transformation by release the firm from certain environmental pressures (Fischer & Pollock, 2004). It is also found to leverage the utilization of the venture's resources (Florin, Lubatkin, & Schulze, 2003). Other applications of social capital in organizational research include analyzing firms' innovation capability (Ahuja, 2000; Perry-Smith & Shalley, 2003; Shipilov, 2009; Tsai & Ghoshal, 1998), supplier relationships (Baker, 1990; Helper, 1990; Uzzi, 1999), access to resources (Shane & Cable, 2002; Uzzi, 1999), and knowledge management (Phelps et al., 2012). These applications reveal the role of social capital in various organizational activities as a valuable resource. Different from these studies, this research consider social capital a driver in forming organizations' capabilities from the IPV. According to IPV, social connection is part of the lateral relationship creation which can enhance the IPC by increasing the richness and reducing the equivocality of the information, hence, social capital can contribute to the development of interfirm dynamic capabilities. Therefore, this research extends the business value of social capital from a resource to a part of organizational capabilities.

Model and Hypotheses Development

This research focuses on the relationships between IT, social capital, interfirm dynamic capabilities, and the operational capability of supply chains based on IPV. It also includes the impact of environment and task characteristics on these relationships. This research argues interfirm dynamic capabilities can be considered a form of IPC to reduce IPR generated by environmental turbulence and task complexity. A firm's IPR is reflected by the uncertainty and equivocality of the information. The match between interfirm dynamic capabilities and the IPR maximizes the supply chain operational capability. This research also proposes IT and social capital can enhance the interfirm dynamic capabilities by increasing the ability to reduce the IPR. The conceptual research model is below (Figure 5). This section will define these variables and discuss their relationships in the context of the healthcare delivery network.

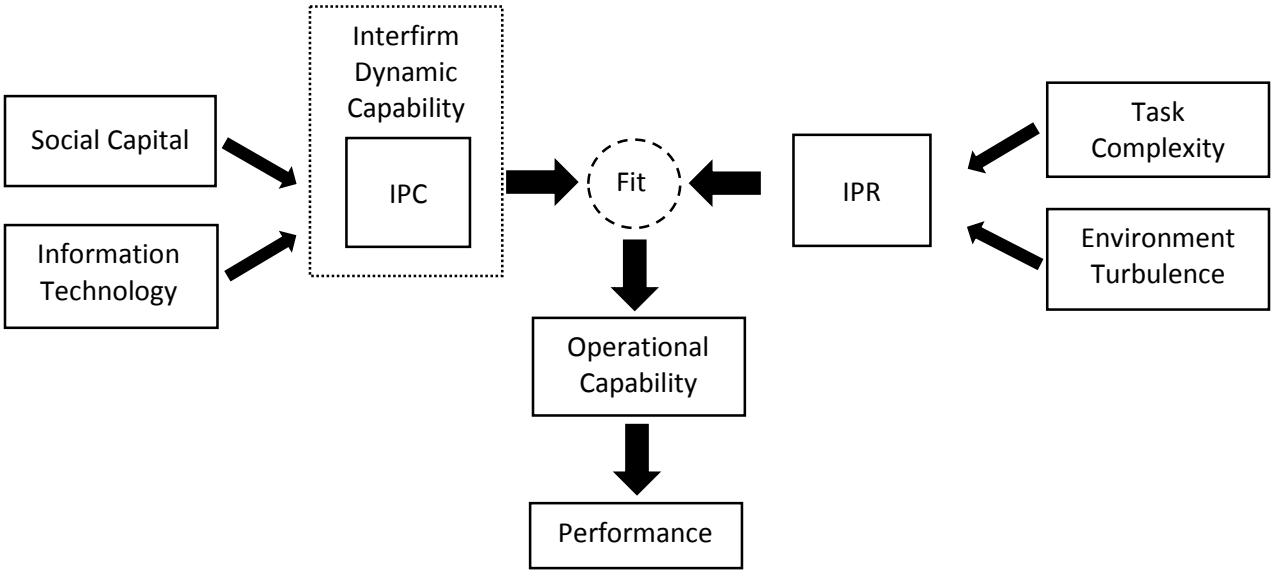


Figure 5. Conceptual Research Model

As was illustrated in the previous section, interfirm dynamic capabilities represent the processes that collect and utilize information effectively to reconfigure current healthcare

delivery capabilities from IPV. The sensing capability helps healthcare providers with collecting and disseminating information in time. A collective mind among healthcare providers and their partners reduces misunderstandings in both behavior and information interpretation (Beske, 2012). Coordination capability enhances the information flow among different parties in the healthcare delivery network (Kanda & Deshmukh, 2008; Pagell & Wu, 2009). Partner development and learning capability improves knowledge accumulation and sharing in all members of the supply chain, which is critical for decision making. Hence, high interfirm dynamic capabilities mean high IPC (Hult et al., 2004).

The outcome of information processing needs to match the IPR generated by the information characteristics (Daft & Macintosh, 1981). When there is uncertainty, healthcare providers need to collect additional information or expand the information sources to reduce such uncertainty. For example, healthcare providers may need to conduct a series of examinations and lab tests collectively in order to find a treatment, which increases the information flow among healthcare providers. When there is equivocality, the vague meaning of the information can cause various interpretations across firms, which slows down the business process and leverages the difficulty in information processing. For example, different healthcare providers usually have their preferred understanding toward patient requirements, which can impede the collaboration and communication with their partners. Hence, healthcare providers need to develop higher interfirm dynamic capabilities when IPR is increased, in order to adjust the current healthcare delivery network for better performance. Following this argument, this research proposes:

H1: IPC (Interfirm dynamic capabilities) need to match the IPR in order to reach high operational capability of the healthcare delivery network.

H2: Higher operational capability of the healthcare supply chain leads to higher healthcare delivery network performance.

IPV suggests IPR is generated by the level of turbulence in the environment and the complexity of the task (Daft & Lengel, 1986; Mani et al., 2010; Puranam et al., 2012). Environmental turbulence is demonstrated by the rate of technology and market change (Fynes, De Burca, & Voss, 2005; Ward & Duray, 2000). In the healthcare industry, the rate of change of technology is high because of the constant innovation in biotechnology, medicine, and IT. Mostly, these changes and their impacts are difficult to foresee. For example, discoveries in cellular biology and pharmaceuticals can alter a patients' treatment method profoundly (Ginsburg & Willard, 2009). The rate of market change is also high because of the diverse requirements for different patients. For example, it is difficult to anticipate patient diversity. Healthcare providers need to quickly catch these changes and effectively address them in order to deliver satisfactory healthcare service.

Task complexity reflects the non-routineness and interdependence of the task. The level of non-routineness increase the difficulty of forecasting the information required to finish the task. Interdependence increases the unexpected and forced changes in the process, which increase uncertainty (Daft & Lengel, 1986; Mani et al., 2010). For example, some rare diseases or emergency situations lead to ad hoc problems with little or vague information for the healthcare delivery network, and all the members in the healthcare delivery network depend on each other for different examinations and lab tests. In that situation, the healthcare delivery network is operating under high uncertainty and equivocality. Therefore, this research argues:

H3: Higher environmental turbulence leads to higher IPR.

H4: Higher task complexity leads to higher IPR.

As stated in the literature review, IT with EDA infrastructure provides series of functions having to do with information processing, and this research classified such types of IT into two categories: sensing and responding. Sensing IT can provide healthcare providers with the ability to generate a comprehensive picture of the market by increasing the speed of data gathering, expanding the source of information, and enabling multidimensional analysis. It also can capture service performance and send alerts to managers in real time (Alavi & Leidner, 2001; Joshi et al., 2010; Sabherwal & Becerra-Fernandez, 2010; Tippins & Sohi, 2003). Responding IT provides firms with various interaction channels with partners in the healthcare delivery network. It also simplifies coordination and communication across departments, and organizations which grant different forms of collaboration (Miozzo & Grimshaw, 2005; Tan & Siew Kien, 2006). This not only reduces information equivocality, but also increases the freedom in developing partnership and alliances among healthcare providers. For example, external and internal integration of healthcare service processes simplifies the information transaction within and across organizational boundaries as well as supports joint activities, which are often required in reacting to patient requirements or emergency situations (Nazir & Pinsonneault, 2012). Therefore, the combining and integrating of IT with EDA infrastructure enhances the healthcare service network's ability to process information and reduce IPR generated by the turbulence environment and the complicate healthcare service processes. Thus, this research argues:

H5: IT with EDA infrastructure will enhance the interfirm dynamic capabilities.

As demonstrated earlier, interfirm dynamic capabilities describe routines involving multiple firms. This feature of interfirm capabilities indicates the essentials of communication and trust between firms (Agarwal et al., 2007; Beske, 2012; Defee & Fugate, 2010; Du et al., 2012). Social capital means there is social bonding between their members and external parties

beyond the professional relationship, which indicates the lateral relationship between organizations. Therefore, it is an important factor impacting firms' IPC, or in this research, the interfirm dynamic capabilities.

First, network tie indicates the creations of lateral relationships among healthcare providers in the network in addition to the current designed ones. These relationships grant healthcare providers information access and the privileged ownership of information sources, which will improve the information sufficiency (Kilduff & Tsai, 2003; Phelps et al., 2012). For example, the connections between healthcare providers will improve their sharing of information and knowledge (Burt, 1992; Granovetter, 1973; Hansen, 1999; Phelps et al., 2012). Also, such network connections increase the conversation among members in the network, which leads to the enhancement of information richness (Nahapiet & Ghoshal, 1998).

Second, trust decreases the cognitive conflicts among healthcare providers, which will improve the IPC according to the IPV. Trust has been found to increase the exchange of information, experts, and resources (Das & Teng, 1998; Kramer & Tyler, 1996; Nahapiet & Ghoshal, 1998; Putnam, 1995). Research suggests the trust between firms is necessary to stimulate open communication and knowledge sharing. The openness between healthcare providers improves the information richness as well as reduces conflicts during the collaboration, therefore, improving the IPC of the overall service network (Das & Teng, 1998; Morgan & Hunt, 1994; Nahapiet & Ghoshal, 1998; Paulraj, Lado, & Chen, 2008; Tsai & Ghoshal, 1998).

These arguments are consistent with the supply chain management literature in that relationship development and trust enhances collaboration and among firms are enablers of conducting effective response to changes quickly (Agarwal et al., 2007; Beske, 2012; Defee &

Fugate, 2010; Du et al., 2012; Laeequddin, Sahay, Sahay, & Waheed, 2010) and facilitates the commitment in the professional relationships, such as partner development (Molm et al., 2000). Such a relationship will also enhance information sharing among healthcare providers, thus improving the sensing capability of the network. Also, a social capital network improves the mutual understanding among members in the network, therefore, improving the development of the collective mind. Thus, this research proposes:

H6: Social capital will enhance the interfirm dynamic capabilities.

Chapter 3. Methodology

This research majorly aims to investigate the impact of IT and social capital on inter-firm dynamic capabilities. It also examines the role of business environment and tasks characteristics on inter-firm dynamic capabilities' impact on supply chain operational capability from the IPV. This research will contribute to the body of knowledge regarding the dynamic capabilities at an inter-organizational level from a prospect not currently addressed in IT and supply chain literature. To accomplish this goal, this research develops a conceptual model and will empirically test it with a survey that will use a sample of currently active US healthcare providers. Data will be collected using a survey instrument and secondary data from Healthcare Information and Management Systems Society (HIMSS) database. The information of social capital, IT application, environment situation, or supply chain activities of the organization will be best described by the senior executives who know the overall picture of the organization. Therefore, this study focuses on gathering data from the most senior executive in the healthcare organization. The detail of the methodological procedure, including the survey development, data collection and analysis, is illustrated in this chapter.

Survey Development

This section identifies each of the variables used in the research model while offering the rationale and motivation in support of the choices. Table 2 summarizes the source and item number for each variable that will use survey to collect data. A 5-point Likert scale questionnaire was developed to collect data to test the model proposed in Chapter 2. Items are

identified from the literature to measure the constructs in the model. Appendix A provides the list of questions that will be used in the survey.

Table 2

Summarization of Item Source

Variable		**Source**	**Item #**
Environmental Turbulence (ET)		Pavlou & El Sawy (2011)	3
Task Complexity (TC)		Karimi, Somers, & Gupta (2004)	3
Information Processing Requirement (IPR)		Karimi, Somers, & Gupta (2004)	4
IT Application (IT)	Sensing IT	Developed for this study	3
	Responding IT	Developed for this study	4
Information Processing Capacity (IPC)	Sensing Capability	Pavlou & El Sawy (2011)	3
	Learning Capability	Agarwal & Selen (2009)	3
	Coordination Capability	Ettlie & Pavlou (2006)	3
	Collective Mind	Ettlie & Pavlou (2006)	3
	Partner Development	Allred, Fawcett, Wallin, & Magnan (2011)	3
Social Capital (SC)	Network Tie	Chow & Chan (2008)	3
	Trust	Norman (2002); Tsai & Ghoshal (1998)	3
Operational Capability (OC)	Coordinated Care Delivery	Ahgren & Axelsson (2005)	3
	Information Sharing	Du, Lai, Cheung, & Cui (2012)	3

Environmental Turbulence

As illustrated in Chapter 2, environmental turbulence describes the external situation that impacts the IPR that firms need to address. Environmental turbulence is defined by the change rate of the technology and market. In order to capture the pace of changes in patients' needs and technological breakthroughs, which will impact the healthcare delivery network, these three items were adapted from Pavlou and El Sawy's research (2011), which is originally from the scale developed by Jaworski and Kohli (1993).

Task Complexity

Task complexity describes the internal situation impacting the IPR that firms need to address. It is defined by the non-routineness of the procedure and the interdependence among the tasks. The measurement for this construct is adapted from Karimi, Somers, and Gupta's study (2004), and has three items to describe the complexity in the healthcare delivery network.

Information Processing Requirement

Information processing requirement is used to define the information healthcare providers need to address in the network. The measurement describes the uncertainty and equivocality in the information, which limits the result of decision making. Similar to task complexity, the current study will use four items adapted from Karimi and colleagues' work (2004) to demonstrate such features the healthcare providers are facing in the network.

IT Application

In Chapter 2, IT application has been classified into two categories and their function is summarized accordingly. The items measuring the IT support that healthcare providers adopt are generated according to these various functions. Therefore, IT application is measured by items specifically developed for this study: three items to measure the sensing IT function and three items to measure the responding IT function. These items reflect the degree to which the respondents believed their IT application supports the functions summarized in chapter 2. Also, secondary data such as the type of system and level of implementation might also be collected from the HIMSS database and used to reveal the IT functions healthcare providers implemented for developing the healthcare delivery network.

Social Capital

The current study considers social capital a reflective higher-order construct with the dimensions of the reflective construct comprised of network tie and trust. The measurement of network tie was adapted from three items used by Chow and Chan (2008). It describes the relationship among various healthcare providers in the network. To capture trust, three items were drawn from the scales developed by Norman (2002) and Tsai and Ghoshal (1998). Together, six items are used to understand the social capital that exists in the healthcare delivery network.

Inter-firm Dynamic Capabilities

Inter-firm dynamic capabilities are considered as a second-order reflective construct comprised of sensing capability, learning capability, coordination capability, collective mind, and partner development. Three items adapted from Pavlou and El Sawy (2011) measure the sensing capability. The learning capability of the healthcare delivery system is captured by three items adapted from Agarwal and Selen (2009). Collective mind and coordination capability among the healthcare delivery partners are each measured by three items adapted from Ettlie and Pavlou's study (2006). The partner development is measured by three items followed in Allred, Fawcett, Wallin, and Magnan's study (2011). In total, fifteen items are developed for the measurement of inter-firm dynamic capabilities.

Operational Capabilities

The operational capabilities of the health care delivery network are measured by coordinated healthcare service delivery and information sharing, which reflects the service planning and control. The collaborative service delivery capability is measured by three items

from Ahgren and Axelsson (2005). Information sharing is measured by three items adopted from Du, Lai, Cheung, and Cui's study (2012).

Performance

The performance of the healthcare delivery network will be measured by the quality and financial performance of the healthcare providers. The quality performance will be measured by patient days in the hospital and mortality rate. The financial performance will be measured by annual operational margin and the return on assets. This research will use archival data to obtain these measures from the Center for Medicare & Medicaid Service (CMS).

A pretest of the instrument will be conducted with doctoral students and professionals from MIS, supply chain, organizational behavior and healthcare industries. The pretest would refine the wording of the items to improve the items' clarity for further participants.

Participants and Data Collection

The survey were emailed and mailed to the CEO of each healthcare provider listed in the HIMSS Analytics Database to increase the responding rate. CEOs are chosen because they have a rich knowledge about the situation of joint healthcare delivery processes, they also have a good understanding of IT implementation in the organization, and the social capital between their organizations and other healthcare providers. CEOs of the listed healthcare providers in the database will receive an invitation if they provided a valid mail address.

The survey packets will include a one-page cover letter customized for each CEO by using their name and thanking their participation in advance. A self-addressed and return envelope for the paper-based questionnaire is also included in the packet. Furthermore, a web address for the online version will be offered in the instructions provided on the front of the

paper questionnaire. Due to budget limit, 2000 mails were sent out to collect data, 13 replies received.

The online questionnaire will be created on the survey website: Qualtrics. A unique identifier would be assigned to each survey packet so that the response from the CEO could be tracked if a CEO chose to use the online option for participating in the survey. This identifier will also be used to link the response with the secondary data obtained from the CMS. 4164 CEOs (including the participants that received mail invitation) were selected and 450 of them blocked the email. A reminder to was sent out every week in the first 4 weeks and then every other week in the next 8 weeks.

As to the incentive that might motivate the participation of CEOs, an executive summary of the results personalized to the CEO's organization will be provided at the end of the study. In total, 106 responses were collected which makes the response rate 2.85%. Table 3 shows the demographics of the respondents.

Table 3

Demographics of Respondents

Job Level		**Years with current organization**	
Senior Executive	102	<10	36
Upper Management	2	11-20	37
Middle Management	1	21-30	18
Other	1	30+	15
		Experience with current job	
		<10	41
Gender		11-20	31
Female	68	21-30	21
Male	38	30+	30

Data Analysis

The methodology concerning data analysis in this study started with the appropriate procedures for data preparation and screening. Data entry error or omission from respondents may cause missing data. Outliers can be values that appeared to be out of range or improperly coded. Also, data analysis requires specific distribution assumptions about the data, failing to meet these assumptions will cause bias in the result or even yield no result. Therefore, it is important to check the adequacy of data before any analysis.

The data will be organized into an Excel file to examine for missing data, outliers, and normality through descriptive statistics, frequency distributions, indexes of univariate skew and kurtosis. Missing data was replaced with the mean value of the variable as suggested by Hair and colleges (2009). There are nine missing values found in the survey data. In addition to these basic inspections, this study will use Mahalanobis' distance, a classic method to identify outliers in a multivariate point cluster (Rousseeuw & Van Zomeren, 1990), to check for outliers for the collected data.

Confirmatory factor analysis (CFA) using partial least squares (PLS) were used to check the validity (convergent and discriminant) and reliability of the measurement model. The validity of the construct indicates whether the developed items measure the construct as this research believes. Convergent validity means the identified items measure the same thing and is shown when each of the measurement items loads with a significant t-value on its latent construct (Gefen & Straub, 2005). On the other hand, discriminant validity, another facet of factorial validity, indicates the identified items measure different things. It can be demonstrated by comparing the square root of each Average Variance Extracted (AVE) for each latent construct with any correlation between any pair of latent constructs (Chin, 1998). As a rule of

thumb, it has been suggested that the former one should be over 0.50 and larger than the later one (Fornell & Larcker, 1981). Reliability indicates the overall consistency of the measurement and it is commonly reported by the Cronbach's Alpha. Typically, the measurement needs to report a score above 0.70 for internal consistency (Nunnally, 1978)

Hypotheses Tests

The literature suggests that the analysis of "fit" could be conducted in six aspects: 1) mediation, 2) moderation, 3) matching, 4) covariance, 5) gestalts, and 6) profile deviation (Venkatraman, 1989). Among these aspects, the analysis of covariance, profile deviation, and match requires a large sample size, considering the current sample size, mediation, moderation, and gestalts were used to analyze the model. Also, the hospital performance comes from CMS database, after merging the survey data with the CMS database, 45 matches found. The relationship between operational capability and performance will not impact the other relationships tested in this test because it only relates to the outcome of the "fit" between IPR and IPC. Thus, the test of the relationship between operational capability and performance (hypotheses 2) involves only 45 sample. The survey will continue and once matches between two databases over 100, another round of data analysis will ne conducted to update the results.

Fit as Mediation

Mediation means that another variable intervenes the impact of independent variable on the dependent variable. This approcach processes fit as indirect effect; the mediator accounts for a significant proportion of the relationship between the predictor and dependent variable (Venkatraman, 1989). In this research, it means that the impact of IPR on hospitals operational capability is intervened by IPC (Figure 6), which breaks the hypothesis 1 into three subset ones:

H1a: IPR will have a negative impact on operational capability.

H1b: IPR will have a positive impact on IPC.

H1c: IPC will have a positive impact on operational capability.

Also, because we have four indicators for the hospital performance, the hypothesis between operational capability and performance is also tested with four subset ones:

H2a: Higher operational capability reduces the average patient days in the hospital.

H2b: Higher operational capability reduces the mortality rate.

H2c: Higher operational capability reduces the operational cost.

H2d: Higher operational capability increases the ROA.

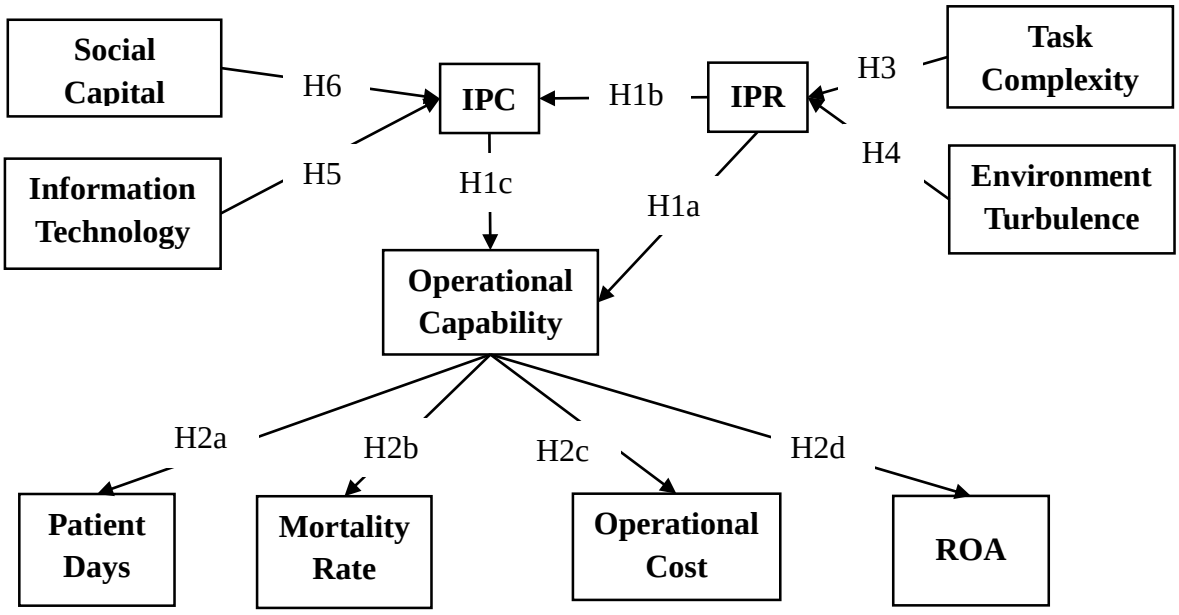


Figure 6. Fit as Mediation

The rest of the research model remain same, and the test of this mediation model is suggested with a path-analytic framework (Venkatraman, 1989). PLS was used to analyze the path model because it can handle smaller sample sizes. Compared with structural equation modeling (SEM) that will be impacted by the non-normality of the data, PLS will not make any underlying assumptions about the distribution of the data. Also, PLS allows for the use of true moderation variables modeled as interaction terms (Chin, Marcolin, & Newsted, 2003). Thus, PLS is suitable for the analysis of the mediation model and hypothesized relationships.

Fit as Moderation

From moderation aspect, fit means that the outcome variable is impacted by the interaction between the two fit variables (Figure 7). Literature suggests that it is a common aspect to conceptualize a contingency theory model. Therefore, the fit between IPR and IPC and their relationship with hospital's operational capability can be expressed as follow: the impact of IPR on hospital delivery networks' operational capabilities is dependent on IPC. According to this aspect, the test of H1 is broken down to three sub-hypotheses as follow, and the rest hypotheses will be the same as the mediation model:

H1a: IPC will have a positive impact on operational capability.

H1b: IPR will have a negative impact on operational capability.

*H1c: The interaction between IPC*IPR will have an impact on operational capability.*

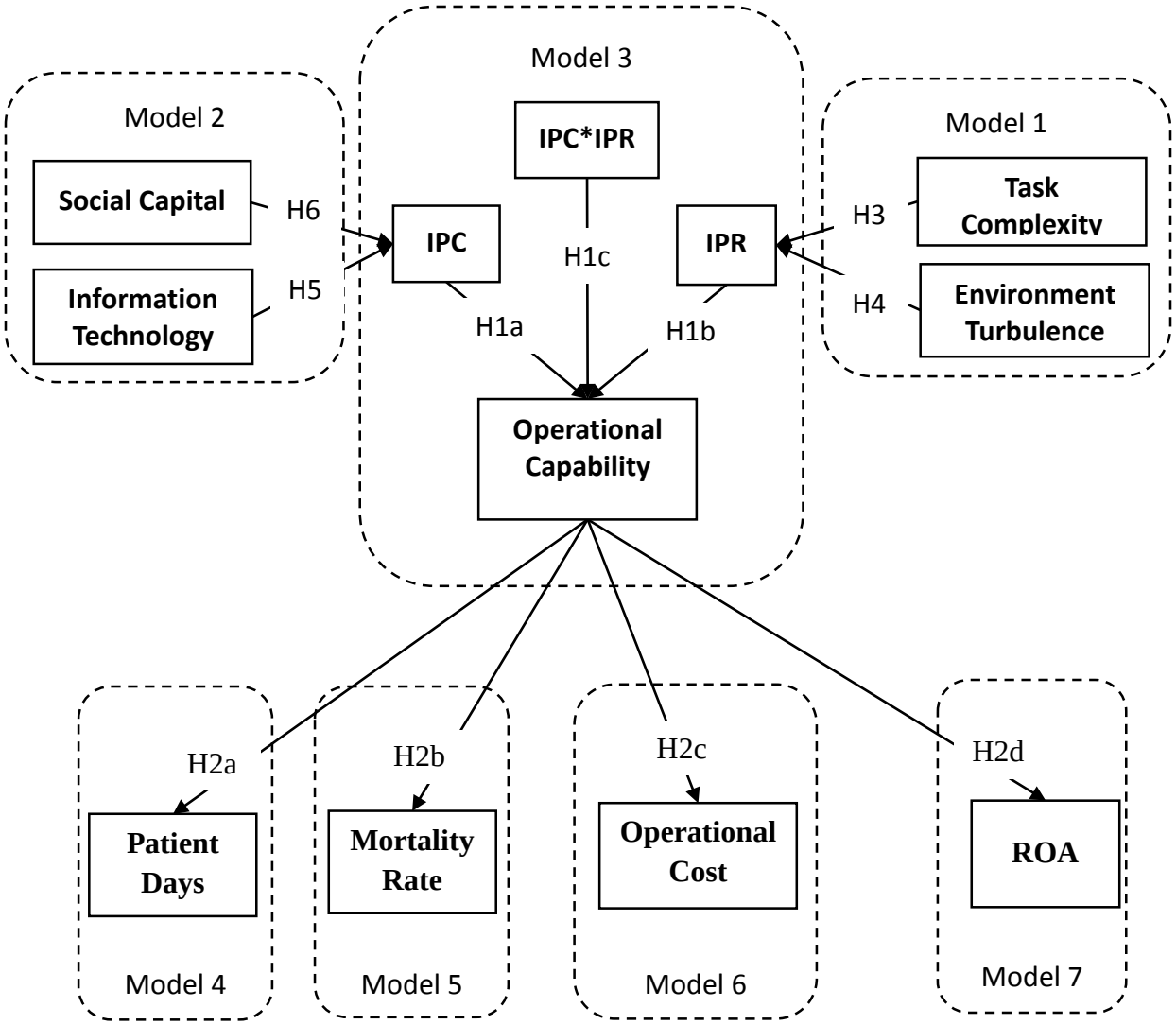


Figure 7. Fit as Moderation

This conceptualization will not change other relationships in the model therefore the rest hypotheses remain unchanged. The suggested test method for moderation is regressions. A seemingly unrelated regressions (SUR) model is used to test the overall research model. SUR is suitable in this situation because the model has a series of dependent variables regressed on the same set of independent variables using the same dataset (Knott, 2001). In such situation, the error of each regression system is correlated with each other which makes the ordinary least

squares regressions (OLS) less fit compared with SUR because SUR considers the correlation structure across the error terms. Breusch-Pagan tests were conducted to check whether SUR approach was more efficient than estimating separate OLS equations (Knott, 2001).

Fit as Gestalts

When conceptualizing fit as gestalts, the literature suggests following Miller's work (1981) and consider fit as a pattern. From this prospect, fit means "internal coherence of a set of variables" (Venkatraman, 1989, p. 432). The goal is to find "recurring clusters of attributes or gestalts" (Miller, 1981, p. 5). Such gestalts could reveal different feasible sets of internally consistent and equally effective configurations, which provide an in-depth understanding of the fit concept. Accordingly, when analyzing fit from gestalts prospect, the linear association is not examined. Taxonomic method, such as cluster analysis, is suggested to discovery the configuration between IPR and IPC. Therefore, the formation of hypothesis 1 remain the same. Hypotheses 2 to 6 described linear relationship between variables therefore they were not tested with this method.

To perform the cluster analysis, this study adopted both hierarchical and non-hierarchical cluster procedures (Flynn et al., 2010; Zhao et al., 2006, Ketchen & Shook, 1996). The hierarchical procedure identifies the number of clusters and generates the final cluster centroids to be used as cluster seeds in the non-hierarchical procedures and create clusters (Hair et al., 2009). This research followed Bensaou and Venkatraman's (1995) recommendations for hierarchical cluster analyses: 1) I standardize the aggregate score for each variables used in the analysis, 2) squared Eclidean distance were used as similarity measure, and (3) Ward's minimum variance method was used for cluster formation. To determine the cluster number, the heterogeneity change of different cluster solution was examined. The cluster solution with the highest percentage increase in agglomeration coefficient indicates the best solution. In the second stage of non-hierarchical cluster analysis, K-means method is used to generate various clustering solutions and compare their cubic cluster criteria (CCC), which

is a direct measure of heterogeneity of each cluster solution (Hair et al., 2009). The cluster solution with highest CCC is the best.

Configuration of IT Application and Social Capital

Other than understanding the configuration between IPC and IPR in resulting different operational capabilities, another round of cluster analysis was performed to provide in-depth understanding of the relationship between IT, social capital and IPC. This additional analysis complement this research by offering additional information to research question 2 and 3, which focused on finding relationships between IT application and social capital with inter-firm dynamic capabilities. The analysis followed the same procedure as the analysis for fit as gestalts.

Chapter 4. Results

This Chapter presents the analysis results of the research data. It starts with the data preparation and analysis results are presented according to each statistical model. And finally the hypotheses test result were compared across the different analysis.

Data preparation

As explained in Chapter 3, the methodology concerning data analysis in this study started with the appropriate procedures for data preparation and screening. Nine missing values found in the survey data and they were replaced with the mean value of the variable as suggested by Hair and colleges (2009). SAS JMP was used to generate the Mahalanobis' distance scores, and seven outliers were detected. After the inspection, the respondents of these seven cases spent very short time answering the survey compared with rest of the respondents, thus we take out these seven case from the sample and the data that available for analysis is 99.

Confirmatory factor analysis (CFA) using partial least squares (PLS) were used to check the reliability of the measurement model and validity (convergent and discriminant) described in Chapter 3. As showed in Table 4, all cronbach's alphas are larger than 0.7. Although the AVE values of task complexity, IPR and IPC are slightly lower than 0.5, they are very close and larger than the correlation between the pair of latent constructs. This could be because of the sample size. As the data collection goes on, another round of discriminant validity examination will be performed. Convergent validity is shown when each of the measurement items loads with a significant t-value on its latent construct (Gefen & Straub, 2005). Table 5 shows that all the item loadings are larger than 0.45 at a significant level of 0.05, which is suggested as the rule of thumb for a good convergent validity for measurement.

Table 4.

Descriptive Statistics, Discriminant Validity, and Reliability Test Results

Construct	Mean	SD	Conbach's α	AVE	ET	TC	IPR	IT	IPC	SC
Environmental Turbulence (ET)	4.182	0.049	0.783	0.724	1.000					
Task Complexity (TC)	3.824	0.052	0.897	0.492	0.296	1.000				
Information Processing Requirement (IPR)	3.766	0.049	0.711	0.481	0.112	0.478	1.000			
IT Application (IT)	3.362	0.066	0.864	0.556	-0.081	0.090	0.173	1.000		
Information Processing Capacity (IPC)	3.343	0.046	0.757	0.491	0.067	0.004	0.009	0.327	1.000	
Social Capital (SC)	3.520	0.049	0.856	0.582	0.017	-0.118	-0.072	0.215	0.649	1.000
Operational Capability (OC)	3.555	0.048	0.715	0.533	0.024	0.024	-0.109	0.267	0.435	0.343

Table 5

Factor Loading Table

	ET	TC	IPR	IT	IPC	OC	SC
ET1	0.815**						
ET2	0.672**						
ET3	0.781**						
TC1		0.711**					
TC2		0.593**					
TC3		0.702***					
IPR1			0.77***				
IPR2			0.566**				
IPR3			0.565**				
IPR4			0.616**				
IT1				0.791**			
IT2				0.822**			
IT3				0.467**			
IT4				0.754**			
IT5				0.652***			
IT6				0.577**			
IT7				0.686***			
IPC1					0.629**		
IPC2					0.681**		
IPC3					0.621***		
IPC4					0.656***		
IPC5					0.623**		
IPC6					0.672**		
IPC7					0.482**		
IPC8					0.503***		
IPC9					0.613**		
IPC10					0.648***		
IPC11					0.708**		
IPC12					0.718***		
IPC13					0.607**		
IPC14					0.65**		
OC1						0.739***	
OC2						0.723**	
OC3						0.647**	
OC4						0.643**	
OC5						0.479**	
SC1							0.575**
SC2							0.611**
SC3							0.772**
SC4							0.753**

SC5							0.783**
SC6							0.655**
*p<0.1, **p<0.05, ***p<0.01							

Hypotheses Tests

Fit as Mediation

Smart PLS 3.0 was used to analyze the model. Tough the sample size was small, it still met the generally accepted requirement for PLS of at least 10 observations for each predictor in the most complex relationship (Higgins, and Thompson 1995; Chin, 1998, Barclay). Table 6 presents the summary result of hypotheses tests when IPC is considered as a mediator between IPR and operational capability. Figure 8 presents the result in the form of relationship model. Hypotheses 1a to 1c addressed the "fit as mediation" between IPR and IPC, as well as its impact on operational capabilities. Only hypothesis 1c was found significant, therefore the result did not support the hypothesis of fit between IPR and IPC.

Hypotheses 2a to 2d investigate the impact of healthcare delivery network's operational capabilities on hospitals' healthcare service quality and financial performance. Hypothesis 2c and 2d were found significant, which demonstrate a significant relationship between operational capabilities and financial performance. No significant relationship were found between operational capabilities and quality performance.

Addressing the antecedents of IPR, Hypotheses 3 and 4 concerned the impact of environmental turbulence and task complexity of the healthcare delivery network on IPR. The task complexity was found significantly related to the IPR. Support was not demonstrated for a significant relationship between environmental turbulence and IPR.

Hypotheses 5 and 6 tested the idea of possible relationship between IT implemented in the healthcare delivery network, social capital among healthcare providers in the network and the IPC. Positive relationships were found with these two hypotheses, which means that IT and social capital will contribute to the development of IPC.

Table 6

Hypotheses Test results for Mediation Model

Hypotheses	**Relationships**	**Coefficients**	**Results**
H1a	IPR=>OC	-0.223	Not Supported
H1b	IPR=>IPC	0.003	Not Supported
H1c	IPC=>OC	0.535***	Supported
H2a (N=45)	OC=>Patient Days	- 0.117	Not Supported
H2b(N=45)	OC=>Mortality Rate	- 0.182	Not Supported
H2c(N=45)	OC=>Operational Cost	- 0.144**	Supported
H2d(N=45)	OC=>ROA	0.185*	Supported
H3	TC=>IPR	0.522***	Supported
H4	ET=>IPR	0.113	Not Supported
H5	IT=>IPC	0.291***	Supported
H6	SC=>IPC	0.627***	Supported
*p<0.1, **p<0.05, ***p<0.01			

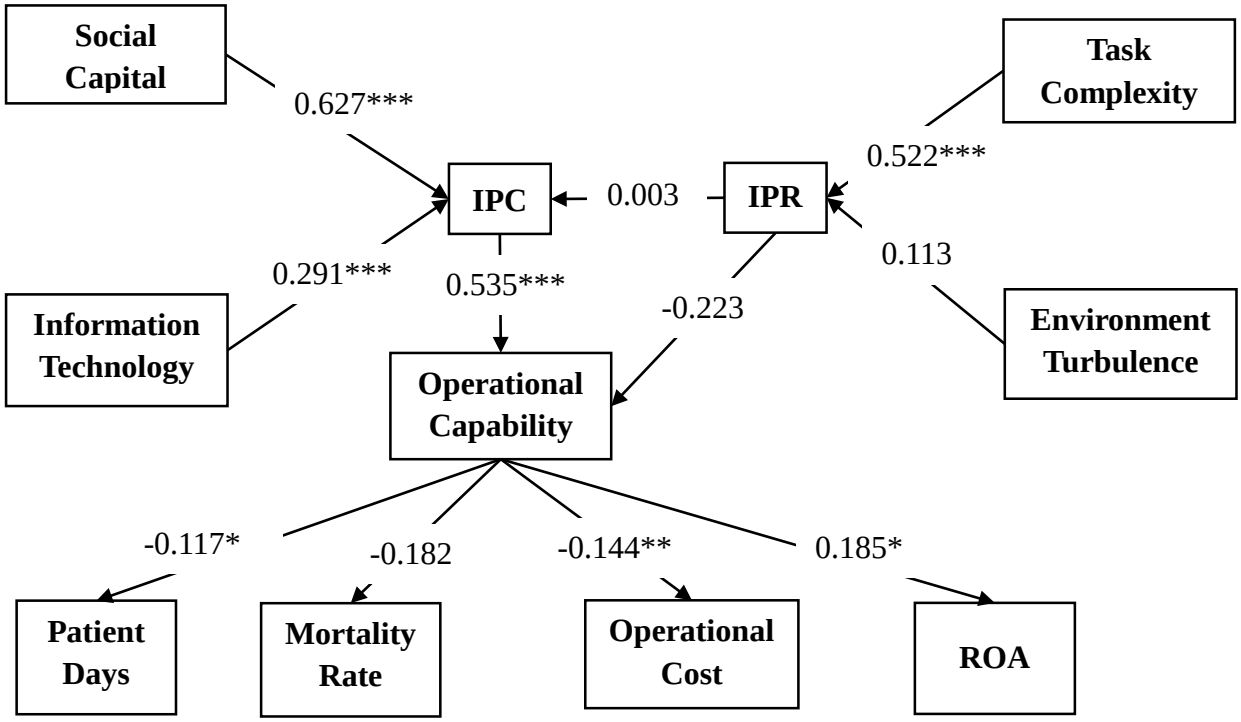


Figure 8. Fit as Mediation

Fit as Moderation

Stata 14.0 is used to run the SUR to test the moderation model. Table 8 presents the hypotheses test result when considering the interaction between IPR and IPC. And Figure 9 illustrate the result in the relationship model. The Breusch-Pagan tests (Table 7) used to compare all OLS regression models step by step, producing all significant results, which means it is appropriate to use the SUR approach to testing the moderation model. Because the regression of model 4 to 7 only use a subset of the sample, they were not compared with the rest OLS models.

Hypotheses 1a to 1c express the idea of fit between IPR and IPC as moderation. Mediation was not found because only hypothesis 1c, which addresses the relationship between IPC and operational capabilities, was supported. The rest hypotheses test yielded the same results as the tests for fit as mediation.

Table 7

Breush-Pagan Test Result

Breusch-Pagan Test	**Chi-square**
Model 1 vs. 2	8.15**
Model 1 vs. 2 vs. 3	6.32**
Model 4 vs. 5 vs. 6 vs. 7	31.61***

Table 8

Hypotheses Test Result for Moderation Model

Hypotheses	**Relationships**	**Coefficients**	**Results**
Model 1			
H3	TC=>IPR	0.503***	Supported
H4	ET=>IPR	0.111	Not Supported
Model 2			
H5	IT=>IPC	0.162**	Supported
H6	SC=>IPC	0.689***	Supported
Model 3			
H1a	IPC=>OC	2.068**	Supported
H1b	IPR=>OC	-1.234	Not Supported
H1c	IPC*IPR=>OC	-0.410	Not Supported
Model 4 (n=45)			
H2a	OC=>Patient Days	-0.511	Not Supported
Model 5 (n=45)			
H2b	OC=>Mortality Rate	-0.86	Not Supported
Model 6 (n=45)			
H2c	OC=>Operational Cost	-0.279**	Supported
Model 7(n=45)			
H2d	OC=>ROA	0.317*	Supported

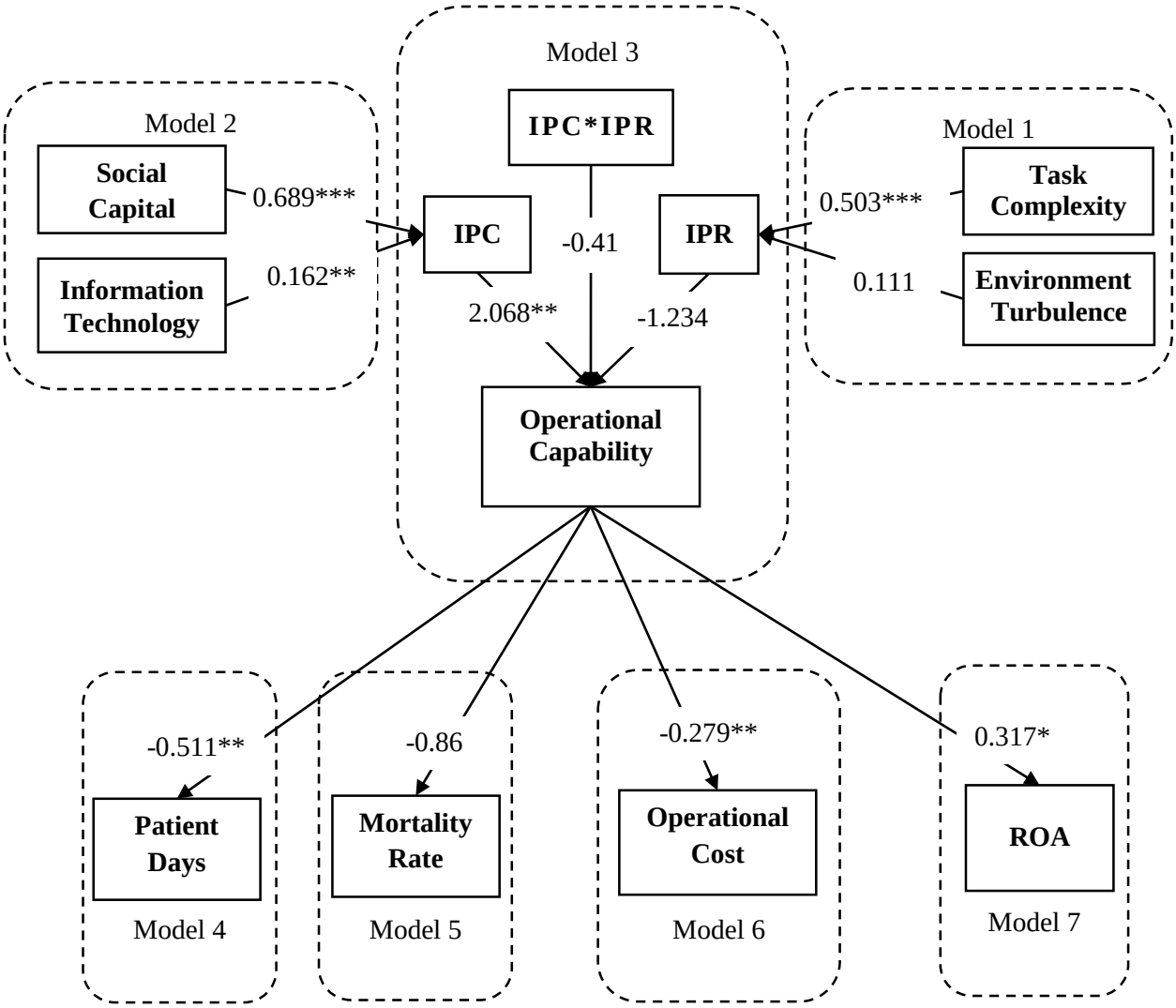


Figure 9. Fit as Moderation

Fit as Gestalts

SAS JMP 11 was used to perform the cluster analysis. For better interpretation of the result, all data was standardized. The hierarchical and nonhierarchical procedure described in Chapter 3 was followed to perform the cluster analysis and yielded consistent result as showed in Table 9. The change in agglomeration coefficient peaked at a three-cluster solution so as the CCC index, which meant that the three-cluster solution offered the highest heterogeneity across groups. Thus, this solution was retained for further analysis.

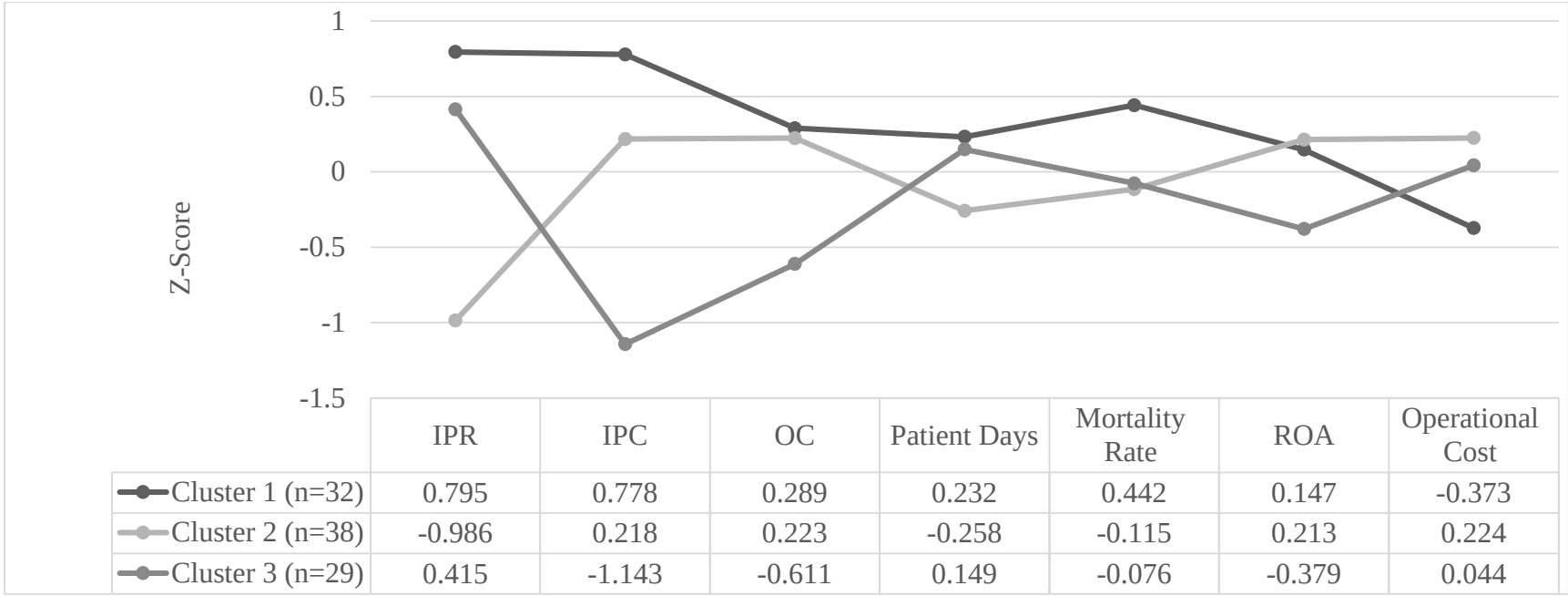
Table 9

Cluster Solution and Heterogeneity Test

N. of Clusters	Agglomeration Coefficient	% Change in Coefficient	CCC
2	7.368	0.018	-2.008
3	**4.658**	**0.368**	**-1.820**
4	3.901	0.162	-4.151
5	2.801	0.282	-3.326

Figure 10 presents the parallel comparison of the three clusters regarding their average IPC, IPR, operational capabilities, and performance. Hospitals in the first cluster (n=32) demonstrated a high level of both high IPR and IPC. Hospitals in the second cluster (n=38) exhibited a low IPR and a high IPC. Hospitals in the third cluster (n=29) showed a high IPR with a low IPC. Cluster 1 represented a balance between IPR and IPC while cluster 2&3 indicated a misalignment between IPR and IPC.

Hospitals in both cluster 1 and 2 had high operational capabilities, however, hospitals in cluster 1 had high patient days, mortality rates, ROA and low operational cost (n=14) whereas hospitals in cluster 2 had low patient days, slightly below average mortality rate, high ROA and operational cost (n=16). Hospitals in cluster 3 (n=15), with low operational capabilities, had high patient days, slightly below average mortality rate, low ROA and slightly above average operational cost. This pattern supported the hypotheses that only a fit between IPR and IPC will lead to the optimal operational capabilities.



	IPR	IPC	OC	Patient Days	Mortality Rate	ROA	Operational Cost
Cluster 1 (n=32)	0.795	0.778	0.289	0.232	0.442	0.147	-0.373
Cluster 2 (n=38)	-0.986	0.218	0.223	-0.258	-0.115	0.213	0.224
Cluster 3 (n=29)	0.415	-1.143	-0.611	0.149	-0.076	-0.379	0.044

Figure 10. Comparison of Three Clusters

Configuration of IT Application and Social Capital

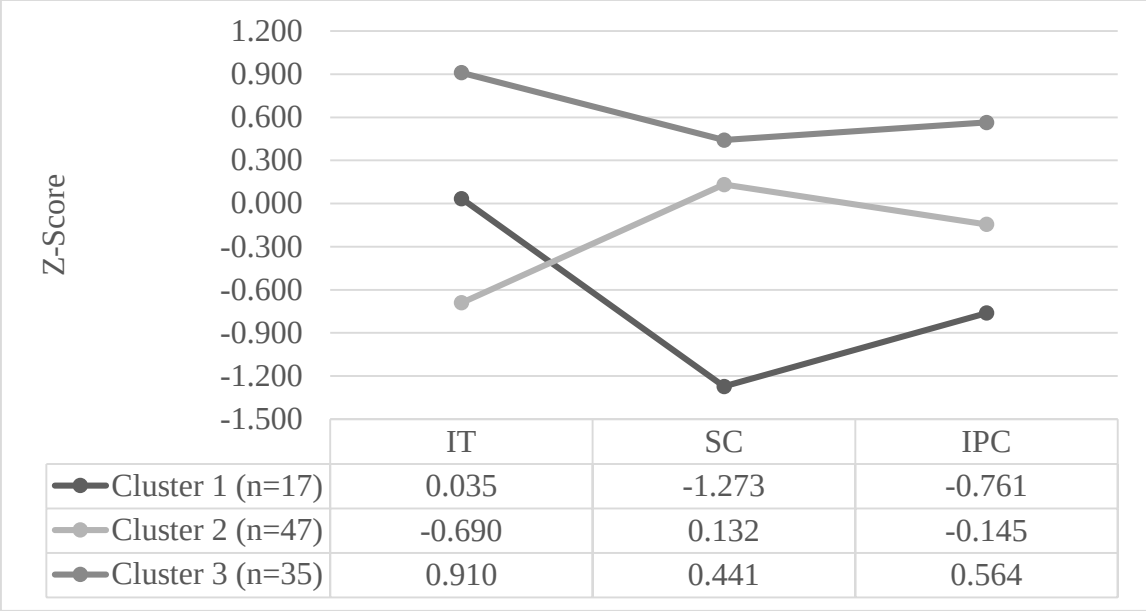
SAS JMP was also used to perform the cluster analysis with the same procedure as the analysis for fit as gestalts. The hierarchical cluster analysis yielded a three-cluster solution and the CCC from non-hierarchical cluster procedure confirms this result (Table 10). According to this the heterogeneity test, the CCC index and percent change in agglomeration coefficient peaks at a three-cluster solution, thus it is retained for further analysis.

Table 10

Cluster Solution and Heterogeneity Test

N. of Clusters	**Agglomeration Coefficient**	**% Change in Coefficient**	**CCC**
2	8.490	0.180	-4.828
3	**6.222**	**0.267**	**-4.353**
4	5.694	0.085	-7.468
5	4.582	0.195	-7.775

Figure 11 laid out the parallel comparison of IT application implemented, social capital, and IPC across three clusters. Hospitals in cluster 1 (n=17) with average IT application implementation and low social capital had low IPC. Hospitals in cluster 2 (n=47) with low IT application implementation and slightly above average social capital had IPC slightly lower than average. Hospitals in cluster 3 (n=47) with high IT application implementation and high social capital had high IPC. This finding confirms the hypotheses that IT and social capital has a positive impact on firms IPC.



	IT	SC	IPC
Cluster 1 (n=17)	0.035	-1.273	-0.761
Cluster 2 (n=47)	-0.690	0.132	-0.145
Cluster 3 (n=35)	0.910	0.441	0.564

Figure 11. Comparison of Three Clusters

Chapter 5. Discussion

This Chapter examines the findings of the data analysis, as presented in Chapter 4, and offers additional discussion regarding these results. Implications of the research for both literature and practitioners are presented. The chapter concludes with limitations of the study and an agenda for future research.

Findings of the Four Analysis

Comparison of the three Test of Fit and the Outcome

Hypotheses 1 and 2 address the fit between IPR and IPC, and its outcome. The link between IPR-IPC fit to operational capabilities was found by moderation and mediation analysis. These two analysis only revealed that IPC has a positive impact on operational capabilities, and such operational capabilities have a positive impact on hospitals' financial performance. This is consistent with other research (both firm and interfirm level) that dynamic capabilities are higher order capabilities and have an indirect impact on firms' performance via operational capabilities.

The analysis of fit as gestalts supports the relationship between IPR-IPC fit to operational capabilities. The three clusters found with cluster analysis indicates that only hospitals with both high levels of IPR and IPC had high IPC and better financial performance (low operational cost and high ROA) than average. Although hospitals with high IPC and low IPR had similar operational capabilities, their financial performance was lower than the first cluster (high ROA and high operational cost). Hospitals with low IPC and high IPR had low operational capabilities and lowest financial performance (low ROA and high operational cost). This finding

confirms the earlier argument in Chapter 2 that when IPC and IPR are not fit, firms either overly spend their resources in generating unnecessary IPC or suffer from the deficiency of IPC. The study did not find the link between the operational capabilities of healthcare delivery network and hospitals quality performance (patient days and mortality rates). This could be because the quality performance are impacted by many other factors other than the operational capabilities, such as the doctor expertise and patient sickness level.

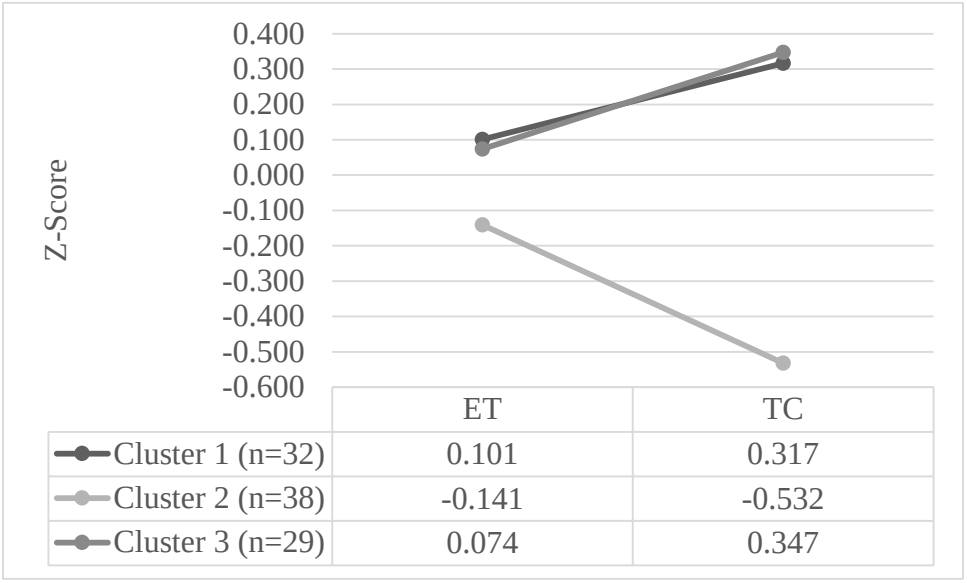
The different findings from these three fit approaches reinforced Venkatraman's (1989) and Bergeron and colleagues' (2001) argument that different methods of analysis of fit tend to result in different finds, thus it is important to specify the exact perspective of fit used in the study and obtain theoretical support for the choice.

Impact of IT and Social Capital on IPC

Hypotheses 5 and 6 were established to test the impact of IT and social capital on IPC, and they were supported by the mediation and moderation analysis. This means that there is a significant positive linkage from the IT implemented in the hospitals and social capital among hospitals in the network to IPC. The cluster analysis investigated the configurations between IT and social capital and different operational capabilities each configuration results. The finding show that social capital has a stronger impact on IPC at interfirm level compared with IT. Hospitals with low social capital with other partners in the healthcare delivery network had the lowest IPC even though they had an above average IT application implemented. On the other side, hospitals with higher social capital regardless their low IT implementation still manage to maintain an above average IPC.

Impact of Task Complexity and Environmental Turbulence on IPR

Hypotheses 3 and 4 address the impact of and task complexity and environmental turbulence on IPR. Only hypotheses 4 (task complexity) was supported, and this finding was consistent with the result of both mediation and moderation analysis. It means that with more complicated tasks, hospitals need more information and effort to make decisions, thus the IPR is higher. The relationship between environmental turbulence and IPR was not found significant. Part of the reason could be because all hospitals are in the same industry, which makes the variation of the environmental turbulence low. With a relative small sample size, it is difficult to detect small deviations. A little investigate was conducted to confirm this argument by examine the average z-score of environmental turbulence and task complexity according to the three clusters yielded by analysis of fit as gestalts. It is clear that the environmental turbulence for hospitals in three clusters were all close to the average whereas the task complexity showed a distinct difference in two directions.



	ET	TC
Cluster 1 (n=32)	0.101	0.317
Cluster 2 (n=38)	-0.141	-0.532
Cluster 3 (n=29)	0.074	0.347

Figure 12. Comparison of Environmental Turbulence and Task Complexity

Implications

Academic Implication

Literature of IPV. This research extends the application of IPV by overlapping it with dynamic capabilities. The result suggests that IPC can be considered as a form of dynamic capabilities by improving the decision-making. The result also confirms that at interfirm level, IT and the lateral relationship could improve the IPC of a supply chain, like the findings previous literature obtained at the firm level and group level. Furthermore, this research extends the approach to generate lateral relationship. In this research, the impact of social capital, an informal lateral relationship, on IPC was examined. Previous literature only suggests the creation of formal lateral relationships such as cross-functional teams and liaison could improve the IPC. The results of this research suggest that at the interfirm level, social capital (trust and network connections) has higher weight than IT in improving the supply chain's IPC.

Literature of dynamic capabilities. This research assessed firms' dynamic capabilities from the prospect of IPV instead of the traditional RBV. This different theory grounding reveals the importance of dynamic capabilities from a new angle. Also, the research identifies five dimensions of dynamic capabilities at the interfirm level from the literature to form the IPC of a supply chain and empirically test the construct by applying it to the healthcare delivery network. The result indicates that such formation of interfirm dynamic capabilities improves the hospitals' financial performance (operational cost and ROA) by impacting the network's operational capabilities.

Literature of IT business value in healthcare. This research aims to respond to the call of exploring IT business value by investigating the impact of IT with EDA on IPC at the

interfirm level. The research summarized the function of IT with EDA from the Boyd's OODA loop and classified the IT applications into two category: sensing IT and responding IT. These two IT application were then connected to interfirm dynamic capabilities. The result shows that at interfirm level, IT could help firms co-create operational capabilities via the development of interfirm dynamic capabilities.

Literature of social capital. Social capital has been applied in various research as stated in Chapter 2. This research extends its application to the study of interfirm dynamic capabilities from the aspect of IPV. The finding highlights the importance of social capital in improving the dynamic capabilities in a supply chain.

Practical Implication

From early 1990's, hospitals have actively formed healthcare delivery network to improve their operation and service quality. Therefore, it is important that they develop a dynamic network to adjust to the rapid changes in the market. This research investigate the factors impact the process. The research suggests the importance of evaluating the IPR hospitals facing and developing the interfirm dynamic capabilities accordingly in order to result in better financial performance. If hospitals develop dynamic capabilities over the required level, it will increase their operational cost instead of reduce it.

In order to evaluate the IPR, managers should look at the turbulence of the market, such as changes in technology and patient need, and the complexity of their tasks, for example, the interdependence of the tasks and vagueness of the problem they encountered. In order to create the correct level of interfirm dynamic capabilities for a healthcare delivery network, managers can start from 1) the ability to detect changes in the environment, such as the frequency of

scanning the environment and sharing information with partner and checking with patients to understand their needs; 2) the ability to assess the knowledge from partners and learn from them; 3) the ability to develop a collective mind, such as sharing risk and rewards, interrelating actions and developing global prospect of tasks and responsibilities with partners; 4) the ability to coordinate activities, such as the setup of cross-firm teams, synchronization of information, and resources allocation; 5) the ability to help partners grow, such as monitoring and communicating their performance and sharing resources. If managers want to improve these interfirm dynamic capabilities of the healthcare delivery network, managers should consider implementing IT applications with EDA and establishing good relationships with their partners. And out of these two options, social capital holds a heavier weight in improving the dynamic capabilities, simply improving the IT application is not enough at the interfirm level.

Limitations and Future Study

This study has presented and empirically test a model of fit between IPR and IPC, and their antecedents as well as outcomes at interfirm level. In turn, support has been demonstrated for significant financial performance benefits as a result of achieving fit. IT with EDA and social capital are two drivers for better IPC. In addition, the cluster analysis revealed that social capital has a heavier weigh on improving the IPC compared with IT. The model and associated results should serve as a foundation for future studies regarding dynamic capabilities, IT business value and social capital at interfirm level.

As with any research project or study, this research comes with its own limitation. First, the model was developed for dynamic supply chain development but only applied to part of the supply chain of one single industry: healthcare. This generates the concern of making a

generalized statement of the model. The next step of this research is to collect additional data from other industry and empirically test the model in various industries.

Second, the study employed only one year of financial and operational data. Although it is a common practice, studies have suggested that use of up to three years of data following the survey may be more effective in revealing the benefit of IT. In addition, research suggests that social capital changes over time, survey data can only capture a snap shot of the situation. Considering these two limitations, future research is suggested to using longitudinal data for both independent and dependent variables to provide a more complete, detail view of the relationship between IT, social capital, and interfirm dynamic capabilities.

Third, this study only considered one type of IT (EDA) implemented in the supply chain, researchers could consider expanding the model by examining other type IT, such as cloud based application. Research also could investigate the IT impact from other aspects such as the level of actual IT utilization or the IT management. Additionally, IT has been suggested as a way to creating new business capabilities (Kohli & Grover, 2008), therefore, it will be worth to have in-depth investigation of the relationships between various types of IT and individual dimension of interfirm dynamic capabilities and the possible benefit associated with them.

A fourth limitation regards the statistical power of the data analysis. The limited time and budget as well as the difficulty of motivating CEOs to fill out the survey result a small sample for data analysis. Given the small sample size and the number of constructs in the model, such situation may impact the analysis of scale measurement (the slightly low AVE value of task complexity, IPR, and IPC) and the possibility of Type II error exists. The relationship between environment turbulence and IPR, the relationship between operational capabilities and hospital

quality performance were not supported; this could be because of the small sample size. Furthermore, the link between operational capabilities and performance was tested with only 45 data because of the merge of the survey and archival data. Although the use of subset sample for the outcome hypothesis testing does not impact the test of other hypotheses, it weakened the test result. Future studies could overcome this concern by using a larger sample size.

Furthermore, this study employed quality and financial performance benefits as a result of achieving the fit between IPR and IPC at interfirm. The quality performance was measured by patient days and mortality rates, and the financial performance was measured by operational cost and ROA. No significant result were found for the two quality performances. Further study could consider other measurements for quality performance, such as patient readmission rate.

Conclusion

As supply chains in many industries experience rapid changes in the business environment, firms continue to improve the dynamism of the supply chain in order to response to those changes efficiently and effectively. Dynamic capabilities are suggested reflects such dynamism in the supply chain and IT could facilitate this process. Yet, few studies have been empirically conducted at the interfirm level to understand the impact of IT on dynamic capabilities improvement and the benefit associated with such improvement. Moreover, most studies involving dynamic capabilities are grounded in RBV; there is the need of approaching it from other aspects.

In response to the calls for research at the interfirm level of dynamic capabilities and IT business value co-creation, this research adopts IPV and proposes that IPC of a supply chain is a format of interfirm dynamic capabilities and the fit between IPC and IPR will improve the

operational capabilities and eventually improve the performance of a supply chain. Building upon IPV literature which suggests IT and lateral relationships are two drivers of IPC, this research proposes that IT with EDA and social capital as the two antecedent for IPC. A model presents these propositions were formed and empirically tested by applying to the healthcare delivery network. The finding confirmed these three proposition and laid as a groundwork upon which to build and extend interfirm dynamic capabilities and IT business co-creation research. The finding also offers valuable practical suggestions for managers in the healthcare industry.

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Appendix 1. Summary of Measurement

Environmental Turbulence	
ET1	The technology in our organization is changing rapidly.
ET2	Technological breakthroughs provide big opportunities for our organization.
ET3	The environment in our hospital is continuously changing and difficult to forecast.
Task Complexity	
TC1	We frequently deal with ad hoc, non-routine problems with our healthcare partners.
TC2	Frequently, we may decide to restate the problem and access slightly different information than we had at first planned.
TC3	The business problems we deal with frequently involve more than one organization group.
Information Processing Requirement	
IL1	Frequently, our need for information arises on an irregular schedule and is not predictable in advance.
IL2	There is a great deal of varieties in the problems, issues, or questions for which we need information in the work.
IL3	Frequently, it is necessary to spend a fair amount of time figuring out how to address a problem before we begin an analysis.
IL4	Frequently, after we check the available information, we change the view of the problem and the need of additional information.
IT Application	
Sensing IT	
SE1	The IT in our firm capture information from different sources (e.g. departments, partners) and make it accessible to relevant people in real-time.
SE2	The IT in our firm captures the key performance indicators of the business processes with partners in real time.
SE3	The IT in our firm organizes and display data graphically.
Responding IT	
RE1	The IT in our firm stores knowledge and make it accessible to the employees to complete work tasks.
RE2	The IT in our firm allows us to perform different analysis to support decisions making.
RE3	The IT in our firm helps to monitor and to control the business processes to support action taking.
RE4	The IT in our firm supports the workflow across the firms.
Social Capital	
Network Tie	
NT1	In general, I have a very good social relationship with my partners' members.

NT2	I always hold a lengthy conversation with my partners' members.
NT3	In general, I am very close to my partners' members.
Trust	
TR1	We can rely on our partner.
TR2	We trust that our partner's decision will be beneficial to the network.
TR3	In general, our partners will always keep the promises they make to you.
Information Processing Capacity	
Coordination Capabilities	
CC1	We setup cross-firm teams with our healthcare partners to ensure collaboration.
CC2	We ensure that the output of our work is synchronized with the work of our healthcare partners.
CC3	We ensure an appropriate allocation of resources (e.g., information, time, reports) with our external healthcare partners.
Sensing Capability	
SC1	We frequently scan the environment to identify new business opportunities and share the relevant part with our partners.
SC2	We periodically examine the likely effect of changes in our business environment on patients together with our partners.
SC3	We often check our services to ensure they are in line with what the patients want together with our partners.
Learning capability	
LC1	We learned new or important information from partners.
LC2	We learned or acquired new capability, as a result of the partnership.
LC3	Working with partners increase our contextual capabilities and knowledge.
Collective Mind	
CM1	Our partners and us have a global perspective of each other's' tasks and responsibilities.
CM2	Our partners and we carefully interrelate actions to each other to maximize joint performance.
CM3	We have a defined and accepted approach to sharing risks and rewards with other healthcare providers.
Partner Development	
PD1	My organization aggressively shares various resources to help partners improve their capabilities.
PD2	Partner performance is closely monitored.
PD3	Partner scorecards are used to communicate expectations for performance levels.
Operational Capabilities	
Coordinated Care Delivery Capability	
CD1	We execute a clinical guideline (what shall be done and by whom) for a specific patient group with the local/regional/national healthcare providers.
CD2	We setup coordinated work routines between other healthcare providers and us (chain of care).

CD3	We collaborate with different healthcare providers to pool resources together for required healthcare activities.
Information Sharing	
IS1	The healthcare providers in the network exchange timely, accurate, and complete information of the patient.
IS2	We exchange confidential information with other healthcare providers in the network.
IS3	Our partners and we keep each other informed of data changes but limited to those agreed for sharing.

Appendix 2. Information Letter

AUBURN
UNIVERSITY

RAYMOND J. HARBERT
COLLEGE OF BUSINESS
DEPARTMENT OF AVIATION & SUPPLY CHAIN MANAGEMENT

You are invited to participate in the survey for the research entitled "Understanding the Role of Social Capital and Information Technology in Creating a Dynamic Supply Chain." This research aims at finding out how an organization's social capital with its partners and the information technology application will affect the dynamism of the overall healthcare delivery network. This research is approved by Auburn University and is the basis for my Ph.D dissertation in Management Information Systems. Your participation is very valuable to the success of the research and the completion of my dissertation work at Auburn University.

You were chosen as a candidate because you are expected currently to work as the senior manager of a healthcare organization which is a member of the Healthcare Information and Management Systems Society (HIMSS). We obtain your contact information through HIMSS Analytics Database. The principal investigator of this study is Ms. Yun Wu, a Doctoral student, with the direction of Dr. Terry Byrd, who is a Bray professor from the Auburn University College of Business.

No personal information is collected, the information you provided can be only accessed by the researcher and faculty advisor. Also the data may be used to publish in academic journal, and/or present at a professional meeting. Because your participation is essential to my research, I would like to offer you a free executive summary of the result of this research-as a way of saying "Thank You" for your response. The summary will include the aggregates for all participating hospitals. To request your executive summary (in electronic form), simply list your preferred email address in the area indicated on your completed survey. Your email address will not be tied to you response to maintain the anonymity of the survey.

The participation is voluntary, if you change your mind about the participating, you can withdraw at any time by closing the webpage. If you decide to participate, you will be asked to answer questions about the organization you are currently working. The survey should take approximately 10-15 minutes to complete. You may choose your preference of two available response methods: (1) an online survey (the URL is showed at the bottom of this letter); or (2) the enclosed paper survey. If you are busy and cannot finish the survey, please ask another appropriate senior manager in your hospital to respond to the survey on your behalf.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334) 844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION ABOVE, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, PLEASE USE CHOOSE THE WAY YOU PREFER TO COMPLETE THE SURVEY.

YOU MAY PRINT A COPY OF THIS LETTER TO KEEP.

The Auburn University Institutional Review Board has approved this document for use from __12/02/2014_ to _04/22/2017_. Protocol #_14-155-EX1404__

Please use this link to fill out the online survey:
https://auburn.qualtrics.com/SE/?SID=SV_3e2sl8T6SY9c83X

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Appendix 3. Survey

Direction. *The following statement about your thought of the organization you are currently working for. For each item, indicate how well it describes the organization by choosing the appropriate response next to each item. The response to the item ranges from "Strongly Disagree" to "Strongly Agree". When you have decided on your answer, choose the appropriate number.*

Q1. **The technology in our hospital is changing rapidly.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q2. **Technological breakthroughs provide big opportunities for our hospital.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q3. **The environment in our hospital is continuously changing and difficult to forecast.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q4. **Our hospital frequently deals with ad hoc, non-routine problems with our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q5. **Frequently, we may decide to restate the problem and access slightly different information than we had at first planned.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q6. **The problems our hospital deals with frequently involve more than one organization group.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q7. **Frequently, our hospital's need for information arises on an irregular schedule and is not predictable in advance.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q8. **There is a great deal of varieties in the problems, issues, or questions for which we need information in the work.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q9. **Frequently, it is necessary to spend a fair amount of time figuring out how to address a problem before we begin an analysis.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q10. **Frequently, after we check the available information, we change the view of the problem and the need of additional information.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q11. **The IT in our hospital captures information from different sources (e.g. departments, partners) and makes it accessible to relevant people in real-time.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q12. **The IT in our hospital captures the key performance indicators of the business processes with partners in real time.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q13. **The IT in our hospital organizes and displays data graphically.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q14. **The IT in our hospital stores knowledge and makes it accessible to the employees to complete work tasks.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q15. **The IT in our hospital allows us to perform different analysis to support decisions making.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q16. **The IT in our hospital helps to monitor and to control the business processes to support action taking.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q17. **The IT in our hospital supports the workflow across the organization.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q18. **Our hospital executes a clinical guideline (what shall be done and by whom) for a specific patient group with the local/regional/national healthcare providers.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q19. **Our hospital sets up coordinated work routines between other healthcare providers and us (chain of care).**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q20. **Our hospital collaborates with different healthcare providers to pool resources together for required healthcare activities.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q21. **Our hospital exchanges timely, accurate, and complete information with our healthcare partners**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q22. **Our hospital exchanges confidential information with our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q23. **Our healthcare partners and us keep each other informed of data changes but limited to those agreed for sharing.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q24. In general, our hospital has a very good social relationship with our healthcare partners.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q25. Our hospital always holds a lengthy conversation with our healthcare partners.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q26. In general, our hospital is very close to our healthcare partners.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q27. Our hospital can rely on our partners.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q28. **Our hospital trusts that our partnesr' decision will be beneficial to the overall healthcare delivery network.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q29. **In general, our partners will always keep the promises they make to our hospital.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q30. **Our hospital sets up cross-firm teams with our healthcare partners to ensure collaboration.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q31. **Our hospital ensures that the output of our work is synchronized with the work of our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q32. **Our hospital ensures an appropriate allocation of resources (e.g., information, time, reports) with our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q33. **Our hospital frequently scans the environment to identify new business opportunities and shares the relevant part with our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q34. **Our hospital periodically examines the likely effect of changes in our business environment on patients together with our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q35. **Our hospital often checks our services to ensure that they are in line with what the patients want together with our healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

***Q36.* Our hospital learned new or important information from healthcare partners.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

***Q37.* Our hospital learned or acquired new capability, as a result of the partnership.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

***Q38.* Working with healthcare partners increase our hospital's contextual capabilities and knowledge.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

***Q39.* Our healthcare partners and us have a global perspective of each other's' tasks and responsibilities.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q40. **Our healthcare partners and us carefully interrelate actions to each other to maximize joint performance.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q41. **Our hospital has a defined and accepted approach to sharing risks and rewards with other healthcare providers.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q42. **Our hospital aggressively shares various resources to help our healthcare partners improve their capabilities.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q43. **Our healthcare partners' performance is closely monitored.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q44. **Our healthcare partner scorecards are used to communicate expectations for performance levels.**

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q46. **Gender**

- Male
- Female

Q47. **Your job title**

Q48. **Your job level**

- Senior Executive
- Upper Management
- Middle Management
- Other

Q49. **Your years with this hospital**

Q50. **Your years of experience in your current job**

Q51. **NOTE:** ***To request your copy of the executive summary of the results of this study, please provide a valid email address you prefer to receive the document:***