MANAGING THE FLOOD OF INFORMATION: THE ROLE OF INFORMATION PROCESSING IN CONTEMPORARY ORGANIZATIONS

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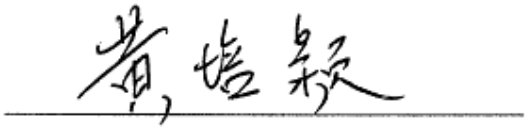
DECLARATION

I hereby declare that this thesis is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.



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SUMMARY

The rapid advancement of information technology (IT) over the past decades has brought about a dramatic increase of information, making the management of information a big challenge to contemporary organizations. As a result, in order to secure superior organizational performance in the information age, organizations should go beyond investing in IT assets to investing in information processing. This thesis is motivated to develop conceptual and theoretical frameworks to enhance our knowledge about organizational information processing. To achieve this goal, I attempt to study organizational information processing from three relevant research themes in the literature, namely information processing capability, information processing framework, and information processing strategy. Accordingly, three case studies were conducted.

The study of Haier Group focuses on the research theme of information processing capability. The company is the largest household appliance manufacturer in China. It is well-recognized for its responsiveness to market changes in the turbulent Chinese household appliance market. The company has developed strong information processing capability which allows it to achieve operational agility. The study shows that operational agility is achieved through the process of constructing IT-enabled information processing network and implementing organizational control. It identifies three types of information processing capability—information sensitivity, information synergy and information fluidity—that enable operational agility.

The study of Karta (pseudonym) centers on the research theme of information processing framework. The company is a leading Chinese Business-to-Consumer (B2C) company with over 40 million customers. It is proficient in processing customer information to generate a favorable online

shopping environment, which leads to successful customer attraction and retention. Three types of customer agility (i.e. reactive customer agility, proactive customer agility, and coactive customer agility) are identified from the case. It indicates that customer agility is achieved by developing information processing framework that is composed of information processing structure, information processing capability and information processing culture.

The study of Jeanswest and Haier focuses on the research theme of information processing strategy. Jeanswest is a multinational apparel chain store. Haier is a multinational household appliance manufacturer. The two companies applying different e-business strategies both achieve a great success in Chinese B2C market. The study shows that traditional organizations can achieve improved firm performance by aligning e-business strategy with information strategy during e-business transformation. Specifically, operational efficiency is achieved when the piggyback e-business strategy is aligned with the bridging information strategy, while e-business service innovation is enhanced when the stand-alone e-business strategy is aligned with the buffering information strategy. Furthermore, the study develops a process model to explain how information strategy is implemented for e-business transformation.

The findings from three studies make significant theoretical and practical contributions. In terms of theoretical contribution, it contributes to IS and information processing literature by addressing some important theoretical gaps and providing several explorative models. In terms of practical contributions, it stresses the significant role of information processing in organizational life and provides practical instructions for managers to improve the management of information.

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1. INTRODUCTION

1.1 Background and Motivation

This is an age featured by information explosion. The emergence and broad application of modern information technology (IT) have brought about a dramatic increase of information in every aspect of organizational life. On one hand, the amount of information soars with the adoption of enterprise systems within organizational boundary. The ERP systems not only lead to business process automation, but also generate a large amount of information about products, staff, and processes. On the other hand, the trend of information explosion reached a peak with the advance of Internet technology. E-commerce technology offers organizations with the privilege to access a vast amount of customer information. Furthermore, the emergence of Web 2.0 technology redefines the way how customers interact with organizations and gives birth to huge amounts of user generated contents. Thus contemporary organizations are flooded by massive information internally and externally.

As the amount of available information grows, the competence of information processing becomes critical to organizations. This is manifested in many real-world examples. Zara, one of the biggest clothing retailers in the world, successfully beats it competitors with the support of effective information processing, which allows a constant exchange of information throughout every part of the company's supply chain, and offers real-time information to support rapid decision making (Ferdows et al., 2004). Ebay.com, the most popular online auction website in United States, gains many innovative ideas by gathering and processing information shared by its customers in a virtual customer community (Sambamurthy et al., 2003). JD.com, one of the largest B2C platforms in China, collects and analyzes all kinds of customer

information to generate personalized recommendations to improve customers' shopping experience. These are all the real-world examples that point to the critical role of information processing. Just as the chief information officer of Wal-Mart said, "the driver of change has transitioned from technology to information. Technology at this point is simply a means to an end. What is really strategic is the use of the information and how we exploit and maximize it. We're in a business that competes at the speed of information, and my job is to ensure that we present it in such a way that we use it to drive execution and improvements in our business" (Mithas et al. 2011, p. 240).

Meanwhile, academic researchers also recognize the value of information processing and call for relevant research. Davenport (2006) argues that the capability to process information is critical for contemporary organizations. Marchand et al. (2000) describe information orientation, which refers to the capabilities to effectively manage and use information, as a key to the success of a company. A recent study conducted by Mithas et al. (2011) shows that information processing capability is crucial for building other firm capabilities for customer management, process management, and performance management. They further demonstrate the significance of information processing in improving firm performance. As noted by Kohli and Grover (2008, p. 32), "firms might possess good business capabilities, but to make a meaningful difference in operational excellence and competitive response, these capabilities can be enhanced not only by IT, but also by the ability to manage and exploit information to create information capabilities". They further point out the lack of research on the relationship between information processing and business capabilities and call for future research. Thus research on information processing will be valuable and fruitful. IS researchers should

take the lead in examining the role of IT in information processing and its implications to organizational performance.

1.2 Information Processing Research

Extensive literature review on information processing research reveals four research themes (see Table 1-1) in the literature. The first one concerns information processing capability. It is an organizational capability to collect, analyze and disseminate information (Mithas et al., 2011). This capability can be developed through interacting with a specific set of information technologies used by organizations. The second one concerns information processing structure. It refers to a set of technologies used to support various information processing activities (Kwon et al., 2007). It constitutes the basic artifact and foundation of information processing for contemporary organizations. The third one concerns information processing culture. It refers to a set of organizational cultures which root in information processing activities and will affect the effective use of information (Marchand et al., 2000). It helps predict the information processing behaviors of organizational members. The last one concerns information processing strategy. It refers to a subset of information processing mechanisms (such as the creation of lateral relations or the creation of self-contained tasks) that is implemented to reduce task uncertainty (Bode et al., 2011). These four research themes constitute a holistic picture of the existing research on information processing. I will introduce them one by one.

Table 1-1. Four Research Themes of Information Processing Research

Research Themes	Definition	Description or Examples	Key Sources
Information Processing Capability	This refers to an organizational capability to manage information effectively over the life cycle of information use, which includes sensing, collecting, organizing, processing and disseminating information (Marchand et al., 2000).	It might include (1) providing data and information to users in an accurate, timely, reliable, secure, and confidential manner, (2) offering universal connectivity and access with adequate reach and range, and (3) adjusting the infrastructure for emerging business goals and directions (Mithas et al., 2011).	e.g. (Mithas et al., 2011), (Kohli & Grover, 2008), (Marchand et al., 2000), and (Marchand, 2005)
Information Processing Structure	This refers to a set of technologies used to support various information processing activities of firms (Kwon et al., 2007).	Technologies used to establish information processing structures include ERP systems, EDI, data warehouse, online forum, etc. For example, online retailers can establish online communities where customers can share their shopping experiences, discuss about the products, and make product recommendations (e.g. Nambisan, 2002).	e.g. (Nambisan, 2002), (Kwon et al., 2007), (Gattiker & Goodhue, 2005), and (Premkumar et al., 2005)
Information	This refers to a set of	Some information processing	e.g. (Anand

Processing Culture	organizational cultures or shared values which root in information processing activities and will affect the effective use of information (Marchand et al., 2000).	cultures include integrity, formality, control, sharing, transparency, and proactiveness. For example, information proactiveness presents when organizational members actively explore and respond to competitive action opportunities and leverage information to enhance existing and create new products or services(Marchand et al., 2000).	et al., 1998), (Marchand et al., 2000), (Leidner & Kayworth, 2006), and (Jarvenpaa & Staples, 2001)
Information Processing Strategy	This refers to a subset of information processing mechanisms (such as the creation of lateral relations or the creation of self-contained tasks) that is implemented to reduce task uncertainty (Bode et al., 2011)	Organizations can create lateral relations or invest in information systems to increase the capacity of information processing (Galbraith, 1974; Tushman & Nadler, 1978). Or they can establish slack resources or create self-contained tasks to reduce the needs of information processing (Galbraith, 1974)	e.g. (Bode et al., 2011), (Galbraith, 1974), (Tushman & Nadler, 1978), and (Srikanth & Puranam, 2011)

Firstly, information processing capability is defined as an organizational capability to manage information effectively over the life cycle of information use, which includes sensing, collecting, organizing, processing and disseminating information (Marchand et al., 2000). Mithas et al. (2011) describe information processing capability as the ability to provide data and

information to users in an accurate, timely, reliable, secure, and confidential manner, the ability to offer universal connectivity and access with adequate reach and range, and the ability to adjust the infrastructure for emerging business goals and directions. While IT infrastructure offers organizations the base foundation, the capability to process information is of greater salience in influencing firm performance (Cotteleer & Bendoly, 2006; Mithas et al., 2011). Mithas et al. (2011) report that information processing capability is crucial for building other firm capabilities for customer management, process management and performance management. They further demonstrate the significance of information processing in improving a firm's performance.

Secondly, information processing structure refers to a set of technologies used to support various information processing activities of firms (Kwon et al., 2007). Contemporary organizations are using IT to redesign themselves in order to compete more effectively (Lee & Grover, 1999). Gattiker and Goodhue (2005) report that ERP systems allow organizations to integrate business processes effectively, leading to high quality information and better coordination between different units of the firms. Based on Kwon et al. (2007), IT is leveraged by organizations to support the highly responsive network-based structure, in an effort to effectively facilitate information processing, communication and knowledge sharing. Premkumar et al. (2005) examine the role of various technologies (e.g. EDI, private Web, and public e-marketplace) in enabling the establishment of communication structures across organizations in a supply chain context. Therefore, IT-enabled information processing structures offer firms an effective way of managing information.

Thirdly, information processing cultures is defined as a set of organizational cultures or shared values (such as integrity, sharing, and proactiveness) which

are rooted in information processing activities, and will affect the effective use of information (Marchand et al., 2000). Existing research shows that information processing activities are often closely intertwined with organizational cultures (e.g. Leidner & Kayworth, 2006; Marchand et al., 2000; David et al., 2000; Hall, 1983). There are several types of information processing culture identified by Marchand et al. (2000). For example, information integrity is an organizational value that is against the behaviors of manipulating information for personal gains, such as keeping information to oneself or purposely passing on inaccurate information. Information proactiveness is another type of culture that is present when organizational members actively explore and respond to competitive action opportunities, and leverage information to enhance existing and create new products or services. Information sharing is a value that treasures the free exchange of non-sensitive and sensitive information. It occurs within organization and across organizational boundaries (i.e., with customers, suppliers and partners).

Lastly, information processing strategy refers to a subset of information processing mechanisms (such as the creation of lateral relations or the creation of self-contained tasks) that is implemented to reduce task uncertainty (Bode et al., 2011). Information processing view suggests that organizations can proceed in either of two general ways to cope with uncertainty (Galbraith, 1974; Tushman & Nadler, 1978). Firstly, organizations can increase information processing capacity by applying the 'bridging strategy' (Bode et al., 2011). It forestalls uncertainty by facilitating access to reliable and timely information that allow organizations to make more informed decisions at the time of uncertain event (Mithas et al., 2011; Premkumar et al., 2005). For example, organizations can create lateral relations or invest in information systems to increase the capacity of information processing (Galbraith, 1974;

Tushman & Nadler, 1978). Secondly, organizations can reduce the information processing needs by applying the 'buffering strategy' (Bode et al., 2011). It implies acceptance of lower performance or redesigning tasks to simplify existing relationships (Srikanth & Puranam, 2011). For instance, organizations can establish slack resources or create self-contained units to reduce the needs of information processing (Galbraith, 1974).

While the four research themes of information processing research constitute the foundation of this thesis, I also introduce other relevant concepts in the three studies. For example, operational agility is investigated in the first study and customer agility is discussed in the second study. Instead of describing these concepts in the current section, I would like to explain these concepts in each specific study.

1.3 Research Focus and Potential Contributions

The literature review reveals a dominant focus on evaluating the fit between a firm's information needs and information processing design (e.g. Gattiker & Goodhue 2005; Premkumar et al. 2005; Fairbank et al. 2006; Mani et al. 2010). Most existing research applies a quantitative approach to assess the capabilities of information processing, such as the research investigating the fit between information needs and information processing capability in an inter-organizational supply chain context (Premkumar et al. 2005), the study examining different information processing design choices in risk management (Fairbank et al., 2006), and the research exploring various information processing alternatives in a business process outsourcing context (Mani et al. 2010). However, there is relatively little knowledge about the development and implementation processes of information processing. This might post a serious challenge to the progress of theory development in

information processing. On the other hand, there is a lack of exploration toward information processing in e-commerce companies. E-commerce companies conduct more information processing tasks than the traditional organizations. The way how they process information might vary from the way how traditional organizations do. So it will be meaningful to study information processing in e-commerce companies.

Research strategy is developed based on the literature review. This thesis is composed of three in-depth case studies that delve into three distinctive research themes (see Figure 1-1). The first study focuses on information processing capability. It is an attempt to understand how information processing capability is developed to enhance operational agility in a traditional organization. The second study centers on information processing framework. I attempt to understand how information processing framework is leveraged for developing customer agility in an e-business organization. The integrative information processing framework is composed of information processing capability, information processing structure, and information processing culture. The third study focuses on information processing strategy. In this study, I try to investigate how different information processing strategies are implemented in the context of traditional organizations' e-business transformation. A summary of the three studies can be found in Table 1-2. The arrangement of this thesis covers the above four research themes identified through extensive literature review and allows the generation of a comprehensive understanding toward organizational information processing.

Figure 1-1. Research Strategy

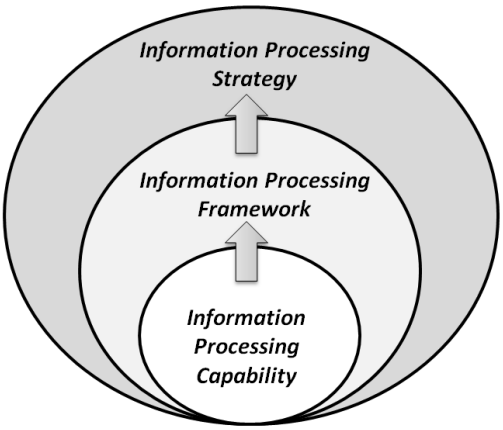


Table 1-2. A Brief Summary of Three Studies

	Study One	Study Two	Study Three	
Company Name	Haier	Karta (pseudonym)	Jeanswest	Haier
IS Phenomenon	Digitalization of Traditional Organization	E-Business Company	E-Business Transformation of Traditional Organization	
Research Theme	Development of Information Processing Capability	Development of Information Processing Framework	Implementation of Information Processing Strategy	
Research Question	How to develop information processing capability for operational agility?	How does information management enable online retailers to achieve customer agility?	How do traditional organizations implement information strategy for e-business transformation?	
Number of Interviewees	16	18	22	34
Total	27 Hours	20 Hours	20 Hours	47 Hours

Duration of Interview				
Summary of Findings	1. Two-step process to develop information processing capability for operational agility: the construction of IT-enabled information processing network and the implementation of organizational control. 2. Three types of information processing capability that can enhance operational agility: information sensitivity, information synergy, and information fluidity.	1. Customer agility is achieved by establishing information processing structure, developing information processing capability, and instilling information processing culture. 2. Three types of customer agility are identified: reactive customer agility, proactive customer agility, and coactive customer agility.	1. Performance gains (e.g. operational efficiency) can be achieved when there is an alignment between the e-business strategy and information strategy. 2. Information strategy is implemented through interpretation process and enactment process. Application of different information strategies leads to different actions conducted in each process	

The first study addresses the research question of how to develop information processing capability for operational agility. It is motivated by two theoretical gaps. One refers to the lack of understanding about the underlying mechanisms through which information processing capability can be developed. Another one concerns the lack of clarity in the process through

which IT facilitates operational agility. I select Haier, the largest household appliance manufacturer in China, as the case company. The company is well-recognized for its responsiveness to market changes in the turbulent Chinese household appliance market. This study allows me to develop a process model of developing information processing capability for operational agility. As the model suggests, operational agility is achieved through a two-step process—the construction of IT-enabled information processing network and the implementation of organizational control—to enhance the right information processing capability. Furthermore, this study identifies three types of information processing capability—information sensitivity, information synergy and information fluidity—that enable operational agility.

The second study investigates the research question of how information processing enables online retailers to achieve customer agility. This study attempts to fill the theoretical gaps regarding the lack of progress in developing conceptual and theoretical models in information processing and the lack of knowledge regarding how customer agility is developed. I select Karta (pseudonym), a leading ChineseB2C company with over 40 million customers, as the case company. The company is proficient in processing customer information to generate a favorable online shopping environment, which leads to successful customer attraction and retention. In this research, an integrative information processing framework is proposed to investigate the process of developing customer agility. Three types of customer agility (i.e. reactive customer agility, proactive customer agility, and coactive customer agility) are identified from the case. This study shows that customer agility is achieved by establishing information processing structure, developing information processing capability and instilling information processing culture.

The third study answers the research question of how to implement information strategy for e-business transformation in a traditional organization. This study is motivated by two theoretical gaps. On one hand, there is a lack of research on the e-business transformation process of traditional organizations. On the other hand, existing information processing studies neglect the process of information strategy implementation. I select two traditional companies that have entered e-business market as the case companies and conduct comparative analysis. The two companies applying different e-business strategies both achieve a great success in Chinese B2C market. Two models are developed to explain how information strategy is implemented for e-business transformation. The first model concerns the alignment of e-business strategy and information strategy. The second model concerns the process of implementing information strategy for e-business transformation. It suggests that traditional organizations should align information strategy with their e-business strategy to achieve performance gains.

The thesis aspires to provide IS researchers a better understanding of organizational information processing and a fresh perspective to examine IS management issues. Three case studies generate several explorative theoretical models and rich findings that help achieve this goal. The thesis also makes significant contributions to the information processing literature by identifying and addressing some important theoretical gaps, such as the lack of information processing capability development process.

This thesis also offers many valuable implications to practitioners. It stresses the significant role of information processing in organizational life and provides practical instructions for managers to improve the management of information. The findings are especially relevant to traditional organizations

that attempt to go digital or enter e-business market as well as e-business companies. However, with appropriate adjustment, these findings are also applicable to organizations that face the challenge of information management.

1.4 Thesis Organization

The Chapter 1 has offered an overview of this thesis including motivations, theoretical background, and research focus. The remainder of this thesis is organized as follows. Chapter 2 describes the study of Haier, which attempts to explore how information processing capability is developed for operational agility. Chapter 3 depicts the study of Karta, which tries to explore how information management enables online retailers to achieve customer agility. Chapter 4 introduces the study of Jeanswest and Haier, which attempts to address how traditional organizations implement information strategy for e-business transformation. Chapter 5 concludes the thesis by summarizing the findings and generating future research propositions from the studies, followed by a discussion of the potential theoretical and practical contributions.

2. STUDY I: OPERATIONAL DECISION MAKING AS A SOURCE OF OPERATIONAL AGILITY: AN INFORMATION PROCESSING PERSPECTIVE[1]

2.1 Introduction

Operational agility is a capability that enables organizations to sense changes in turbulent business environments, as well as conceive appropriate competitive actions to seize market opportunities (Sambamurthy et al., 2003). It has been described as an important determinant of firm success in today's rapidly changing business environments (Dove, 2001). As a result, this concept has attracted much attention from industry and academia. Practitioners in United Kingdom have initiated the Operational Agility Forum since 2009. Senior business and IT professionals gather and debate how organizations could sense and respond more efficiently and effectively to a new business environment. Moreover, one of the largest professional service firms, Ernst & Young, has published a report to share some practical lessons for developing operational agility (Ernst&Young, 2011). Meanwhile, many studies have been conducted by academic researchers to examine operational agility, contributing valuable findings to this body of knowledge (e.g. Sambamurthy et al., 2003; Raschke, 2007; Raschke & David, 2005; Tallon, 2008; Wu & Li, 2008).

Despite the increased knowledge of operational agility achieved in the past few years, the fundamental question of how operational agility is developed remains unanswered. Existing studies mainly center on identifying and validating the antecedents of operational agility. IT has generally been

[1]The following manuscript has been accepted as forthcoming paper in the European Journal of Information Systems.

considered as an enabler of operational agility (Sambamurthy et al., 2003). Other relevant antecedents that have been studied include digital options (Sambamurthy et al., 2003), IT infrastructure (Raschke, 2007), and IT capabilities (Tallon, 2008; Wu & Li, 2008). These studies share a common assumption that treats the relationship between IT and operational agility as a "black box", and implicitly presumes it to be automatic. However, the assumption might not be true, since the impact of IT is limited unless it is aligned with the business processes of an organization (Porter, 2001). Some studies offer a rebuttal of this assumption. They indicate that greater investments in the process and IT may hinder and even impede agility (Overby et al., 2006; Weill et al., 2002), partly due to the relatively fixed physical and technological artifacts of information systems (Galliers, 2007). This is contradictory to the findings that endorse IT as an enabler of operational agility. The inconsistent findings in the literature challenge studies that treat the relationship between IT and operational agility as a "black box" and reveal a lack of clarity of the process through which IT enables operational agility. Therefore, there is a need to investigate the process of operational agility development and open up the "black box" that lies between IT and operational agility.

This study draws on the lens of information processing to examine the development of operational agility. Effective information processing enables firms to acquire relevant, accurate, and comprehensive information in a timely and cost economic manner (Mithas et al., 2011), leading to more efficient communication and rapid decision making, which is essential for operational agility (Sambamurthy et al., 2003; Glenn, 2009). The ability to process information is significantly increased through the application of information systems (Mani et al., 2010). Hence, the lens of information processing offers a

sound means to observe the process through which IT enhances operational agility. The information processing view of the firm characterizes firms as information processing systems, faced with various types of task uncertainty (Galbraith, 1973; Tushman & Nadler, 1978). The objective of the firm is to develop the right information processing capability that facilitates the right amount of information needed to cope with uncertainty, and achieve desired performance (Mani et al., 2010). Accordingly, I theorize that the achievement of operational agility requires firms to develop appropriate information processing capabilities, to reduce uncertainty and thereby enhance sensing and responding capabilities.

The research question of this study is: *How to develop information processing capability for operational agility?* Informed by the information processing view of firms, the information processing network (e.g. Kwon et al., 2007; Ahuja & Carley, 1999) and organizational control (e.g. Leifer & Mills, 1996; Turner & Makhija, 2006) are examined as two strategies to enhance information processing capability. I adopt qualitative methods and conduct a case study of the largest household appliance manufacturer in China. The findings show that operational agility is achieved through a two-step process—the construction of information processing network and the implementation of organizational control—to enhance the right information processing capability. Furthermore, three types of information processing capability—information sensitivity, information synergy and information fluidity—that enable operational agility are identified. Based on the theoretical findings, a five-step practical guide of developing information processing capability for operational agility is provided for practitioners.

2.2 Literature Review

2.2.1 Operational Agility

Operational agility refers to "the ability of firms' business processes to accomplish speed, accuracy, and cost economy in the exploitation of opportunities for innovation and competitive action" (Sambamurthy et al., 2003, p. 245). It highlights the ability of firms' internal business processes to rapidly cope with market or demand changes (Lu & Ramamurthy, 2011). Operational agility is considered as an important determinant of a firm's success in today's rapidly changing business environments (Dove, 2001). A prominent real-world example that capitalizes on operational agility for business success is that of Zara, one of the biggest clothing retailers in the world. Its success is founded on a super-responsive supply chain, which enables the company to deal with unpredictable and quick changes of customers' tastes in the highly volatile fashion garment industry. This "fast fashion" system depends on effective information processing, which allows a constant exchange of information throughout every part of Zara's supply chain, and offers real-time information to support rapid decision making (Ferdows et al., 2004).

Past research on operational agility mainly centers on identifying and validating the antecedents of operational agility. Sambamurthy et al. (2003) posit IT as an enabler of operational agility. They argue that IT is applied to establish electronic communication channels, which in turn enable a rapid and up-to-date supply of comprehensive information to enhance operational agility. Some empirical studies on operational agility apply variance models to investigate the impacts of antecedent constructs on operational agility, such as research investigating the effects of a firms' IT infrastructure on operational

agility (Raschke, 2007), a study examining the relationship among environmental dynamism, managerial IT capabilities, technical IT capabilities and operational agility (Tallon, 2008), and the research exploring the mediating effects of operational agility on the relationship between IT capability and firm performance (Wu & Li, 2008). It seems that they generally treat the relationship between IT and operational agility as a "black box", and implicitly assume it to be automatic.

However, there are some studies that offer a rebuttal of this assumption. These studies indicate that greater investments in process and IT may hinder, and even impede agility (Overby et al., 2006; Weill et al., 2002), partly due to the relatively fixed physical and technological artifacts of information systems (Galliers, 2007). Inflexible IT systems, rigid IT architectures, or disparate technology silos often result in constraints on businesses (van Oosterhout et al., 2006). As a result, IT may become a disabler for agility (Lu & Ramamurthy, 2011). This is contradictory to the findings that endorse IT as an enabler of operational agility. The inconsistent findings in the literature challenge studies that treat the relationship between IT and operational agility as a "black box", revealing a lack of clarity in the process through which IT enables operational agility. Therefore, this study attempts to open up the "black box" between IT and operational agility, and close the theoretical gap by investigating the process of operational agility development.

2.2.2 Information Processing View

The information processing view of the firm posits that firms need quality information to cope with uncertainty and improve their decision making (Galbraith, 1973). This theory identifies three important concepts—information processing requirement, information processing

capability, and the fit between the two to obtain optimal performance (Galbraith, 1973). The information processing requirement is the amount of information about organizational activities that is needed to address uncertainty (Tushman & Nadler, 1978). Information processing capability refers to the ability to gather, synthesize and disseminate information properly to cope with uncertainty (Tushman & Nadler, 1978). Uncertainty stems from three sources, namely environmental dynamism, task interdependence and task complexity (Tushman & Nadler, 1978; Gattiker, 2007). High levels of uncertainty defer decision making (Wang et al., 2013), impairing the efficiency and effectiveness of sensing and responding activities. Accordingly, this study argues that firms should develop appropriate information processing capabilities that reduces uncertainty and fit the information needs of operational agility.

Typically, firms have two strategies to cope with uncertainty and increased information needs. Firstly, firms can increase adaptability by implementing advanced information processing mechanisms to reduce uncertainty (Galbraith, 1974). Information processing mechanisms that provide real-time, accurate and relevant information allow firms to be flexible in adapting activities at the time of uncertain event (Mithas et al., 2011). An example of this strategy is the implementation of integrated information systems that enhance information flow and reduce uncertainty (Premkumar et al., 2005). Secondly, firms can enhance the predictability of task execution by pre-specifying agreed-upon actions to reduce the effect of uncertainty (Galbraith, 1974). The approach to pre-specify actions, formal or informal, can guide and motivate organizational members to achieve congruent judgment in the face of uncertainty (Ouchi, 1979), and thereby facilitate decision making. A classic example of this strategy is the development of rules or standard operating procedures (SOP) to

reduce the effect of uncertainty (Tushman & Nadler, 1978). The above two strategies enable rapid response to environmental change (Wang et al., 2013), and thus they are significant for the development of operational agility. Both of them are reflected in the constructs described below.

Information processing network is defined as a dynamic network-based information processing structure which operates as a coordination mechanism that transcends formal hierarchy (Kwon et al., 2007). It often assumes the role of backbones that support information and knowledge-based activities within and across firm boundaries (Owen-Smith & Powell, 2004). Since effective information gathering, synthesizing, and disseminating of an information processing network is essential for survival and competence (Kodama, 2005), firms should construct and refine information processing networks to maintain an optimal information flow (Kwon et al., 2007). With the step-shift advances in IT over the past few decades, the potential of IT to create and maintain flexible information processing networks has been demonstrated by researchers and practitioners (e.g. Fulk & DeSanctis, 1999; Jarvenpaa et al., 1998; Kraut et al., 1999; Wiesenfeld et al., 1999; Kwon et al., 2007; Pan et al., 2012).

The structure of networks has been used by prior research as a main dimension to study information processing networks (e.g. Pan et al., 2012; Kwon et al., 2007). The structure of an information processing network depicts the patterns through which organizational communication is expedited and information is processed (Ahuja & Carley, 1999). Existing studies have examined the level of hierarchy and the degree of centralization of information processing networks (e.g. Ahuja & Carley, 1999; Kwon et al., 2007). Hierarchical levels are reflected by the number of levels one must go through in order to obtain information (Hummon & Fararo, 1995). Centralization indicates the extent to

which a network or group is organized around its focal point (Freeman, 1979). While an information processing network with high levels of hierarchy and centralization is well suited to tasks that are routine and with low levels of interdependence, the information processing network with low levels of hierarchy and centralization is more efficient in dealing with tasks that demand flexibility and adaptability (Ahuja & Carley, 1999; Baker, 1992).

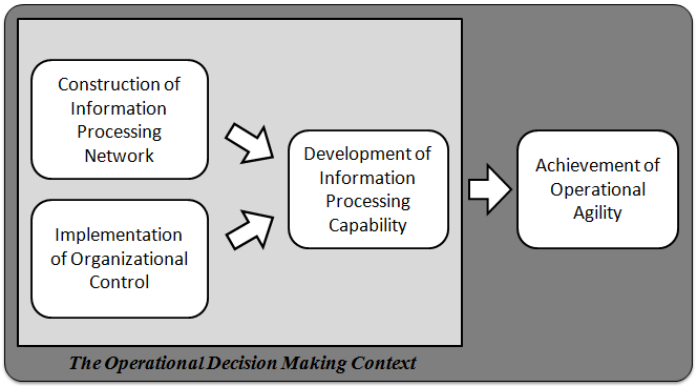
Organizational control is defined as all attempts to ensure that individuals behave in a manner consistent with organizational objectives (Ouchi, 1979; Ouchi, 1980). Organizational control encompasses routines, coordination mechanisms or organizational norms (Turner & Makhija, 2006). It aligns individual capabilities, activities and performance with the organization's goals and aspirations (Cardinal et al., 2004). Organizational control facilitates information flow by influencing individuals' information processing behaviors (Leifer & Mills, 1996). It requires "specific relationships between individuals and groups that influence how information is shared and knowledge is disseminated within the firm" (Turner & Makhija, 2006, p. 198).

Organizational control can be classified into four control modes—behavior control, outcome control, clan control and self control(Kirsch, 1997). Behavior control is exercised when proper behaviors are pre-specified and rewards are based on how well the behaviors are followed (Rustagi et al., 2008). Outcome control specified desired goals without defining proper behaviors and rewards are based on whether the goals are achieved (Kirsch et al., 2002). As the appropriate behaviors and expected outcomes are pre-specified, behavior and outcome controls are associated with less flexibility necessary to cope with uncertainty (Leifer & Mills, 1996). Clan control operates when all members of the work group embrace a common set of norms and values. Rewards and sanctions are based on whether individuals behave in accordance with these

norms and values (Kirsch et al., 2010). In self control, individuals define their own goals and processes for the task, and then proceed to self-monitor, self-reward and self-sanction (Kirsch et al., 2002). As clan and self controls use unwritten, unofficial values, norms and beliefs to guide individual behaviors, they provide more job discretion for individuals, and are characterized by higher levels of flexibility and responsiveness (Leifer & Mills, 1996).

To sum up, I propose that the achievement of operational agility requires firms to develop the right information processing capability to reduce uncertainty and thereby enhance the sensing and responding capabilities. Figure 2-1 shows a conceptual model of how operational agility is achieved. The construction of information processing network and the implementation of organizational control are two strategies for developing information processing capability. This model is applied to guide subsequent data collection and analysis.

Figure 2-1. A Conceptual Model of How Operational Agility Is Achieved



2.3 Research Methodology

To investigate the research question regarding how operational agility is achieved, I adopted a case research approach. There are two reasons for choosing the case study method. First of all, the research question is a "how" question, appropriate to explore through case studies (Walsham, 1995).

Secondly, both organizational information processing and operational agility are complex and multi-faceted phenomena that are embedded within an organizational context (Pentland, 1999), which makes it more suitable to examine the phenomena through relevant stakeholders' interpretations (Klein & Myers, 1999) rather than a quantitative approach.

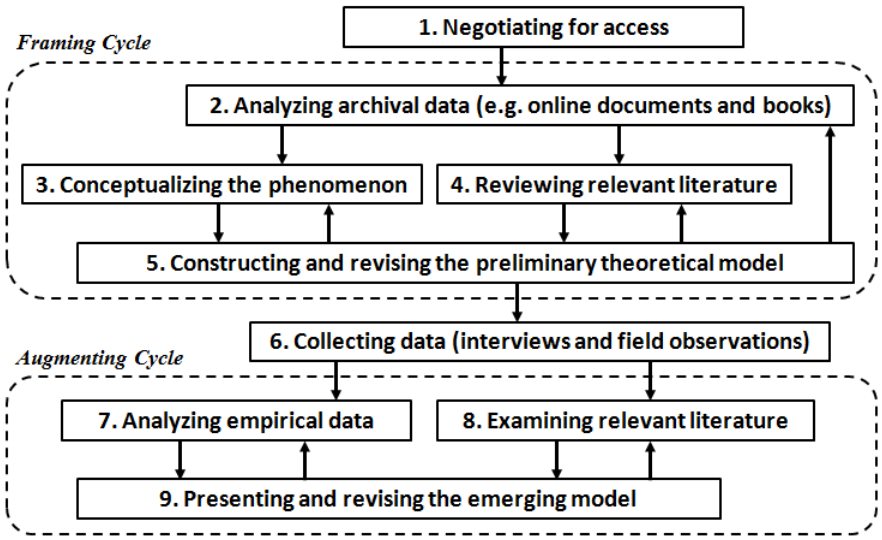
Three criteria for case selection were developed. Firstly, the case company should be situated in a highly competitive business environment, so that there is a need to develop operational agility. Secondly, the company should have demonstrated its capability in leveraging business processes to detect and respond to market changes (i.e. operational agility), so that managerial knowledge regarding how to achieve operational agility can be extracted from the case. Thirdly, the internal operations of the selected company should be complicated enough, so that it is necessary to develop appropriate information processing capability to deal with the associated uncertainty. This informs me that a large company is preferred. Accordingly, I chose Haier, the largest household appliance manufacturer in China, as the case company. The company is well-recognized for its responsiveness to market changes in the turbulent Chinese household appliance market. Arguably this might be due to its excellent order fulfillment process, which provides the company with flexibility and efficiency in adjusting its product designs and productions. Thus, this company is particularly appropriate for this study.

2.3.1 Data Collection

The investigation took place over a 23-month period between May 2010 and March 2012. I followed the theory-building process as prescribed by Pan and Tan (2011) to design and conduct this study. The steps in this research are shown in Figure 2-2 (adapted from Pan and Tan (2011)). An archival analysis

that took around five months complemented the discussions. A large amount of archival data from online documents, websites and books (e.g. Yong, 2008) was collected and analyzed. A mix of first and secondary data would increase the reliability of the study (Yin, 2003). Meanwhile I reviewed the relevant literature to predict a certain relationship between the theoretical lens and the phenomenon. These initial data collection and analysis allowed me to better understand the issues and, in combination with the review of the literature, confirmed the idea of applying the information processing perspective as an investigative lens for the phenomenon of interest. Accordingly an initial set of pertinent themes (such as information processing networks and organizational controls) was pre-identified. This resulted in the formation of the preliminary model (see Figure 2-1), which served as a "sensitizing device" (Klein & Myers, 1999) to guide the following data collection and analysis.

Figure 2-2. The Steps of Investigation



Onsite data collection was conducted twice in September 2010 and November 2011. A series of group interviews with an average of 3 informants per group were conducted with the middle and top management (see Appendix 7-1 and Appendix 7-2). According to Fontana and Frey (2000), a group interview can

produce “rich data that are cumulative and elaborative; they can be stimulating for respondents” (p. 652). Thus, the type and range of qualitative data generated from group interviews are often deeper and richer than those collected from one-to-one interviews, which helps achieve a more comprehensive view toward the complex phenomena I attempt to study. The selection of participants for each group was based on the criteria that either they came from the same department, or they had attended the same project. Interviews were based on topic guides (see Appendix 7-1), which demonstrated relevant probes at appropriate junctures (Pan et al., 2007). I adjusted the interview questions so that they were based on the organizational role of informants. Each informant was assured of the confidentiality of the data provided, especially when potentially sensitive information was sought (Walsham, 2006). The 10 group interviews, taking an average of 90 minutes were recorded digitally and later transcribed by one of the authors to form an equivalent single document of more than 100 pages (font size 10pt and single line spacing). Given that the interviews were conducted in Chinese, the authors spent much time in translating the data. The group interviews were complemented by 2 individual interviews with the informant who was the most familiar with the process I was studying. The individual interviews also served to confirm my preliminary understanding, formed during group interviews. A follow-up interview was conducted with the director of Haier University and the director of Supply Chain Department in November 2011. The informants helped me verify and consolidate the findings. Site visits to the company’s facilities in the headquarters were arranged, and around 60 photos were collected during site visits. Whereas the interviews formed the primary source of data, they were corroborated by other secondary data such as internal publications, organizational documents, and field notes. Multiple data

collection allows triangulation offering stronger substantiation of constructs and hypotheses (Eisenhardt, 1989).

2.3.2 Data Analysis

Three coding techniques (i.e. open coding, axial coding and selective coding) which are commonly used in a qualitative study (e.g. Lim et al., 2012; Kirsch, 1997; Pan et al., 2006) were applied to analyze the interview data. Initially, the process of developing the information processing capability for operational agility was coded using open coding technique (Strauss & Corbin, 1990). Open coding starts by placing conceptual labels on the data to capture organizational activities that help explain the process. It centers on uncovering general recurrent themes. Some of the conceptual labels used in this study – such as "*regular meetings*" and "*providing clear rules and procedures*" – are control mechanisms suggested by the literature; others – such as "*implementing strict schedule control*" – were suggested by the data (Strauss & Corbin, 1990). In total, I developed 47 conceptual labels that matched my research objectives. The second step of data analysis was to link similar concepts from open coding into theoretical constructs, through axial coding (Strauss & Corbin, 1990). Associations among concepts were made primarily by referencing constructs from the preliminary model and the existing literature. Continuing with the previous example, "*regular meetings*" and "*providing clear rules and procedures*" are suggested by the literature as mechanisms to implement behavior control. The concept of "*implementing strict schedule control*" has not been discussed by the literature. It is executed by specifying a proper schedule to follow. Based on this characteristic, I treated it as a mechanism to implement behavior control. As a result, I theorized the common underlying theme of these labels as the "*implementation of behavior control*". Through axial coding, a meaningful

comprehension of the phenomenon of interest was generated (Lim et al., 2012). Since the context of this study is the order fulfillment process, including order forecasting, sales and production planning, and goods production tasks, I differentiated the three tasks during data analysis to achieve three distinct sets of constructs. A summary of axial codes is provided in Appendix 7-3. An example of the statistics of codes for group-6 interview is shown in Appendix 7-4. Again, in the previous example, the hit of "*implementation of behavior control*" in the planning task is 58.3%, which indicates that more than half of the interviews have discussed this theme. As a last step, I used selective coding technique to integrate and refine concepts in order to ascertain a coherent picture of the phenomenon observed (Strauss & Corbin, 1990). In this step, the process of developing information processing capabilities for operational agility was selected as the core phenomenon. Furthermore, the constructs identified from axial coding were integrated and related to the core phenomenon. I accomplished this by examining back and forth the interview data, relevant literature and the emerging model. The emerging model was presented to several senior case researchers to generate feedback which helped me revise the model. This augmenting cycle (Pan & Tan, 2011) (steps 7, 8, and 9 of the investigation) lasted several months until theoretical saturation was reached, in which the findings of case study were comprehensively explained and no additional data could be collected or added to improve the emergent model (Eisenhardt, 1989).

2.4 Case Description

2.4.1 Organizational Background

Haier is the largest household appliance manufacturer in China, with over 240 subsidiary companies, more than 110 design centers, plants and trading

companies throughout the globe. The company receives more than 0.9 million sales orders monthly. These orders involve more than 10,000 types of customized products, which require the procuring of more than 260,000 types of material. As the company grew rapidly, top management observed several problems of the order fulfillment process. Sales orders were predicted by salespersons based on prior experience. This information went through several levels of hierarchies to approach sales department in the headquarters, through which information was adjusted several times by different hierarchies. As a result, it was less likely for sales orders to be accurate. After this, the information was transferred to other departments (e.g. production, procurement and logistics departments) for fulfilling the orders. However, the cooperation across departments was inefficient, since information traveled across these departments one after another. This means that one department has to wait for the input of another department to proceed. Therefore substantial time was wasted in the planning process. Production was based on inaccurate sales orders, which caused the problem of increasing inventory. This is a serious problem that might cause negative cash flow. Furthermore, as product category increased dramatically, the manufacturing process became increasing complex. For example, it was difficult to manage raw materials, since some of them were general components used by different products, while some of them were specific to one product. As a result, the company started a large scale of business process reengineering in 2008. This allowed the company to reshape its order fulfillment process. The overall operation improved significantly. The cycle of the order fulfillment process was shortened to two weeks, which is considered as best in the industry in China.

I am interested in the order fulfillment process changes. Specifically, I would like to examine how the company developed information processing

capabilities to achieve operational agility throughout the order fulfillment process. Order fulfillment is a key process in managing the supply chain (Croxton, 2003). This process can is defined as a complete process from the point of sales inquiry to the delivery of a product to customer (Fogarty et al., 1991). The tasks of order forecasting, sales and production planning and goods production are three significant tasks in the order fulfillment process (e.g. Fliedner, 2003). Under the background of order fulfillment, I examine information processing practices that support the three sequential tasks. Data collected are presented according to the sequence of these tasks in the subsections that follow.

2.4.2 Forecasting Task

The order fulfillment cycle in Haier begins with the order forecasting task. Sales department and salespersons try to predict customer demands over the next few weeks and generate sales orders for production. However, customer demands change unpredictably and quickly, which results in uncertainty of the task. The CEO of Haier described every customer as a "flying target" (Yong, 2008, p27) to reflect the dynamic nature of customer demand changes. Furthermore, the need to handle a mass of customer demand information generated from more than 10,000 points of sales brings about increased uncertainty. As a result, the uncertainty of the order forecasting task requires the company to become sensitive to changes, so that it can capture accurate customer needs.

To become more sensitive to market changes, the company developed an information processing structure that allowed efficient information collection from the local market. An example of this structure is the order management system. In the past, customer demands gathered by salespersons went through

several levels of hierarchy to reach the sales department in the headquarters, through which information became distorted. This phenomenon could be vividly described as the ‘bullwhip’ effect. The order management system was developed to solve this problem. It enables direct information exchange between salespersons that are close to local market and sales department in the headquarters. Hence, information distortion is largely eliminated. The headquarters also started to provide daily feedback information to salespersons via Short Messaging Service (SMS). The information processing structure facilitates a more efficient information exchange between salespersons and headquarters

The ability to capture customer changing needs is further enhanced by the implementation of a performance management program and employee empowerment. Based on information from the order management system, the company designed a performance management program called “individual goal combination”. The program motivates salespersons to make more accurate decisions regarding customer orders that they are going to fulfill. It evaluates a salesperson’s performance and classifies it based on the extent to which it is consistent with organizational goals. While desired performance is rewarded, undesirable outcome is punished in monetary terms. This program enhances a salesperson’s responsibility to ensure the accuracy of decisions made. Furthermore, salespersons were given sufficient discretion in decision-making which guaranteed flexibility in combating demand variability. This is reflected in the belief that “every salesperson is a Strategic Business Unit (SBU)” propagated by the company. Providing tools to support decision making helps to improve decision accuracy. An order forecasting system which integrated complicated forecasting models and a large amount of sales data was developed and used to assist in decision making.

Through the above practices, salespersons became more responsible. In order to establish a positive performance record, salespersons actively reach customers to understand their sales and inventory. They ask the sales department to offer analytical tools for order forecasting, so that they are capable of making more accurate sales decisions. This allows the generation of accurate market information which is delivered to the headquarters in an efficient manner. As a result, the company became more sensitive to market changes. The relevant themes identified under 'Forecasting Task' are summarized in table 2-1.

Table 2-1. The Relevant Themes and Data Identified under 'Forecasting Task'

Axial Codes	Exemplary Quote and Open Codes
Construct Information Processing Network	Director of Department 1: *"We provided a portal for product representatives (salespersons). They not only make sales orders, but also view sales information of their own customers … They can see the amount of income and loss every day. They also can see new tasks assigned by the headquarters. If they have any problems, such as some problems in customer's model machine, they can feed back to the headquarters directly."* (Open code: establish multiple communication channels between salespersons and the headquarters) Director of Strategy Department: *"The information of the performance evaluation result will be sent via SMS to every salesperson daily. By doing this, even though they are on a business trip, they still can know their performance, so that they can adjust accordingly."* (Open code: establish multiple communication channels between salespersons and the headquarters)
Implement Outcome	Director of Department 2: *"If you can fulfill your plan completely, you can get all your salary and season rewards. If*

Control	*you want to get your salary, you have to make a sound sales plan, to sell profitable products and to sell fast."* (Open code: implement comprehensive performance evaluation and provide incentives based on performance) Director of Department 4:*"We realized that the most important thing we should do is to clarify the responsibility of salespersons. We need to record sales information of salespersons formally. We allow them to view their performance. How many orders are placed? How many products are sold? All the information is recorded. They are responsible for their sales."* (Open code: define individual responsibility)
Implement Self Control	Director of Strategy Department: *"Except for selling fast, selling more, and selling profitable products, we still have one principle, which is to be independent in managing the business and responsible for one's own profits and losses."* (Open code: instill a sense of responsibility) Project Manager of Department 4:*"The performance of a company is determined by the performance of its employees. If each employee is performing well, the performance of the company as a whole will be good. So we need to combine individual interests with the organizational objectives."* (Open code: fusion of individual goals and organizational objectives)
The Role of Information Processing Capability	CIO of Haier: *"By implementing these mechanisms (to manage salespersons), our salespersons are just like engines with extremely strong power, because these mechanisms are very motivating."* (Open code: achievement of high staff morale) Director of Haier University: *"The sales order is generated based on sales information, including the sales of previous week, the current inventory, and the cycle of inventory turnover. Therefore this information becomes more precise."* (Open code: achievement of accurate prediction)

2.4.3 Planning Task

The sales and production planning task generates a congruent plan to coordinate the actions of diverse departments. Since the actions of different departments might depend on and influence each other, the task requires a tight cooperation between them. For example, the sales orders decided by the sales department influence the procurement plan of procurement department and the production plan of production department, so that they should communicate and adjust their plans accordingly. The interdependent nature of the planning task results in the uncertainty that the company needs to cope with. Furthermore, different departments have diverse requirements and goals which could be potentially conflicting, leading to increased uncertainty. Therefore, the company needs to facilitate effective communication and collaboration across departments to reduce the uncertainty of the planning task.

To achieve effective collaboration, the company constructed an information processing network that enabled efficient information exchange and integration across departments. The company restructured its IT infrastructures and integrated existing systems to boost extensive information exchange. For example, the company integrated around 600 existing systems, and established a unified data sharing platform to expedite information sharing. Furthermore, they developed an order review system to support the integration of relevant information from different departments. The order review system is used to check the alignment between requirements and constraints of different departments so that decisions made based on it will be consistent across departments. The system saves them much time and effort in resolving the redundancy and inconsistency of diverse departments' activities.

The company implemented a series of clear procedures for coordination, and nurtured a collective culture to further enhance communication and collaboration across departments. A series of clear procedures guarantee sufficient communication and smooth potential conflicts across departments. These procedures formulated concrete time and activities to be performed by specific department as well as individual. For instance, the company conducted routine cross-departments meeting every Wednesday to communicate and negotiate sales and production issues. Except for the formal mechanisms, Haier's collective culture plays a key role in supporting the task. The company propagates common organizational value across departments. It also emphasizes individual obedience to "one common goal" of the company. It promotes the belief that individual will benefit more when the goal of the company is accomplished. This culture is reflected by many slogans that the authors have observed in the case site. The collective culture facilitates collaboration by resolving conflicts across departments which cannot be solved by pre-specified rules.

Overall, these activities facilitated tight information exchange and integration across departments. Effective decision making in sales and production planning process relies heavily on a high amount of interaction and communication across departments. As information is integrated across departments, so the coordination of allocated resources, activities and roles across departments will be improved, leading to cost economic coordination. The relevant themes identified under 'Planning Task' are summarized in table 2-2.

Table 2-2. The Relevant Themes and Data Identified under 'Planning Task'

Axial Codes	Exemplary Quote and Open Codes
Construct Information Processing Network	Project Manager of Department 4: *"When the company becomes larger, responding slowly (to customer demand) is undesirable. To be fast, we have to use information technology to achieve process synchronization … All the departments, including salespersons, production staff and research staff will receive orders at the same time."* (Open code: implement internal systems integration) Director of Infrastructure Operation and Maintenance Department: *"To facilitate the cooperation among departments, we made several changes to the existing information systems technically, such as establishing a bus sharing platform and the release of GVS."* (Open code: create an information sharing platform)
Implement Behavior Control	Director of Department 2: *"For the process between forecasting and production, we use the "161 week order" mechanism to adjust the frequency of the process and improve its efficiency … After using this mechanism, the cycle of order fulfillment is reduced from 40 days to 17 days. Actually we control the frequency of our business."* (Open code: implement strict schedule control) Director of Department 1: *"We have a set of procedures and mechanisms to cope with coordination between sales and operation. Salespersons will report results of order prediction on every Monday; the headquarters will adjust the results of order prediction on every Tuesday; then estimate short-term order prediction on every Wednesday; estimate long-term order prediction on each Friday."* (Open code: provide clear rules and procedures)

Implement Clan Control	Director of Department 4: *"Now we emphasize the goal of the whole process, from acquiring orders to the whole supply chain. We have to unify our goals. Only when the unified goal is achieved can the value of each individual be realized."* (Open code: instill a common goal) Director of Strategy Department: *"Haier's organizational culture is the key. Although some of us might not understand the company's strategy fully, we executed quickly. Our colleagues from other departments are also willing to cooperate."* (Open code: foster collective actions)
The Role of Information Processing Capability	Director of Department 3: *"Technically, we implemented an information sharing platform. It helps to save money, save time and save efforts. Saving time means accessing to information is very fast. Saving money actually means information is shared and there is no necessity to purchase additional devices. In the past some tasks took us lots of efforts; for example, we had to negotiate a lot for the procurement task and it took us 40 days to deliver. But now it only takes one day."* (Open code: improved operational efficiency) Director of Infrastructure Operation and Maintenance Department: *"Once the sales order is fixed, support departments are ready to fulfill the sales order. For example, the information about the sales order is transferred to the systems of production department. A production plan will be generated accordingly. This information is simultaneously transferred to procurement department. The process is almost synchronized."* (Open code: achievement of process synchronization)

2.4.4 Production Task

As a household appliance giant with a broad product range, the company produces over 10,000 types of customized products monthly. The process of fulfilling large production orders involves many complex issues. For example,

the company needs to decide on the distribution of production tasks across manufacturing plants efficiently, and these decisions are made based on the considerations regarding the production capacity of plants, shipping address of sales orders, availability of raw materials, and other relevant issues. The complex nature of the task becomes a source of uncertainty. Furthermore, the compressed production time leads to increased uncertainty. Thus, the ability to facilitate the efficient flow of information between headquarters and manufacturing plants is needed to reduce the uncertainty of the production task.

The company developed an information processing network that enabled rapid information dissemination of the headquarters to facilitate cooperation between the headquarters and plants. Given the large scale of information needed to process, it is infeasible to handle it manually. The company's ERP system, which is named "Global Value System (GVS)", plays a pivotal role in processing and disseminating information. It records information relating to raw material, product and production process. Through analyzing the capacity of each manufacturing plant, sales order details, inventory information and other relevant information, many decisions are made by the system automatically. The system further arranges a production plan for each plant, based on the information relating to that particular plant. Thus, decision making is conducted automatically, and manual interventions are largely eliminated.

The company further developed clear rules and procedures, as well as implemented a performance management program to enhance the efficiency of information flow. Although the production task is complicated, establishing clear rules and procedures enables the complex task to be divided into smaller and simpler ones. As employees follow pre-specified rules and procedures,

efficiency of the production process is largely improved. The company also developed the modularization of raw materials to reduce the complexity of the production process. Furthermore, with increasing process-related information recorded in the systems, the company implemented performance management program in production department to monitor and motivate employees. The performance of employees is evaluated based on certain evaluation criteria, and salary is influenced by the outcomes of the evaluation. Evaluation criteria, such as delivery on time and accuracy of order delivery, are pushing employees toward raising efficiency. As each employee becomes faster, the whole process speeds up.

Activities conducted in this task facilitated fluent information flows from the headquarters to manufacturing plants. With the support of fluent information flows, decision making could be conducted automatically by the system without manual interventions. As a result, the company is able to achieve efficient production. The relevant themes identified under 'Production Task' are summarized in table 2-3.

Table 2-3. The Relevant Themes and Data Identified under 'Production Task'

Axial Codes	Exemplary Quote and Open Codes
Construct Information Processing Network	Technical Leader 1 of Department 3: *"The systems are used to confirm and distribute production orders. After some manual adjustments, production orders will be transferred to factories every Wednesday night. Production department of each factory will organize its production accordingly. All of these are conducted by ERP systems."* (Open code: leverage ERP system for production scheduling) Director of Department 1: *"Our intranet covers all the factories. All information exchange is processed through information*

	systems." (Open code: establish an information hub)
Implement Behavior Control	Technical Leader of Department 4:*"The production task is driven by production plans. All the relevant systems will be used to monitor and execute tasks such as execution of production orders, management of material and product inventory, quality management and shipment. Usually we provide operation instructions to guide the normative operation."* (Open code: provide clear rules and procedures) Director of Department 2:*"We have developed a modularized production process. Now we attempt to increase the percentage of general modules. Some modules can be customized based on customer needs. As a result, we reduce the procurement and production cycle."* (Open code: modularized production process)
Implement Outcome Control	Director of Department 1: *"'Individual-goal combination' is applied to all the staff, including staff from the supply chain and production department. There are specific performance management mechanisms for them. For manufacturing persons, their performance is evaluated based on the fulfillment of production goals."* (Open code: implement comprehensive performance evaluation and provide incentives based on performance) Technical Leader of Department 2: *"(The evaluation criteria for production department include,) first, deliver on time. Second, accuracy of order delivery. Furthermore, we also evaluate fulfillment of production capacity. For example, our production capacity is 5000 per day, but we only produce 4000 (which is undesirable). This can be considered as the usage ratio of production capacity."* (Open code: define different performance evaluation criteria)
The Role of Information Processing	Director of Department 4: *"We emphasize the efficiency of the whole supply chain, from the input of customer orders to output of products. The cycle is only around 21 days. I cannot remember the*

Capability	*exact number, but it does improve a lot. Our delivery cycle is the best in our (household appliance) industry. Our delivery efficiency is quite high."* (Open code: improved operational efficiency) Director of IT Infrastructure Management Department: *"We set up the '161 week order' mechanism in 2009. Some changes were made to our information systems accordingly. By doing this, we not only implemented zero inventory management, but achieved high-responsiveness toward customer demand."* (Open code: improved operational efficiency)

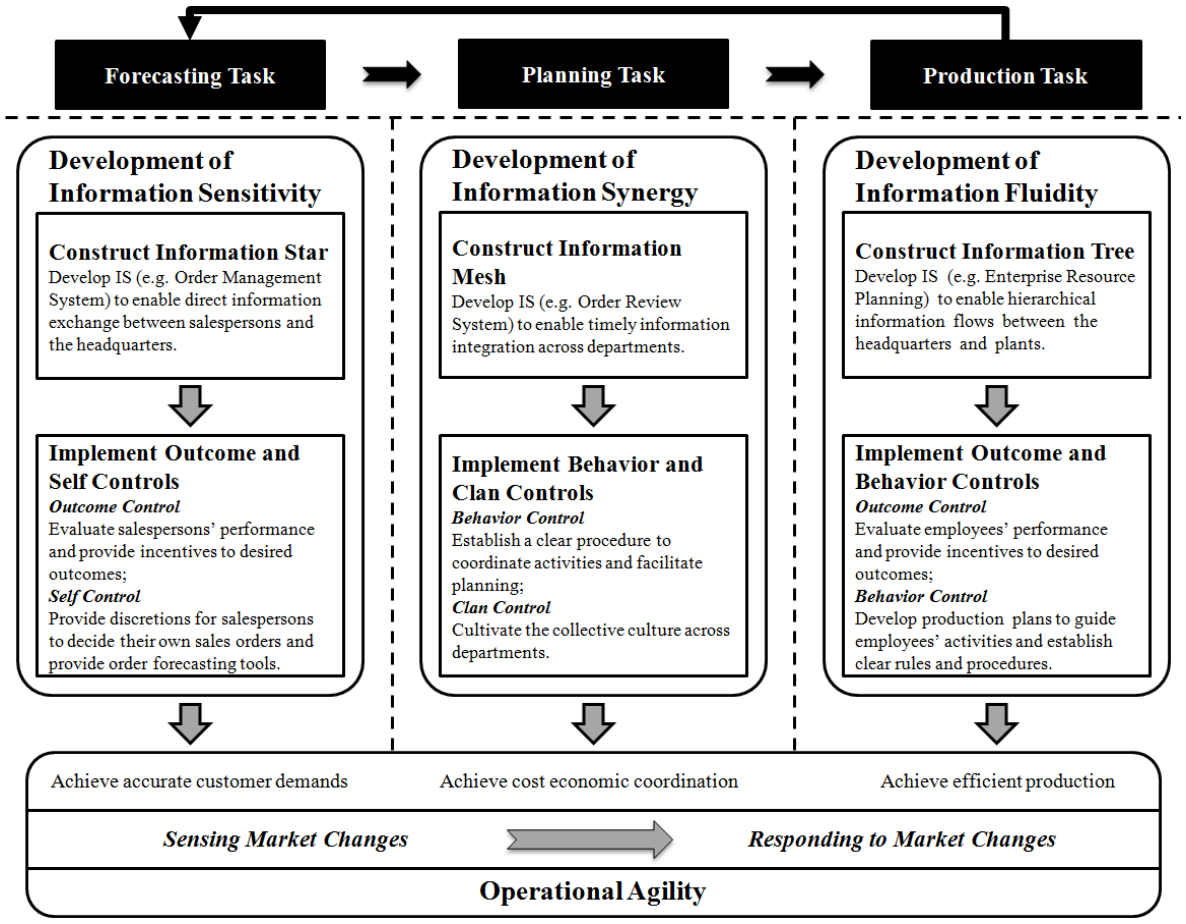
A timeline of the order fulfillment process changes in Haier is provided in Appendix 7-5. With above changes, the overall operation may be significantly improved. On one hand, the company is capable to detect market changes precisely. Salespersons are not only providing the accurate information of sales orders, but also offering their understanding of consumer preferences of the local market. As a result, the company has developed many innovative products such as the shrimp washer and the holiday freezer. On the other hand, the company is able to respond rapidly to market changes. The internal operational cycle has been largely reduced, allowing the company to deal with unpredictable market changes. For example, the company has successfully fulfilled an order placed by a German retailer within two days. Without an efficient order fulfillment process, it is less likely that the company will achieve this.

2.5 Discussion

To address the research question, I went through an iterative process between the relevant literature, the qualitative data and the emerging model. Subsequently a process model (see Figure 2-3) was developed. As the model suggests, operational agility is achieved through a two-step process—the construction of information processing network and the implementation of

organizational control—to enhance the right information processing capability. Next, I explain the process model in detail, and show how the model enriches our understanding of operational agility.

Figure 2-3. A Process Model of Developing Information Processing Capability for Operational Agility



2.5.1 Development of Information Sensitivity

Decision making for forecasting was conducted within an environment filled with great uncertainty stemmed from environmental dynamism (Lee & Grover, 1999). One specific type of environmental dynamism is termed demand uncertainty, which indicates the changes in demand for products and the inability to accurately predict these fluctuations (Premkumar et al., 2005). It captures one of the natures of the contemporary business landscape, where

customer needs keep changing rapidly (Overby et al., 2006). The metaphor of 'flying targets' from Haier's CEO attests to this challenge facing the company.

To cope with the information needs emanating from environmental dynamism, the '**information star**' was established and the **outcome and self controls** were implemented. Information star is an information processing network characterized by high level of centralization and low level of hierarchy (Pan et al., 2012). This kind of network is built by establishing direct information exchange channels to connect salespersons in point of sales and sales department in the headquarters. This structure is similar in spirit to the hybrid communication network, in that it allows both efficiency and flexibility simultaneously (Brown & Eisenhardt, 1998). The centralized structure is efficient when information interactions occur vertically (e.g. information sent from central nodes to peripheral nodes) (Ahuja & Carley, 1999); low level of hierarchy representing a flat structure is flexible in facilitating mutual adjustment between the center and peripheral nodes. Examples of enterprise information systems that enable the construction of information star include order management systems and intranet portals. To ensure the optimal performance of salespersons at the point of sale, the outcome and self controls were implemented. By developing the performance management program to evaluate salespersons' performance and providing incentives to desired performance, outcome control was executed (Eisenhardt, 1985). Meanwhile, the company provided sufficient discretions for salespersons to make sales decisions, and offered tools (such as the order forecasting tools) to support their tasks, which indicates the execution of self control (Manz et al., 1987). These control mechanisms not only ensure that salespersons behave in a way that is consistent with organizational objectives, but also provide them with ample room to react to market changes.

Accordingly, the ability to detect changes in customer needs readily by collecting and analyzing relevant information was developed. I name it '**information sensitivity**'. This was developed by constructing the information star and implementing the outcome and self controls. The information sensitivity is similar to the 'market sensitivity' (Christopher, 2000) in supply chain research, which is considered as a key determinant of agile supply chain. This capability helps an organization to make accurate sales decisions. It further contributes to the sensing component of operational agility by enhancing the market intelligence capability (Overby et al., 2006).

2.5.2 Development of Information Synergy

The great uncertainty that confronted the decision making for planning originated mainly from task interdependence (Gattiker, 2007; Sharma & Yetton, 2007), since this task required tight collaboration across departments. Actions taken within one department affect the actions and work outcomes of other departments (McCann & Ferry, 1979) in this task. This interdependence among departments increases the likelihood that changing conditions in one department require other departments to adjust (Thompson, 1967; Sharma et al., 2008). To achieve this type of adjustment, each department should be aware of information about other departments during decision making (Gattiker, 2007).

The requirement to deal with task interdependence drove the establishment of '**information mesh**' and the implementation of **behavior and clan controls**. As the information processing network is characterized by a low level of centralization and hierarchy, I name it 'information mesh'. The information mesh is built by establishing highly connected information exchange channels across diverse departments, to enable timely information integration. This

structure is similar to the 'small world' network (Kwon et al., 2007) or the organic communication network (Ahuja & Carley, 1999). It supports routine communications among actors or units, and enhances mutual dependence among interconnected nodes, especially when tight collaboration is desired to connect value chains within the organization (Newman, 2004). Electronic calendars, workflow systems, and knowledge management systems are examples of enterprise information systems that enable the construction of information mesh. To ensure decision making is based on consistent information, behavior and clan controls were implemented. The behavior control was used through establishing a clear procedure to coordinate activities across departments and conducting regular meetings to facilitate planning (Eisenhardt, 1985). The clan control was executed by propagating the "one common goal" belief and cultivating the collective culture among departments (Ouchi, 1979; Ouchi, 1980). These control mechanisms were implemented to optimize the flexibility of collective actions, while maintaining efficient cooperation among different departments during decision making.

Consequently, the ability to integrate information for effective communication and collaboration across unit boundaries was developed. I name it '**information synergy**'. According to Dewett and Jones (2001), information synergy can be achieved when IT allows the different units to adjust their actions to the needs of the other units on an ongoing basis. The findings show that information synergy was developed through constructing the information mesh and implementing the behavior and clan controls. Given the crucial role played by IT in this task, this finding is consistent with Dewett and Jones (2001). This capability helps organization achieve cost economic coordination across diverse departments. It further contributes to the sensing and responding components (Overby et al., 2006) of operational agility, in that it

allows the organization to achieve a holistic understanding of environments and create a coordinated responding plan to guide organizational actions.

2.5.3 Development of Information Fluidity

Decision making for production was confronted with great uncertainty, mainly stemming from task complexity (Lee & Grover, 1999). It is found that the task becomes more complex as the number of factors and their interactions increase (Ramamurthy, 1990). Task complexity captures the characteristic of the production process through which various types and a large number of products are produced. This complex product structure constitutes one of the key determinants of production complexity (Calinescu et al., 1998). As product structure becomes complex, so distinct information cues must be processed in decision making.

The '**information tree**' was established, and the **outcome and behavior controls** were implemented to fulfill information needs. As the information processing network is characterized by high level of centralization and hierarchy, I name it 'information tree'. The information tree is built by establishing hierarchical information disseminating channels between the headquarters and manufacturing plants. This is similar to the 'moderate scale free' network (Kwon et al., 2007) or the mechanistic communication network (Tushman, 1979). Among systems of a given size and complexity, it requires less information exchange among actors (Simon, 1977) than do the information mesh, so that less information cues are generated, reducing the need of manual interventions. The dispersed manufacturing plants of the case company rely on this communication hierarchies for efficiency in communication and coordination (Ahuja & Carley, 1999). Enterprise resource planning systems and supply chain management systems are examples of

enterprise information systems that enable the construction of information tree. Accordingly, the outcome and behavior controls were implemented to coordinate among members during the production process. To implement outcome control, employees' performance was evaluated, and incentives were provided to a desired outcome (Eisenhardt, 1985). Behavior control was executed by developing production plans to guide individuals' activities, utilizing a modularization method and establishing clear rules and procedures (Kirsch, 1997). These control mechanisms allow the company to pre-specify desired behaviors, as well as outcomes, which reduces the demand for decision making and enhances operational efficiency.

I name the information processing capability developed in this task '**information fluidity**', which indicates the ability to facilitate efficient flow of information by increasing automation in processing information. This is achieved through constructing the information tree and implementing the outcome and behavior controls. Existing research finds that information systems (e.g. ERP) enhance task efficiency by improving information flow (Gattiker & Goodhue, 2005). This is corroborated by the study that information systems allow organization to achieve information fluidity for improved efficiency. The information fluidity contributes to the responding component of operational agility by enhancing the production capability (Overby et al., 2006).

Operational agility may be defined as the ability to achieve accurate customer demands, cost economic coordination, and efficient production in the context of order fulfillment (e.g. Fliedner, 2003). By developing information sensitivity, information synergy and information fluidity, firms may achieve accurate market demands, cost economic coordination and efficient production in order fulfillment. Since the three information processing capabilities

developed are iteratively applied in these tasks (see the black arrows show in Figure 2-3), they are routinized for repeated application. Thus, the model suggests that operational agility can be attained through developing three routinized information processing capabilities. Based on these findings, I provide a practical guide for developing the information processing capability for operational agility (see Table 2-4), which helps practitioners improve business operations.

Table 2-4. A Five-Step Practical Guide

Developing information processing capability for operational agility
Step 1: *Investigate the Information Needs of Business Process*. The first step requires the focal organization to understand the information needs of business process. Information needs stem from task environment, task interdependence and task characteristics. Is the task environment dynamic? Is it a task that requires tight cooperation among multiple stakeholders? Is the task complex? The focal organization must be able to address these questions before it is ready to develop information processing capability. The outcome of this step allows the organization to concentrate on fewer aspects of business process, but the most salient ones.
Step 2: *Evaluate the Cost and Benefit*. The second step requires the organization to evaluate the cost and benefit of developing information processing capability. While the information synergy is capable of dealing effectively with greater amounts of uncertainty than information fluidity, there are costs associated with this increased information processing capacity. It takes more time, effort and energy to manage the information mesh and implement the behavior and clan controls. Thus, the benefits of increased information processing capability must be weighed against the associated costs of managing the information processing network and implementing control mechanisms. The outcome of this step makes the organization narrow down the feasible alternatives.
Step 3: *Construct an Information Processing Network*. The step 3 requires

the organization to construct an appropriate information processing network. It involves evaluating the current information processing network and generating a new information processing network. The deliverables of step 1 and 2 will serve as the input for this step. Accordingly, the focal organization must evaluate whether the current information processing network (i.e. existing information and communication systems) is capable of fulfilling the information needs estimated in step 1. If the existing one fails, then more effort should be devoted to adjusting the existing one or creating a new network. It might be feasible to make some changes to the existing information processing network, such as integrating the legacy systems. It might also be workable to tailor a new information processing network for the business process. The focal organization should evaluate the alternative approaches to decide on the most suitable one.
Step 4: *Implement Appropriate Control Mechanisms*. This step requires the organization to implement appropriate control mechanisms to influence employee's information processing behavior. The focal organization should first choose between formal controls and informal controls. Formal controls require a prescription of expected behaviors or outcomes. The focal organization can choose behavior control or outcome control to implement formal controls. Informal controls are based on social or people strategies which provide the organization with flexibility in dealing with uncertainty. Accordingly, clan control and self control may be used to implement informal controls.
Step 5: *Align Control with Information Processing Network*. Finally, the organization should adjust control mechanisms to fit the information processing network. Since the information processing network differs in terms of the flexibility in dealing with uncertainty, so do control mechanisms. Informed by this study, different information processing networks work better with specific control mechanisms. For example, the information mesh is better with behavior and clan controls, while the information tree working better with outcome and behavior controls. It is this very combination that allows the company to achieve operational agility.

Therefore, the company should adjust the control mechanisms implemented to make it suitable for the information processing network.

2.6 Conclusion

2.6.1 Theoretical Contributions

This study provides potential contributions to the literature in several ways. Firstly, it contributes to the agility literature by developing a process model to show how operational agility is achieved. Past research on operational agility mainly centers on identifying and validating the enablers or antecedents of operational agility (e.g. Raschke, 2007; Tallon, 2008). However, the process through which operational agility is developed has received little attention. By adopting case research methods, this study empirically examines the process of operational agility development. A process model is developed and it shows that operational agility is achieved through a two-step process that enhances the right information processing capability. I hope that the findings of this study can address the aforementioned theoretical gap.

Secondly, this research also contributes to the information processing view of firms. It makes a contribution by depicting a two-step process – the construction of information processing network and the implementation of organizational control – to show how information processing capability is developed. In this way, some new concepts such as the three types of information processing capabilities are identified. It is hoped that these concepts can form a foundation for future research on the information processing view. Furthermore, it corroborates previous findings, namely that information processing capability plays a foundational role in developing a firm's capabilities to improve firm performance (Mithas et al., 2011).

Finally, previous agility research focuses on investigating the role of IT assets (Mithas et al., 2011), while the current study offers an attempt to study agility from an information processing perspective. Agility is decomposed into two components: sensing and responding (Overby et al., 2006). The sensing components rely on organizational capability in processing information from internal and external environments, so that accurate understanding of environments can be attained before making decisions. The responding components depend on the ability to transform information into an actionable plan and disseminate information to coordinate activities. Thus, the information processing perspective provides a viable theoretical lens to study agility. I hope that this study can provide a sound example of combining the information processing perspective and agility literature and stimulate more efforts to achieve this end.

2.6.2 Limitations and Future Research

The current study has two main limitations. Firstly, by investigating the process of developing information processing capability for operational agility, some new concepts are developed, such as information sensitivity, information synergy, and information fluidity. Although the preliminary definitions and descriptions of these concepts are provided, their measurements are missing in this study. Future research may attempt to operationalize the new concepts and collect survey data to empirically validate the findings from this study. Secondly, the findings of this study may be affected by the retrospective nature of the interview data. A disadvantage of retrospective responses is that they may suffer from errors of recall(Glick et al., 1990). I have sought to minimize this effects in two ways: on the one hand, I chose informants who were personally involved in order fulfillment process changes (e.g. Pan et al.,

2007); on the other hand, a systematic data verification procedure was followed to ensure data triangulation (Klein & Myers, 1999).

The current study enhances our understanding of the impact of information processing on operational agility. According to the agility literature, this construct consists of three interrelated capabilities: customer agility, operational agility, and partnering agility (Sambamurthy et al., 2003). While I am only concerned with operational agility in the current study, research on the impact of information processing on customer and partnering agility is also needed. Customer agility is about co-opting customers and partnering agility is about leveraging assets, knowledge, and competencies of partners. From the information processing perspective, customer agility is more likely to be achieved by processing customer information to support decision making. The ability to integrate partners' information to support decision making is more likely to contribute to partnering agility. Thus, more studies are needed to contribute to the agility literature.

Given that today's business environments have become increasingly turbulent, many IS researchers are motivated to study how IT enables contemporary organizations to adapt to environmental changes (e.g. Lu & Ramamurthy, 2011; Sambamurthy et al., 2003). Most previous research focuses on investigating the role of IT assets (e.g. IT investments). In contrast, this study draws attention to the role of information processing in enabling organizational adaptation. Kohli and Grover (2008) point out that the way in which information processing capabilities may enhance digital business capabilities is an increasingly important topic, which has thus far been neglected. This study responds to their call. Nonetheless, more research on the role of information processing in contemporary organizations is needed.

3. STUDY II: HOW INFORMATION MANAGEMENT ENABLES ONLINE RETAILERS TO ACHIEVE CUSTOMER AGILITY

3.1 Motivation

The significance of B2C electronic commerce (e-commerce) as a shopping and retail channel is now widely acknowledged. Based on a survey by the Pew Internet and American Life Project, the number of Internet users who have at one stage bought anything online has increased from 22 percent in June 2000 to 49 percent in September 2007, and most e-commerce users agree that shopping online is convenient (Horrigan, 2008). This is supported by a recent U.S. Census Bureau report that retail e-commerce sales for 2010 were greater than $169 billion, with an average annual growth rate of 17.9 percent from 2002 to 2010. It seems that online retailing has become popular among shoppers, and online retailers are generating considerable revenue through this channel.

Despite the increasing popularity of B2C e-commerce, however, competing in this industry will not be easy for online retailers. Compared with the traditional bricks-and-mortar retail industry, the online retail channel is characterized by increased uncertainty and turbulence. On the one hand, competitors are better informed, since they can readily access inexpensive intelligence based on the information available online (Granados et al., 2010). They can easily observe the competitive actions of the focal retailer by browsing through the retailer's website, which might put the retailer at a disadvantage. On the other hand, given the abundance of information, consumers are empowered to make better purchase decisions. Internet technologies will allow consumers to compare offerings from different retailers at virtually no cost. Indeed, they can conveniently change retailers

due to very low switching costs (Campbell et al., 2013). As a result, online retailers "must face the challenge of confronting this new open, dynamic, and information-rich business environment" (Granados et al., 2010, p.207).

Arguably, customer agility is the key to survival and prosperity within a turbulent e-commerce environment. Customer agility is the ability to leverage the voice of the customer to achieve market intelligence and to explore competitive action opportunities (Sambamurthy et al., 2003). This facilitates the formulation of effective competitive actions that enable online retailers to attract and retain customers, despite customer information search and switching costs being very low. The popular online retailer Amazon.com collects and analyzes all kinds of customer information to generate personalized recommendations and improve customers' shopping experience. Ebay.com, meanwhile, gains many innovative ideas by gathering and processing messages shared by its customers in a virtual customer community. Both cases show the salience of customer agility in enabling online retailers to gain competitive advantage. Furthermore, it seems that customer agility is achieved through information management, as it allows online retailers to detect customer needs and conceive an appropriate response to meet these needs. This is essential for online retailers, since it helps improve interactions with customers and build a positive relationship to encourage repurchases (Tam & Ho, 2005). With the increasing usage of e-commerce websites as a sales channel, abundant information has been gathered by online retailers. This raises the need to strategically manage information for competitive advantage. The current study attempts to provide a plausible solution by investigating the process of managing information for customer agility.

The research question of this study, then, is as follows: *how does information management enable online retailers to achieve customer agility?* I synthesize

the information management literature to propose an integrative information management framework composed of three interrelated components: information management structure, information management capability and information management culture. Based on the agility literature, agility is developed through the complementary intertwining of information technologies (IT) with organizational structures, skills and cultures (Sambamurthy et al., 2003). Consistently, I posit that customer agility develops through the complementary intertwining of information management structures, information management capabilities and information management cultures. By conducting a case study of a leading Chinese B2C company, I observe three types of customer agility (i.e. reactive customer agility, proactive customer agility, and coactive customer agility) in different phases of the growth of the company. Accordingly, information management varies across different types of customer agility. Furthermore, I develop a process model which demonstrates how information management enables online retailers to achieve the three types of customer agility.

This study addresses three gaps in the literature. First, I develop and validate an integrative information management framework that synthesizes the findings of existing studies. It responds to the research gaps pointed out by Mithas et al. (2011), namely that researchers are not taking the lead in developing conceptual and theoretical models of information management that can provide management implications. This contribution is also valuable because information management has become increasingly crucial in this era of information explosion. Second, despite the literature considering IT as a source of customer agility (e.g. Sambamurthy et al., 2003; Roberts & Grover, 2012), the process by which customer agility is developed has not been previously studied. Current research develops a process model to fill the

theoretical gap, and provides a typology of customer agility to enrich the scare literature on customer agility. Finally, this research seeks to contribute to the business value of IT literature by developing a process model that shows how information management enables online retailers to achieve customer agility. Few studies have investigated the impact of information management on organizational performance (Mithas et al., 2011). Kohli and Grover (2008) point out that the way in which information management capabilities may enhance digital business capabilities is an increasingly important topic, which has thus far been neglected. The current study fulfills this theoretical gap.

3.2 Theoretical Background

3.2.1 Customer Agility

Customer agility refers to the ability of online retailers to leverage the voice of the customer to achieve market intelligence and explore opportunities for competitive action (adapted from (Sambamurthy et al., 2003)), and highlights the pivotal role of customers in stimulating firms' competitive actions in e-commerce industry (Nambisan, 2002). Online retailers can gain innovative ideas from customers by facilitating the interactions between firms and customers as well as eliciting interactions among customers (Roberts, 2009). This has become a critical source of competitive action that helps online retailers attract new customers and retain existing ones in an online retailing environment (e.g. Zhang et al., 2011). For example, the interactions between customers and sales websites generate a considerable amount of data which can be used to reveal customers' habits and preferences. This knowledge leads to customized content, offerings and services that meet individual customers' needs. Thus customer agility is of great significance to online retailers.

Prior work on customer agility centers on examining the antecedents and the performance impacts of customer agility (e.g. Sambamurthy et al., 2003; Roberts & Grover, 2012; Roberts, 2009). In a conceptual study, Sambamurthy et al. (2003) discuss the role of IT in enabling customer agility as well as the impact of customer agility on firms' competitive actions. Roberts (2009) proposes a variance model of customer agility, and empirically examines the relation between IT and customer agility as well as the relation between customer agility and competitive activities. Roberts and Grover (2012) divide customer agility into sensing and responding capabilities and investigate the impact of the alignment between the two capabilities on firm performance. Despite the literature considering IT as a source of customer agility, the process through which customer agility is developed has not been studied previously. This might be due to the implicit assumption that equates the implementation of IT with the achievement of customer agility (e.g.Roberts & Grover, 2012). However such an assumption might not be true, since the organizational impact of IT is limited unless it is aligned with the business processes of an organization (Porter, 2001). As a result, there is a need to examine how to develop customer agility to fill the theoretical gap.

Advances in IT offer online retailers many feasible design choices for developing customer agility. Some responsive technical features (e.g. online product review and live chat) allow online retailers to enhance the interactivity of website so that customer needs will be addressed during the shopping process (Jiang & Benbasat, 2007; Jiang et al., 2010). Based on insights generated through analyzing customer data, some features (e.g. recommendation agents) enable online retailers to provide customized content to serve the needs of individual customers (Zhang et al., 2011; Ho et al., 2011). Furthermore, virtual communities (e.g. online forum) can be leveraged by

online retailers to generate a compelling shopping environment where customers can discuss their shopping experiences (Nambisan, 2002). These technologies bring about different ways to interact with customers, as well as different approaches to leverage customer insights. As a result, customer agility might emerge in several different patterns. In this study, I attempt to examine the development of customer agility and the impact of different technologies upon customer agility.

3.2.2 Information Management Literature

Information management plays a critical role in enabling firms' customer agility. Karimi et al. (2001) find that the ability to configure firms' IT resources and offer key stakeholders timely, accurate, and reliable information helps improve customer service and customer relationships. Nambisan (2002) reports that firms can acquire customer information and disseminate it to customers through the Internet, virtual communities, and personalized information channels with better information management capabilities. A recent study conducted by Mithas et al. (2011) shows that information management capability is crucial for building other firm capabilities for customer management, process management, and performance management. They further demonstrate the significance of information management in improving firm performance. I expect this relationship between information management and customer agility will hold for B2C companies. Information management allows online retailers to capture customer information through the online channel, analyze it for market intelligence and disseminate it to facilitate favorable customer interactions via the sales websites. This is beneficial in attracting and retaining online customers (Tam & Ho, 2005). Therefore, information management is a critical enabler of online retailer's customer agility.

To study the development of customer agility, I synthesize the information management literature to propose an integrative information management framework that is composed of three interrelated components: information management structure, information management capability and information management culture. Information management structure refers to a set of IT used to support various information management activities of online retailers (Kwon et al., 2007). It is the basic artifact and foundation of information management for online retailers. Information management capability is an online retailer's capability to collect, analyze and disseminate information (Mithas et al., 2011). It is developed through interactions with a specific set of information technologies used by online retailers. Information management culture refers to a set of organizational cultures which root in information management activities and will affect the effective use of information (Marchand et al., 2000). It helps predict the information management behaviors of organizational members. Based on agility literature, agility is developed through the complementary intertwining of IT with organizational structures, skills and cultures (Sambamurthy et al., 2003). Consistently, I posit that customer agility develops through the complementary intertwining of information management structures, information management capabilities and information management cultures. The information management framework responds to the research gaps pointed out by Mithas et al. (2011), namely that researchers are not taking the lead in developing conceptual and theoretical models of information management that can provide management implications. I will further review existing works on the three components to develop an integrative information management framework.

Information Management Structure: Information management structure refers to a set of IT used to support various information management activities of

firms (Kwon et al., 2007). Contemporary organizations are using IT to redesign themselves in order to compete more effectively (Lee & Grover, 1999). Gattiker and Goodhue (2005) report that Enterprise Resource Planning (ERP) systems allow firms to integrate business processes, leading to high quality information and better coordination between different units of the firms. Based on Kwon et al. (2007), IT is leveraged by firms to support the highly responsive network-based structure, in an effort to effectively facilitate information processing, communication and knowledge sharing. Premkumar et al. (2005) examine the role of various IT (e.g. EDI, private Web, and public e-marketplace) in enabling the establishment of communication structures across organizations in a supply chain context. Therefore, IT-enabled information management structures offer firms an effective way of managing information.

Information management structures often serve as the backbones that facilitate information and knowledge-based activities for B2C companies. The rapid advances in IT provide many tools to online retailers to manage information, thereby leading to many different types of information management structure. For example, with the abundance of information processed and gathered by sales websites, online retailers are utilizing data mining technology to detect competitive action opportunities by profiling their customers and revealing their habits and preferences (e.g. Xiao & Benbasat, 2007; Adomavicius & Tuzhilin, 2005). Some online retailers have established online communities, in which customers can share their shopping experiences, discuss products and make product recommendations (e.g. Nambisan, 2002). These technologies have become increasingly significant in terms of the competitiveness of B2C industry, and conceptualizing various technologies using IT-enabled

information management structures helps me understand the role of IT in information management.

Information Management Capability: Information management capability is defined as a firm's capability to manage information effectively over the life cycle of information use, which includes sensing, collecting, organizing, processing and disseminating information (Marchand et al., 2000). While IT infrastructure offers online retailers the base foundation, the capability to manage information is of greater salience in influencing firm performance (Mithas et al., 2011; Cotteleer & Bendoly, 2006). Most of the previous studies in the IS field center on technology (e.g. research on technology adoption and implementation) instead of information. However, firms' information management practices and their impact upon business performance are largely neglected. As noted by Kohli and Grover (2008, p. 32), "firms might possess good business capabilities, but to make a meaningful difference in operational excellence and competitive response, these capabilities can be enhanced not only by IT, but also by the ability to manage and exploit information to create information capabilities".

Information management capabilities allow online retailers to harness customer insights by collecting, analyzing and disseminating customer information. Mithas et al. (2011) report that information management capability is crucial for building other firm capabilities for customer management, process management and performance management. They further demonstrate the significance of information management in improving a firm's performance. Thus, I expect that the capability to manage information will facilitate the development of customer agility for B2C companies. This capability can enable online retailers to generate customer insights by analyzing information and to facilitate favorable customer communications

and interactions (e.g. Zhang et al., 2011; Ho et al., 2011). As I have mentioned, online retailers are empowered with many effective technologies, which provide them with the *capacity* to manage information. This raises the need to develop specific information management capabilities to exploit the business value of these technologies.

Information Management Culture: Existing research shows that information management activities are often closely intertwined with organizational cultures (e.g. David et al., 2000; Hall, 1983; Leidner & Kayworth, 2006; Marchand et al., 2000). According to Anand et al. (1998), successful information management is critically dependent on the self-motivated efforts of members and their willingness to participate in information management activities. Thus, they argue that information management is likely to be more effective in organizations with cultures that encourage employee initiative and participation. Consistently, Jarvenpaa and Staples' (2001) study indicates that organizations with a solidarity (tendency to pursue shared objectives) and need for achievement culture will have greater levels of information sharing activities. Thus, this type of organizational cultures influences organizational information management activities by changing the behaviors of organizational members.

I define information management cultures as a set of organizational cultures or shared values (such as integrity, sharing, and proactiveness) which are rooted in information management activities, and will affect the effective use of information (Marchand et al., 2000). It influences the information management behaviors of members of B2C companies, and thereby, the process of information activities. There are several types of information management culture identified by Marchand et al. (2000). For example, information integrity is an organizational value that is against the behaviors of

manipulating information for personal gains, such as keeping information to oneself, purposely passing on inaccurate information or distributing information to justify decisions after the fact. Information proactiveness is another type of culture that is present when organizational members actively explore and respond to competitive action opportunities and leverage information to enhance existing and create new products or services. Information sharing is a value that treasures the free exchange of non-sensitive and sensitive information. It occurs within organization and across organizational boundaries (i.e., with customers, suppliers and partners). A summary of three components of an integrative information management framework is showed in Table 3-1.

Table 3-1. Components of an Integrative Information Management Framework

Components of Information Management	Definition	Description or Examples	Key Sources
Information Management Structure	This refers to a set of IT used to support various information management activities of firms (Kwon et al., 2007).	Technologies used to establish information management structures include ERP systems, EDI, data warehouse, online forum, etc. For example, online retailers can establish online communities where customers can share their shopping experiences, discuss about the products, and make product recommendations (e.g.	e.g. (Nambisan, 2002), (Kwon et al., 2007), (Gattiker & Goodhue, 2005), and (Premkumar et al., 2005)

		Nambisan, 2002).	
Information Management Capability	This refers to a firm's capability to manage information effectively over the life cycle of information use, which includes sensing, collecting, organizing, processing and disseminating information (Marchand et al., 2000).	It might include (1) provide data and information to users in an accurate, timely, reliable, secure, and confidential manner, (2) offer universal connectivity and access with adequate reach and range, and (3) adjust the infrastructure for emerging business goals and directions (Mithas et al., 2011).	e.g. (Mithas et al., 2011), (Kohli & Grover, 2008), (Marchand et al., 2000), and (Marchand, 2005)
Information Management Culture	This refers to a set of organizational cultures or shared values which root in information management activities and will affect the effective use of information (Marchand et al., 2000).	Some information management cultures include integrity, formality, control, sharing, transparency, and proactiveness. For example, information proactiveness presents when organizational members actively explore and respond to competitive action opportunities and leverage information to enhance existing and create new products or services(Marchand et al., 2000).	e.g. (Anand et al., 1998), (Marchand et al., 2000), (Leidner & Kayworth, 2006), and (Jarvenpaa & Staples, 2001)

3.3 Methodology

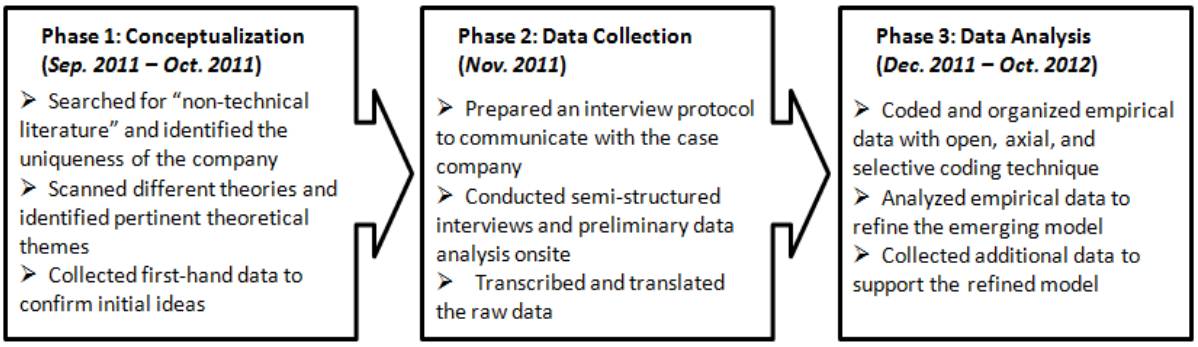
Given limited evidence as to how information management enables online retailers to achieve customer agility, I adopted a case research method to explore the research question (Eisenhardt, 1989). This method is appropriate in examining a "how" question (Walsham, 1995). Furthermore, both information management and customer agility are complex and multi-faceted phenomena that are embedded in organizational context (Pentland, 1999), thereby, investigating the phenomena through relevant stakeholders' interpretations is more suitable than applying a quantitative approach (Klein & Myers, 1999).

I selected Karta (a pseudonym) as the case company for this inquiry. Karta is one of the biggest Chinese B2C companies with over 40 million users and more than 16 million U.S. dollars turnover daily. This company is chosen for four reasons. First, the large customer base could make the interactions and communications between the company and its customers very complicated, leading to a need to develop customer agility. Second, the sales website of the company is well recognized by consumers as one of the best B2C websites in China. This achievement stems from a thorough understanding of the online shopping needs of its customers. Thus I expect the company to have achieved customer agility. Third, my observations of the sales website show that it generates a favorable online shopping environment by facilitating effective communications and interactions with customers, offering customers personalized information and managing a popular online community for customer interactions. It seems that customer agility is achieved through effective information management. Finally, the sales website incorporates a comprehensive set of B2C technologies, such as live chat, online product review, recommendation agent, and online customer community. This brings

about the complexity of the role of IT and the types of customer agility developed. Thus, this company is particularly appropriate for this study.

I followed the theory-building process as prescribed by Eisenhardt (1989) to design and conduct this study. The investigation took place over a fourteen-month period between September 2011 and October 2012. This process was further divided into three phases (see Figure 3-1), which are introduced as follows.

Figure 3-1. A Summary of Three Phases of the Investigation



3.3.1 Conceptualization

In Phase 1, I spent two months on conceptualizing the phenomenon and developing the theoretical lens. I started by searching for "non-technical literature" such as books, magazines, biographies of the CEO of the company, newspapers, and electronic articles, which allowed me to become better acquainted with the company (Pan & Tan, 2011, p.166). The information gathered from these sources was further organized into formal slides, which were presented in front of several case study researchers. I dug for the uniqueness of the company through discussions. Meanwhile, I scanned different theories from both management and IS literature. This led me to some pertinent theories or theoretical constructs, such as customer agility and information management literature. Accordingly, an initial set of pertinent themes (e.g. information management structure, information management

capability, and information management culture) was identified. I also collected some first-hand information from my Chinese collaborator. This information confirmed the archival data collected, as well as my initial ideas. The pertinent themes were adjusted several times once the archival data were updated or new theoretical constructs were identified. This set of themes formed a "sensitizing device" (Klein & Myers, 1999) to guide the following data collection and analysis.

3.3.2 Data Collection

In Phase 2, I mainly focused on issues relevant to data collection, such as preparing an interview protocol, conducting onsite interviews, and organizing the raw data. An interview protocol, including an introduction of the research objectives, a guideline of the interview, a set of interview questions, and resources needed, was compiled into a formal document and sent to the case company for their preparation (see Appendix 7-6). The onsite data collection was conducted in November 2011. A series of individual interviews were conducted with the middle and top management of IT department and human resource department (see Appendix 7-7). The middle managers of IT department provided details of the development and management of IT in their daily works, while the top management of IT department and human resource department offered a high level strategic view of Karta's development. Interview questions were designed to be open-ended, covering history, best practices and a typical workday routine (see Appendix 7-6). The initial theoretical themes identified in Phase 1 served an important role in ensuring that open-ended interviews continuously followed a general direction and a clear structure (Pan et al., 2007). Each informant was assured of the confidentiality of the data provided, especially when potentially sensitive information was sought (Walsham, 2006). Each interview involved multiple

investigators in order to enhance the creative potential of the study as well as confidence in the findings (Eisenhardt, 1989). The six investigators were split into two groups: one group of two was responsible for asking questions, while the rest listened, made notes and asked for clarification if needed.

I conducted preliminary data analysis at the same time as the data collection, to benefit from the flexibility offered by case study method (Eisenhardt, 1989). A significant feature of the case study is that concepts can emerge from data, rather than being restricted by a priori hypotheses (Strauss & Corbin, 1990). This required me to adjust my direction once a new concept arose. A short discussion between all the investigators was conducted following each interview to compare different interpretations. Furthermore, a follow-up discussion was conducted after all the interviews every day to analyze information gathered from interviews and adjust interview questions for the coming interviews. The fifteen interviews, taking an average of 90 minutes, were recorded digitally and later transcribed and translated. Whereas the interviews formed the primary source of data, they were corroborated by onsite observations and secondary data such as internal publications, organizational documents and field notes. Multiple data collection allows for triangulation, offering stronger substantiation of theoretical constructs and hypotheses (Eisenhardt, 1989).

3.3.3 Data Analysis

Three coding techniques (i.e. open coding, axial coding and selective coding) were applied to analyze the interview data. First, I started by using an open coding technique (Strauss & Corbin, 1990) to examine the information management practices and the achievement of customer agility. Open coding was executed through placing conceptual labels on the data to uncover general

recurrent themes that help explain the phenomenon. Some of the conceptual labels used in this research – such as offering members with legitimate roles and granting members access to community representatives (Porter & Donthu, 2008) – were suggested by the literature, while others – such as establishing a synergy of the sales website and the virtual community – were suggested by the data (Strauss & Corbin, 1990). Following this, I linked similar concepts from open coding into theoretical constructs through axial coding (Strauss & Corbin, 1990). Associations among concepts were made primarily according to the integrative information management framework and existing literature. In continuing with the previous example, offering members with legitimate roles and granting members access to community representatives are suggested by the literature as a mechanism to embed community members; while it can be inferred that establishing a synergy of the sales website and the virtual community also enables the company to foster member embeddedness. For these concepts, the common underlying theme is developing embedding capability. Axial coding enables me to generate a meaningful comprehension of the phenomenon of interest (Lim et al., 2012). Finally, the selective coding technique was used to integrate and refine concepts for a coherent picture of the phenomenon examined (Strauss & Corbin, 1990). I treated the process of managing information for customer agility as the core phenomenon of interest. A story line was created to describe this process. Furthermore, I integrated and linked constructs identified from axial coding to the core phenomenon. This was accomplished by examining back and forth the interview data, the relevant literature and the emerging model. The emerging model was presented to a panel of academics and practitioners who were responsible for challenging the underlying logic and data accuracy. The analysis process lasted more than five months until the model reached theoretical saturation, in which newly collected data began to be repeated and failed either to dispute

the model or reveal new themes (Eisenhardt, 1989). The arrival of this stage was confirmed by several experienced case researchers. Throughout the investigation, Klein and Myer's (1999) principles were applied to ensure the reliability and validity of the interpretive field study (see Table 3-2).

Table 3-2. Application of Klein and Myer's (1999) principles for interpretive study

Principle	Evaluative Criteria for Principle [as summarized from Klein and Myers (1999, p.72)]	Application of the Principle in the Current Research
The Fundamental Principle of the Hermeneutic Circle	Requires that "all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form"	Interviews were conducted with the middle and top management of the IT department and HR department (see Appendix 7-7). The middle managers of IT department provided the details of the development and management of IT in their daily work, while the top management of the IT department and HR department offered a high level strategic view of Karta's development. Each interview was guided by some general questions (see Appendix 7-6) at the beginning. This enabled the researchers to establish an appreciation of the whole context.
The Principle of Contextualization	"Requires critical reflection of the social and historical background of the research setting, so that the intended audience	The interviewees ranged from seniors (who witnessed the historical development of the company from start to the time when the study was conducted) to junior employees who had joined the company in later phases

	can see how the current situation under investigation emerged"	(see Appendix 7-7). This allowed the researchers to gain an understanding of the organizational events and decisions leading to Karta's development.
The Principle of Interaction Between Researchers and Subjects	"Requires critical reflection on how the research materials (or 'data') were socially constructed through the interaction between the researchers and participants"	The six investigators were split into two groups: one group of two was responsible for asking questions, while the rest listened, made notes and asked for clarification if needed. The findings were constantly shared with interviewees to obtain feedback. I adjusted the interview questions once a new concept emerged.
The Principle of Abstraction and Generalization	"Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action"	The pre-identified set of themes from customer agility and information management literature constituted the "sensitizing device" (Klein & Myers, 1999) to guide the data collection and analysis. It served an important role in ensuring that the open-ended interviews continuously followed a general direction and a clear structure (Pan et al., 2007). Field notes were taken during the interviews to relate the case details to theoretical, general concepts that described the nature of the phenomenon of interest.
The Principle of Dialogical Reasoning	"Requires sensitivity to possible contradictions between the theoretical preconceptions guiding	Open coding technique allowed me to generate conceptual codes from general socio-technical concepts related to the historical development of the company.

	the research design and actual findings ('the story which the data tell') with subsequent cycles of revision"	These codes were combined into theoretical constructs through the application of pre-identified themes. The process model was generated by examining back and forth the interview data, the relevant literature and the emerging model.
The Principle of Multiple Interpretations	"Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study; similar to multiple witness accounts even if all tell it as they saw it"	I applied the rule of triangulation (Eisenhardt, 1989) to ensure the convergence of interpretations by interviewees from different levels and work areas. A short discussion between all the investigators was conducted following each interview to compare different interpretations. Furthermore, a follow-up discussion was conducted after all interviews every day to analyze data gathered from interviews and adjust interview questions for the coming interviews.
The Principle of Suspicion	"Requires sensitivity to possible 'biases' and systematic 'distortions' in the narratives collected from the participants"	Whereas interviews formed the primary source of data, they were corroborated by onsite observations and secondary data such as internal publications, organizational documents and field notes. Multiple data collection allows for triangulation, offering stronger substantiation of theoretical constructs and hypotheses (Eisenhardt, 1989). The emerging model was presented to a panel of academics and practitioners

		who were responsible for challenging the underlying logic and data accuracy. The analysis process lasted more than five months until the model reached theoretical saturation, in which newly collected data began to be repeated and failed either to dispute the model or reveal new themes (Eisenhardt, 1989).

3.4 Case Description

3.4.1 Organizational Background

Since Karta started its B2C business in 2004, the company has experienced a remarkable increasing rate of over 200% for seven consecutive years. This record has been hardly seen in the entire Chinese e-commerce industry. In 2010, the company had become one of the Top 3 B2C companies in China with more than 1.57 billion U.S. dollars sales per year and 35.6% market share. Nowadays, the company has more than 40 million users and around 6,000 suppliers offering a comprehensive list of high quality products. Around 300,000 customer orders are processed daily with more than 50 million page views performed.

As a B2C company, the salience of IT for Karta is without a doubt. The CEO of the company is a technical savvy person who had programmed for the websites since its inception. He highlights the significance of excellent user experience in determining the success of B2C companies and strategizes IT as the locomotive of the company toward generating excellent user experience. So IT department takes the responsibility for driving the innovation and providing more convenient services to meet customer online shopping needs. The sales website of the company is well recognized by consumers as one of

the best B2C websites in China. It generates a favorable online shopping environment by facilitating effective communications and interactions with customers, offering customers personalized information, and managing a popular online community for customer interactions.

Compared with the offline business, a prominent feature of e-commerce is that selling a product online has become a highly information-intensive work. This can be interpreted from three aspects. Firstly, the physical layout of a traditional offline shop is replaced by a virtual environment full of all sorts of information. There is a need to organize the information to ensure that customers are able to find the information needed. Secondly, much customer information (e.g. transaction information) can be captured in the online platform. It takes significant efforts to leverage this information for competitive advantage. Thirdly, with the emergence of Web 2.0, user-generated information is highly valued. However, how to engage customers in generating valuable information and manage this information remains a headache for most e-commerce companies.

The interviews with Karta's top management and IT professionals show that the company has realized the crucial role of information management for e-commerce success and its associated challenges. This is reflected by one of the informants: "*as an e-commerce company, the most valuable thing is information*". I also observe that as the company grows, it incorporates more advanced technologies into sales website for the purpose of attracting and retaining customers. This also brings about different patterns of information management. Based on different types of technologies developed, I divide the development of the company into three phases: information-based e-commerce (2004-2009), intelligence-driven e-commerce (2009-2010), socialized e-commerce (2010-2011). This longitudinal periodization is

indicated by interviewees. I developed the naming of the phases according to the focus of each phase. Data collected are presented according to the sequence of three phases in the subsections that follow.

3.4.2 Information-based e-Commerce (2004 – 2009)

Karta started its B2C business in 2004. At that time, the outbreak of Severe Acute Respiratory Syndrome (SARS) in China precluded people from going shopping in bricks-and-mortar stores, providing an opportunity for the growth of e-commerce. The company was one of the B2C companies that seized this opportunity. From 2004 to 2009, it centered on reacting to the information needs of online shopping by developing website features that allowed customers to navigate through the web pages readily and gain the relevant information. Thus it is named "information-based e-commerce".

Since 2004, the company has witnessed a dramatic growth in online sales. The rapid increase of customer orders brought significant pressures to the website and systems. As a result, the company twice went through website and systems reconstructions in 2007 and 2009. This led to an interactive website and an integrated ERP system. The ERP system allowed the sales website to retrieve quality information about every aspect of the company, offering strong support to the interactive technical features. It also enabled customer representatives to access various real-time information such as customer information, transaction history and product details. The integrated system brought about high flexibility in reacting to the information needs of online customers.

As quality information was available, the company developed an interactive sales website that enabled customers to find relevant information readily. The CEO of the company highlighted the significance of excellent user experience

in determining the success of B2C companies, and took charge of the overall design of the website. A project team was designated to solve user experience design (UED) issues. This enhanced the organizational ability in designing the overall layout and individual components to meet the information needs of online shopping. The website offered customers many helpful technical features, such as a search engine, product navigation tools and online order tracking. It also provided effective communication tools (e.g. online Q&A, e-mail connection with customer representatives, and product review tools) in case customers failed to find relevant information.

While the communication tools allowed customers to gain more relevant information, they also raised a challenge to the company. To ensure excellent user experience, the company should be able to provide a timely response to customer enquiries. In this case, customer enquiries or comments were given higher priority as compared to the internal needs of the company. Furthermore, customer representatives were given restricted time to offer a response to customer enquiries. I observed a lot of positive comments on the fast reaction of customer representatives. Moreover, the company provided a "promise" delivery date to customers after purchase. This helped reduce customer enquiries, thereby relieving the pressure on customer representatives.

In this phase, the company was responsive to the information needs of online customers. Many customers interacted with the company via communication tools, providing numerous valuable comments. This became an important reference for website interactivity design. For example, the company did not provide online order tracking at the beginning. However, customer representatives reported that many customers made frequent enquiries about delivery status after they bought expensive products such as a laptop. Inspired by this information, the IT department developed detailed online order

tracking tools to meet information need. By reacting to the information needs of online customers, the company developed the ability to leverage customer comments for competitive actions. The exemplary quote and relevant codes identified under 'information-based e-commerce' are summarized in Table 3-3.

Table 3-3. Exemplary Quote and Codes Identified for "Information-Based E-Commerce"

Exemplary Quote	Axial Codes
"*The system-reconstruction in 2009 aimed at integrating back-end operational systems. I was the team leader. Before the reconstruction, many systems were isolated. From 2009, we incorporated technologies from external sources. The reconstruction resulted in a set of integrated operational systems.*" – Director of Logistics System Development Division "*We have integrated ERP systems in the back-end. Customer representatives can find much relevant information from the systems, such as customer information, transaction information, including some inquiries about the products.*" – Director of Software Quality Assurance Division	**Information Management Structure**
"*We have a unified and consistent plan for website design that helps solve design issues, such as how the template is embedded in the website, where to place an advertisement, what kinds of recommendation should be provided. … It includes website design, website development, interactivity design, and user research.*" – Director of Website Data Management Division "*Actually user experience design is a broad topic that requires the efforts of the whole company. Our boss is the chief decision maker for user experience design. He will make the final decision for user experience design issues.*" – Director of Website Product Division	**Information Management Capability**

"*Some of the customer enquiries are answered by customer representatives. The integrated systems enable them to retrieve information needed rapidly. Some of the enquiries are answered by the system automatically. So we can reply to customer enquires in a fast manner.*" – Director of Website Data Management Division "*There are some suggestions or complaints from customers. Usually I pay more attention to the issues raised by customers than the problems of internal systems. I think directors of other divisions have the same understanding toward solving these issues.*" – Co-Director of Website Product Development Division responsible for transaction systems	**Information Management Culture**

3.4.3 Intelligence-driven e-Commerce (2009 – 2010)

Given the massive amount of information accumulated from the previous phase, Karta attempted to ferret out useful knowledge from the wealth of information for competitive actions. This led the company to adopt data mining technology. As from 2009, the company has invested considerable effort in using data mining technology to extract valuable insights and offer customized contents to meet the information needs of individual customers. Therefore, I name it "intelligence-driven e-commerce".

The company established a data warehouse in 2009, which was the first step towards data mining. A data warehouse served as the infrastructure to mine useful knowledge out of the data available. Subsequently, two divisions of the IT department were assigned to collect and manage data from the sales website and the back-end systems (e.g. ERP system, finance system and logistics system) respectively. Data collected included customer information, transaction data and operational data, amongst others. The sales website and the existing systems were adjusted accordingly where additional information

was needed. Data management divisions established several algorithms and analytical models to transform data into more meaningful pieces of information, such as detailed customer segmentations. This knowledge thus became the source of many innovative competitive actions.

The foremost value of the knowledge extracted from data was to help the company create customized contents based on the needs of individual customers. Accordingly, the company devised many competitive actions to leverage knowledge. For instance, it launched the e-mail direct marketing (EDM) based on the detailed customer segmentations. EDM was a marketing approach that used e-mail to disseminate promotion information to customers. The company tailored promotion information according to customers' habits and preferences identified, thus increasing the success rate of the marketing campaign. Another example was to offer customized recommendations for customers during the shopping process. The recommendation tools increased exposure to products that might meet customer needs, and thereby encouraged impulsive purchase. As an improved understanding of customers' habits and preferences was available, the company developed the ability to tailor its offers to meet customer needs.

Despite data mining technology having demonstrated its value in facilitating online sales, the members of the company continued to explore various applications to take full advantage of the technology. IT professionals attempted to understand business needs, and sought to identify the alignment between business and the functions of technology. The company benefited considerably from data mining, leading to the formation of an organizational climate that treasured the value of information. This was reflected in a saying from the company, "*let the data speak*". Furthermore, the entrepreneurial

culture of the company incited organizational members to aggressively leverage this technology for more competitive actions.

In this phase, the company took the initiative of identifying the habits and preferences of individual customers and customizing its offers to meet the needs of individual customers. As increasing customers shopping on the company's sales website, a large amount of customer information was captured. This information provided an essential source for analyzing customer behavior and generating a deeper understanding of customer needs. This was done with the support of data mining technology. By taking the initiative to understand customers' habits and preferences, the company developed the ability to leverage valuable customer data for competitive actions. Exemplary quote and relevant codes identified under 'intelligence-driven e-commerce' are summarized in Table 3-4.

Table 3-4. Exemplary Quote and Codes Identified for "Intelligence-Driven E-Commerce"

Exemplary Quote	Axial Codes
"*Information collected includes the interactions between customers and the sales website, such as the click-stream data. It also includes the transactional information, such as customer orders and relevant information. Furthermore, the interactions between customers and our customer representatives are also recorded and gathered.*" – Director of Website Data Management Division "*If there is a need to collect information that is not recorded by existing systems, we will suggest a revision to the existing systems. Once the information needed is collected, we will extract and clean data. Then the data are stored in data warehouse where they are classified by different themes, such*	**Information Management Structure**

as customer online behaviors, transactions, and products. " – Director of Back-end Data Management Division	
"*The e-mail Direct Marketing is a good example of how we use data. We collected customer data, transaction data and operation data, and then we analyze data and generated customer segmentations. The results will guide the e-mail Direct Marketing. This approach is also used for advertisement and recommendation.*"–Director of Website Data Management Division "*We offer customized recommendations to meet the preferences of individual customers. For example, a store might recommend beer when people buy diapers. Why? The buyers could be men. It is possible that they also want to buy beer. The data mining technology allows us to discover this kind of correlations. We can leverage this knowledge to provide customized recommendations.*" – Co-Director of Website Product Development Division responsible for recommendation systems	**Information Management Capability**
"*It would be very difficult for business people to clarify their requirements. They don't know to whom the website should provide recommendations. However, we (IT professionals) are more capable to do it. We can gain knowledge from analyzing massive amounts of data. So it is important for us to extract knowledge from data to help achieve business goals of the company.*" – Director of Website Product Division "*Karta is a startup company growing with a high speed. We considered ourselves as entrepreneurs. Many middle managers joined the company with a lower salary compared with the previous job and they are strongly motivated to make contributions to the growth of the company.*" – Director of Software Quality Assurance Division	**Information Management Culture**

3.4.4 Socialized e-Commerce (2010 – Present)

Virtual communities (e.g. Facebook) assume increasing importance as Internet users are spending more time on them. Many firms have launched virtual communities for their customers with the aim to increase sales, gain positive word of mouth, and increase information sharing. Karta also took initiative to leverage this emerging technology for competitive actions. It has invested a lot in establishing a virtual community where its customers can share their shopping experiences, discuss products, and make product recommendations. So I name it "socialized e-commerce".

In 2008, the CEO of Karta set up a strategic goal of "socializing" the sales website with a virtual community, which meant that the sales website was going to host a virtual community. He indicated that a virtual community allowed customers to review products, share shopping experiences, and acquire latest product information. In 2010, the company officially launched a virtual community. A division of IT department was designated to take responsibility for the development and management of the virtual community. The company hired a lot of talented people who were good at developing social network sites to propel the development of the online community. The CEO expected the virtual community to enhance the stickiness of the sales website by facilitating interactions between the company and customers, as well as among customers.

However, before the virtual community could contribute to the sales website, it was confronted with the challenge of attracting and retaining members. The company designed the policy elements and information cues of the virtual community to foster a sense of belonging. Some of the examples include granting members access to customer representatives to encourage feedback, ranking memberships into different levels (e.g. silver and golden) and showing

membership information in members' profiles to signal their contributions. Furthermore, the company established the synergy of the sales website and the community to transform customers into community members. The linkage between the sales website and the community was established by showing the products brought from the sales website in members' profile pages.

The company strove to nurture the behavior of sharing shopping experiences to sustain the virtual community in a long run. It arranged the layout and organized the contents of the virtual community to nurture sharing behavior. For example, members were encouraged to upload images to show off the products bought from the sales website. These posts were displayed in the home page of the community, making their contributions more obvious to other members. The contents were organized into different circles, attracting members with similar interests, so that they shared a common topic to discuss. Furthermore, incentives (e.g. bonus points or coupons) were provided to behaviors that contributed to the common wealth of the community.

In this phase, the company attempted to establish a virtual community for more useful information and increased sales. The virtual community allowed its customers to share their shopping experiences, discuss products and make product recommendations. Customers may find helpful information from the community to complement the limited information presented in the sales website. The company can discover many innovative ideas from the discussions among community members. By encouraging customers to create value for the virtual community, the company developed the ability to leverage customers' innovative ideas for competitive actions. Exemplary quotes and relevant codes identified under 'socialized e-commerce' are summarized in Table 3-5.

Table 3-5. Exemplary Quote and Codes Identified for "Socialized E-Commerce"

Exemplary Quote	Axial Codes
"*Our boss talked about the development of a user community last year. He emphasized the significance of a user community and strategized it as a tool to 'socialize' the e-commerce website.*"– Director of Platform Architecture Division "*The community of Karta is doing well. This is probably because we have accumulated a sound customer base. This kind of online shopping community contributes a lot to the development of our company.*" – Director of Chendu Research Institute	**Information Management Structure**
"*The most important thing of building a user community is to develop a variety of applications, such as product review, product show-off (an application that allows user to post the pictures of products they bought) and so on. This helps attract users.*" –Co-Director of Website Product Development Division responsible for transaction systems "*We care about the views of customers. They might make complaints in the user community. We also allow them to access our customer representatives in the user community, so that they can offer us with suggestions and comments.*" – Director of Website Product Division	**Information Management Capability**
"*A successful story is the "Tui Jian You Li" (which means you can get benefits from recommending products to your friends). Customers can develop their own circles in the user community. We provide technical supports for them to recommend a product to their circles. We also provide some incentives to a successful recommendation.*" – Co-Director of Website Product Development Division responsible for recommendation systems	**Information Management Culture**

"*Customers post many product reviews in the user community. This attracts many customers, leading to more purchases and more members willing to share their product experiences. … Currently, the sharing behaviors in online community are driven by incentives, such as bonus points. Consumers share information or attend discussion for the attractive bonus points.*"– Director of Website Product Division	

3.5 Discussion

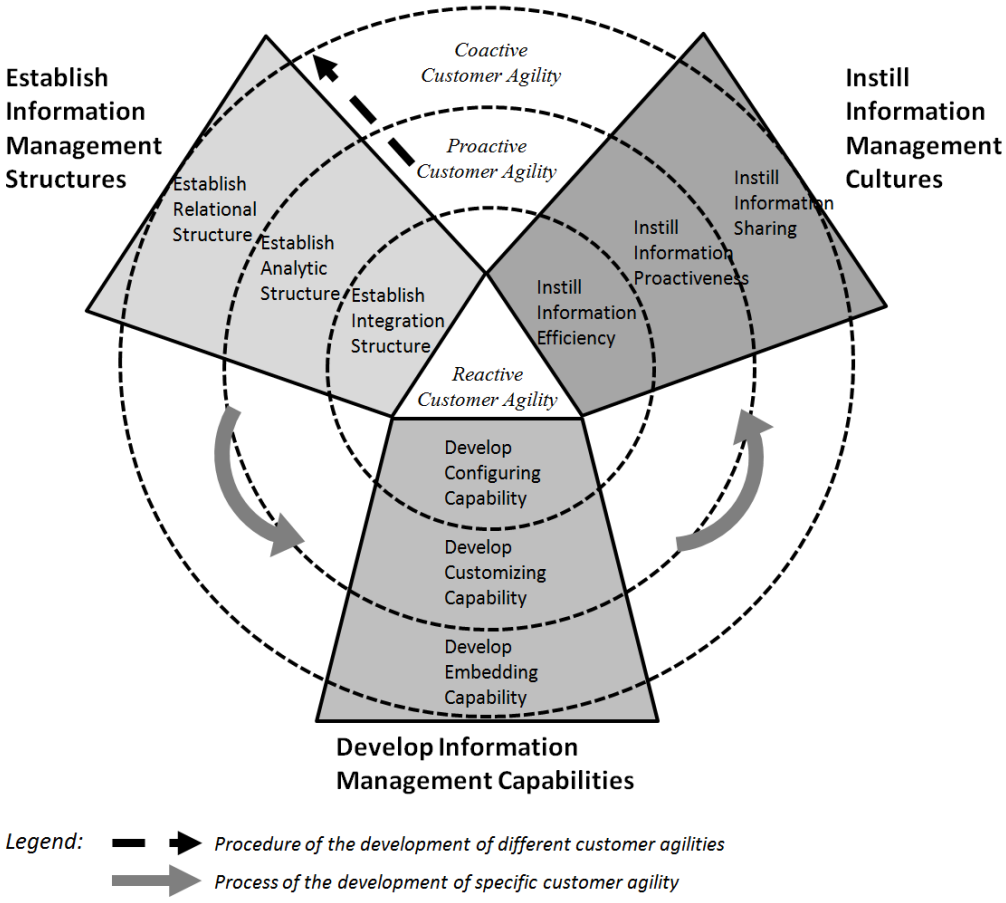
To understand how information management enables online retailers to achieve customer agility, I undertook an iterative process between relevant literature, qualitative data, and the emerging model. Subsequently, a typology of customer agility (see Table 3-6) was identified and a process model (see Figure 3-2) was inductively derived. I introduce three types of customer agility, as well as depict the role of firms in each type of customer agility. The process model shows that the three types of customer agility are developed by establishing information management structure, developing information management capability and instilling information management culture.

Table 3-6. A Typology of Customer Agility

Types of Customer Agility	Definition	Roles of the Focal Firm
Reactive Customer Agility	This refers to the ability of online retailers to leverage the voice of the customer by responding to the needs raised by online customers in a rapid manner (e.g. Chen & Yen, 2004; Jiang et al., 2010).	Fire fighter
Proactive Customer	This is defined as the ability of online retailers to leverage the voice of the customer by revealing	Magician

Agility	customers' preferences and customizing products or services accordingly (e.g. Tam & Ho, 2005; Xiao & Benbasat, 2007).	
Coactive Customer Agility	This refers to the ability of online retailers to leverage the voice of the customer by eliciting customers' participation and contributions in knowledge generation process (e.g. Nambisan, 2002; Porter & Donthu, 2008).	Conductor

Figure 3-2. A Process Model of Managing Information for Customer Agility



3.5.1 A Typology of Customer Agility

Customer agility refers to the ability of online retailers to leverage the voice of the customer to achieve market intelligence and to explore competitive action

opportunities (Sambamurthy et al., 2003). It is developed through the complementary intertwining of IT with organizational structures, skills and cultures (Sambamurthy et al., 2003). Advances in IT bring about different technologies that help online retailers leverage customer insights, and thereby result in different types of customer agility. In the current study, I observed that as the company grew with different technologies incorporated in three phases, it developed three types of customer agility: reactive customer agility, proactive customer agility and coactive customer agility (see Table 3-6). Three types of customer agility emerge from the case, and they are supported by existing literature.

Reactive customer agility refers to the ability of online retailers to leverage the voice of the customer by responding to the needs raised by online customers in a rapid manner (e.g. Chen & Yen, 2004; Jiang et al., 2010). Online customers interact with sales websites to retrieve the information needed for making online purchase (Jiang et al., 2010). The interaction is usually transient, requiring a fast response (Cenfetelli et al., 2008). Hence, website interactivity is critical in determining the quality of sales website (Agarwal & Venkatesh, 2002). Designing technical features (e.g. search engine and product navigation tools) and social communication tools (e.g. online Q&A and live chat) provides the website with greater responsiveness to customer needs (Jiang et al., 2010). The case shows that the company developed various technical features to enhance the interactivity of the sales website. It also offered effective social communications tools in case online customers failed to find the relevant information. By reacting to the needs of online customers in a rapid manner, the company developed an improved appreciation of suitable website design that can meet these needs. In this case, the company that

achieves reactive customer agility may be described as a "fire fighter" in extinguishing the "fire of lack of information".

Proactive customer agility is defined as the ability of online retailers to leverage the voice of the customer by revealing customers' preferences and customizing products or services accordingly (e.g. Tam & Ho, 2005; Xiao & Benbasat, 2007). A sales website captures a massive amount of customer data through interactions with customers (Padmanabhan et al., 2006). The wealth of data provides an essential source for analyzing customers' behavior, leading to a deeper understanding of customer needs (Mithas et al., 2005). Data warehouses allow online retailers to transform customer data into usable information, such as customers' preferences and tastes (Joshi et al., 2010). The insights generated can be used to provide customized content, offerings and services through personalization tools such as recommendation agents (e.g. Xiao & Benbasat, 2007). The current case shows that the company established a data warehouse to manage customer data and tailored content according to the needs of individual customers. By revealing customers' preferences and customizing products or services accordingly, the company developed the ability to leverage the wealth of customer data for competitive actions. Thus, I described the focal company equipped with proactive customer agility as a "magician" who can do some magic to transform the ordinary into treasures.

Coactive customer agility refers to the ability of online retailers to leverage the voice of the customer by eliciting customers' participation and contributions to the knowledge generation process (e.g. Nambisan, 2002; Porter & Donthu, 2008). Virtual communities make this possible by allowing members to share their shopping experiences, discuss products and make product recommendations. This leads to "a shift from a perspective of exploiting customer knowledge by the firm to a perspective of knowledge co-creation

with the customers" (Sawhney & Prandelli, 2000, p. 31). Many innovative ideas are created through the discussions among community members (Nambisan, 2002). However, the value of virtual communities is limited unless members are motivated to participate in, and contribute to the community by sharing information (Ma & Agarwal, 2007). The current case shows that the company managed the policy elements (e.g. incentive policy) and content of the virtual community to attract users and to encourage information sharing. By eliciting customers' participation and contributions to the knowledge generation process, the company can gain many innovative ideas from customers for competitive actions. Accordingly, the focal firm that attains coactive customer agility may be described as a "conductor" leading an "orchestra of customers".

3.5.2 Development of Reactive Customer Agility

As shown by the process model, to achieve reactive customer agility, online retailers should establish integration structure, develop configuring capability and instill information efficiency (see the first dash-line circle in the center in Figure 3-2). Integration structure refers to a set of integrated systems that enables information flow between the applications of different systems. It requires standards for the integration of data, applications and processes to be negotiated and implemented (Weill & Broadbent, 1998). By providing real-time connectivity between diverse applications (Ross, 2003), integration structure allows online retailers to achieve quality information and better information flows, which further leads to significant and sustained firm performance gains (Rai et al., 2006). The case company twice went through systems reconstructions to develop integration structure, which brought about high flexibility in reacting to the information needs of online customers. As a

result, customer service representatives are able to retrieve relevant information readily and respond to online customer's enquiry quickly.

Configuring capability refers to the ability to design and maintain information elements (e.g. product descriptions), the layouts and the interactive patterns of these elements in sales websites to meet the needs of online customers (e.g. Albert et al., 2004). It helps online retailers answer questions such as what kind of information is needed (e.g. Cenfetelli et al., 2008), where to display (e.g. Wells et al., 2011), and how to display (e.g. Jiang et al., 2010). Due to the dynamism of the Internet environment, it is critical to constantly assess potential gaps between customers' needs and the delivered experience through sales websites (Albert et al., 2004). The case company achieved this by investing in user experience design. This led to the development of technical features and social communication tools, thereby improving the interactivity of the sales website (Jiang et al., 2010).

Information efficiency is an organizational value that advocates rapid actions to leverage information for seizing competitive action opportunities. The contemporary business environment has become highly competitive and extremely dynamic, making effective information processing and quick response critical for firms' success in competitions (Mendelson & Pillai, 1998). As a result, many companies adapt their business processes to the increasing time-to-market pressures (Iansiti & MacCormack, 1997). Online retailing offers customers very low information search and switching costs, thus increasing the significance of fast response in retaining customers. In response, the case company instilled information efficiency by prioritizing customer issues and constraining response time, to ensure that when customer issues emerge, organizational members will respond at once. In short, effective information management practices enhance online retailers' ability to respond

to the needs raised by online customers in a rapid manner and help them achieve reactive customer agility.

3.5.3 Development of Proactive Customer Agility

The process model indicates that proactive customer agility is achieved by establishing analytic structure, developing customizing capability and instilling information proactiveness (see the ring in the middle in Figure 3-2). Analytic structure is a set of data management and analysis applications (e.g. data warehouse) that allows online retailers to process massive amounts of customer data (e.g. Joshi et al., 2010). It augments firms' data analytical capability to gain new insights and knowledge by storing, extracting, cleaning and transforming large volumes of data into usable forms (Davenport & Harris, 2007). Organizational value from information is generated when the collected data are analyzed through data mining (Kohli & Grover, 2008). As increasing data were gathered by the sales website, the case company established a data warehouse and assigned two dedicated divisions of IT professionals to manage and analyze the wealth of data for innovative competitive action opportunities.

Customizing capability refers to the ability of online retailers to tailor content, offerings, and services accord with online customers' habits and preferences (e.g. Ho et al., 2011). It leverages personalization technologies (e.g. recommendation agents) to "provide the right content in the right format to the right person at the right time" (Tam & Ho, 2005, p. 271). Increased choice in sales websites has led to an increased amount of information that customers must process before they can make purchase decisions (Schafer et al., 2001). Recommendation agents help reduce the information overload facing customers, thus improving the quality of the purchase decisions made (Xiao & Benbasat, 2007). In the current case, I observed that the company tailored

promotion e-mails based on different customer segmentations and offered customized recommendations for customers during shopping process to improve online shopping experience.

Information proactiveness is an organizational value that encourages members to actively seek out and respond to changes in their market and to leverage this information as a means of enhancing existing products or services, and creating new ones (Marchand et al., 2000). The establishment of analytic structure and the successful experience of utilizing massive amounts of data (e.g. customization) lead to the formation of an organizational climate that treasures the value of data and encourages members to detect competitive action opportunities. For example, business units are more active in engaging IT professionals for identifying cross-selling opportunities and promoting products to targeted customers. Furthermore, it seems that an entrepreneurial culture facilitates the formation of information proactiveness. In essence, effective information management practices enhance online retailers' ability to reveal customers' preferences and customize products or services accordingly, leading to the development of proactive customer agility.

3.5.4 Development of Coactive Customer Agility

Achieving coactive customer agility requires the establishment of a relational structure, the development of embedding capability and the promotion of information sharing among customers (see the ring in the edge in Figure 3-2). Relational structure refers to virtual communities used to connect online retailers and their customers, as well as to facilitate interactions among customers (e.g. Nambisan, 2002). Customers who are knowledgeable and experiential about products can be found in virtual communities (McAlexander et al., 2002). They share and discuss their actual use of

products and unmet needs, which constitute an essential external resource for competitive action opportunities (Kozinets, 1999). Online retailers can use virtual communities to establish ties with customer innovators who provide many innovative ideas (Nambisan, 2002). The case company invested in a virtual community with the purpose of increasing interactions between the company and its customers, as well as among customers, thus enhancing the stickiness of the sales website.

Embedding capability is the ability to leverage organizational resources (e.g. information cues) so as to make participants perceive themselves as organizational insiders and foster participants' embeddedness (e.g. Porter & Donthu, 2008). The literature informs me of many approaches used by sponsors of virtual communities to embed members: offering members with legitimate roles, granting members access to community representatives, promoting contact between the sponsor and members, and allowing members to influence community policies (McAlexander et al., 2002), (Bhattacharya et al., 1995; Preece, 2000; Bhattacharya & Sen, 2003). In addition to using some of the above methods, the case company designed information cues for the virtual community and established the synergy of the sales website and the community to enhance member embeddedness.

Instilling information sharing in virtual communities is essential to enrich the content of virtual communities (Nambisan, 2002). Offering incentives is a practical approach to increase customer willingness to share their ideas (Füller et al., 2006). Companies should be able to allocate economic rents from co-innovation to ensure that sufficient incentives are distributed to customers for continued innovation (Nambisan, 2002). This is considered to be a key factor that influences the success of an online community. The case company provided incentives (e.g. bonus points or coupons) to behaviors contributing to

the common wealth of the community on one hand; on the other hand, it arranged the layout and organized the content of the virtual community to highlight the contributions of community members, inciting sharing behaviors. Overall, effective information management practices enhance online retailers' capabilities to elicit customers' participation and contributions to the knowledge generation process, and enable them to develop coactive customer agility.

As a whole, I have introduced three types of customer agility (see Table 3-6) and discussed the process through which they are developed (see Figure 3-2). It is found that the incorporation of different technologies leads to the development of different types of customer agility (i.e. reactive customer agility, proactive customer agility, and coactive customer agility). The literature suggests that agility is developed through the complementary intertwining of information technologies with organizational structures, skills and cultures (Sambamurthy et al., 2003). Consistently, I find that customer agility develops through the complementary intertwining of information management structure, information management capability and information management culture. Information management structure provides the basis for collecting and managing information, while information management capability offers the necessary ability to interact with specific technologies. Information management culture helps shape the information management behaviors of organizational members. More specifically, customer agility is developed by establishing information management structure, developing information management capability and instilling information management culture.

3.6 Conclusion

3.6.1 Theoretical and Practical Contributions

The current research makes contributions to the literature from the following three aspects. Firstly, this study contributes to knowledge on customer agility. Three types of customer agility (i.e. reactive customer agility, proactive customer agility, and coactive customer agility) are introduced. Reactive customer agility centers on reacting to the needs raised by online customers in a rapid manner (e.g. Chen & Yen, 2004; Jiang et al., 2010). Proactive customer agility allows online retailers to conceive competitive actions by revealing customers' preferences and customizing products or services accordingly (e.g. Tam & Ho, 2005; Xiao & Benbasat, 2007). Coactive customer agility facilitates the creation of innovative ideas by eliciting customers' participation and contributions to the knowledge generation process (e.g. Nambisan, 2002; Porter & Donthu, 2008). The typology of customer agility enhances our understanding of different approaches used to sense and respond to customer-based opportunities (Roberts, 2009). Furthermore, as there is a lack of knowledge regarding how customer agility is achieved, the process model of customer agility developed by this study might fill this theoretical gap.

Secondly, a contribution to the information management literature is also made by the current study. I propose an integrative information management framework that synthesizes the findings of existing research. The value of this framework may be seen when I utilized the framework to analyze how customer agility is achieved. This responds to the research gaps pointed out by Mithas et al. (2011), namely that researchers are not taking the lead in developing conceptual and theoretical models of information management that

can provide management implications. Furthermore, I observe and conceptualize many novel information management practices from the case. For example, information efficiency is conceptualized as an organizational culture that advocates rapid actions to leverage information for seizing competitive action opportunities. As the contemporary business environment becomes highly competitive and extremely dynamic, information efficiency is crucial for sensing and responding to environmental changes. Future research is needed to examine the validity and boundary conditions of the framework, as well as new constructs.

Lastly, this research enhances our knowledge of the business value of IT. While previous studies center on how IT assets (e.g. IT applications) influence various measures of firm performance (e.g. productivity, profitability and customer satisfaction) (e.g. Mithas et al., 2005; Bharadwaj et al., 1999), the current study complements the literature by drawing attention to how information management affects firm performance. Few studies have investigated the impact of information management on firm performance (Mithas et al., 2011). Kohli and Grover (2008) point out that the way in which information management capabilities should be developed to enhance digital business capabilities is an increasingly important topic, that has been under investigated. I show that online retailers can achieve customer agility by establishing an information management structure, developing information management capability and instilling information management culture. This underpins the finding of prior work which show that information management is, indeed, a foundation that enhances other organizational capabilities (Mithas et al., 2011).

In terms of practical contributions, I offer instrumental implications for managing customer interactions in e-commerce companies. The three types of

customer agility provide a clear direction for e-commerce companies to pursue. Given that "*as an e-commerce company, the most valuable thing is information*" stated by one informant, the knowledge of how information is managed for competitive actions is of great significance for e-commerce companies. The process model of this study helps companies to achieve this goal. Furthermore, I indicate that it is crucial for e-commerce companies to develop integrated systems, invest in data mining and establish virtual communities, so as to create better customer services in an increasingly competitive environment. The role of information should also be emphasized by managers to facilitate the development of information management capability, as well as to cultivate information management culture.

3.6.2 Limitations and Future Research

Despite making several contributions, this study has two limitations. Firstly, although the three types of customer agility are derived from qualitative data and corroborated by the existing literature, the validity of the typology should be further examined by future research. Furthermore, the measurement of three customer agilities is not provided by the current study, and this should be addressed in the future, so that the knowledge generated in this study can be consolidated. Secondly, the case company is an online retailer, whose interactions with customers are frequent and recordable. This enables the generation of much valuable customer information. This setting allows me to observe the significant theoretical phenomenon of information management. However, more studies should be conducted to validate the findings of the current research in other settings, such as studies on traditional business environments. What is more, a comparison between the information management practices of an e-commerce company and of a traditional company in an offline setting is likely to generate many interesting findings.

Except for the two research directions derived from the limitations, the literature review on information management reveals that more studies are needed on information management culture, since the volume of this research is much less than those of the other two streams of studies. With the increasing salience of information in a turbulent and competitive environment, more information management will be observed, which is likely to be a promising research direction.

4. STUDY III: INFORMATION STRATEGY FOR TRADITIONAL ORGANIZATIONS' E-BUSINESS TRANSFORMATION: AN INFORMATION PROCESSING PERSPECTIVE

4.1 Introduction

Electronic business (e-business) is transforming the way organizations interact with customers, suppliers, and other business partners, forcing traditional organizations to adapt (Barua et al., 2004). It does not only demand IT capabilities that enable the development of an interactive e-business website, but most importantly also requires the achievement of smooth coordination across back-end activities (Fingar, 2000). While functionalities of an e-business website are becoming commodities, e-businesses are more differentiated by back-end cross-functional integration which is tailored to a firm's strategic context and is woven into the organization's fabric (Zhu & Kraemer, 2005). As a result, when traditional organizations are entering the e-business market, the real challenge lies on the back-end integration process.

The cross-functional integration in traditional organizations' e-business transformation will bring about high task interdependence as it will have to run across different organizational functions (Sorenson, 2003). This implies a profound transformation of the targeted work tasks as well as reallocation of resources (Silva & Hirschheim, 2007). For instance, the existing in-house logistics of traditional organizations provides functions that are tailored for bulk orders from local distributors and channel partners. The incorporation of e-business generates strong task interdependence between e-business and the logistics function, demanding a new function that fits the need of massive delivery orders from individual online consumers. Traditional organizations need to understand and manage this interdependence for better back-end

integration (Sherman & Keller, 2011). As e-business function is intertwined with production, procurement, logistics, and customer service functions (Barua et al., 2004), the success of e-business transformation might hinge on delicately managing task interdependence in back-end integration.

This study draws on information processing view of the firm to investigate the management of task interdependence in traditional organizations' e-business transformation. The theory considers task interdependence as a source of uncertainty that organizations must resolve (Tushman & Nadler, 1978; Galbraith, 1974). The objective of the organization is to choose and implement the subset of information processing mechanisms (rules and programs, hierarchy, joint planning, information systems, etc.) that facilitates the right amount of information needed to cope with uncertainty and achieve desired performance (Gattiker & Goodhue, 2005). Greater task interdependence results in greater need to share information. This is because changes in conditions in one unit may require some adjustment in the other (Sherman & Keller, 2011). In this case, information processing mechanisms must allow the exchange of information across unit boundaries to facilitate mutual adjustment (Tushman & Nadler, 1978). Continuing with the previous example, as the implementation of e-business strategy, traditional organizations need to design appropriate information processing mechanisms that fit the information needs of task interdependence between e-business and logistics function.

So when traditional organizations are entering the e-business market, they need to implement information strategies (i.e. a subset of information processing mechanisms) to meet the information needs of increased task interdependence. The current study attempts to investigate the information strategies that meet this goal and address the research question of "how do traditional organizations implement information strategy for e-business

transformation". I adopt qualitative methods and conduct a longitudinal case study of two large traditional organizations that have entered e-business market successfully. The findings of this study show that traditional organizations can achieve performance gains (e.g. operational efficiency or e-business service innovation) if there is an alignment between e-business strategy and information strategy. Specifically, operational efficiency is achieved when the piggyback e-business strategy is aligned with the bridging information strategy, while e-business service innovation is enhanced when the stand-alone e-business strategy is aligned with the buffering information strategy. Furthermore, a process model is developed to explain how information strategy is implemented for e-business transformation in traditional organizations.

4.2 Literature Review

4.2.1 E-Business Transformation

The 'e-business transformation' refers to the phenomenon that traditional organizations undertake major initiatives to leverage e-business channel to transform how they coordinate value activities internally and externally with the objective of improving firm performance (e.g. Daniel & Wilson, 2003). It requires both the design of front-end functionality and the integration of back-end activities (Zhu & Kraemer, 2005). As the functionality of an e-business website is public and open on the Internet, traditional organizations could easily achieve it through observing and imitating e-business players (Porter, 2001). However, the back-end cross-functional integration process is far more difficult to imitate since its success demands quality complementary resources (Zhu & Kraemer, 2005). This process will generate high task interdependence due to the need of reallocating resources and coordinating

activities across subunit boundaries (Sorenson, 2003).The ability to deal with task interdependence introduced by e-business transformation constitutes a key complementary resource that might generate competitive advantages for traditional organizations. For example, Dell Computer is a successful case that manages to deal with task interdependence by coordinating the activities of manufacturing, distribution, customer service and support for its online direct sales model.

Existing research on e-business transformation primarily centers on identifying critical success factors of the transformation and business values of e-business to traditional organizations, neglecting the process through which e-business transformation is conducted. Researchers have identified supplier and customer readiness, system integration, supplier and customer process alignment as critical success factors for e-business transformation (e.g. Daniel & Wilson, 2003; Barua et al., 2004). Other researchers find that e-business contributes to traditional organizations in terms of revenue generation, cost reduction, asset return, and inventory turnover (e.g. Zhu, 2004; Zhu & Kraemer, 2002).The study that is most relevant to the e-business transformation process is the study conducted by Zhu and Kraemer (2005). They investigate the transformation process by testing the impact of front-end functionality and back-end integration upon e-business value to traditional organizations. Although they emphasize the crucial role of back-end integration, the question of how to achieve it is not answered. The current study attempts to delve into the e-business transformation process and develop a process model that shows how to implement information strategies to deal with task interdependence for e-business transformation.

4.2.2 Information Processing View

According to information processing view of the firm, the key task for organizations is managing uncertainty (Tushman & Nadler, 1978; Galbraith, 1973; Galbraith, 1977). Interdependence is considered as a source of uncertainty that organizations need to deal with (Sherman & Keller, 2011). It is defined as the degree to which a department or subunit is dependent upon others in order to conduct its task effectively (Gattiker, 2007). Since this interdependence is associated with the need for effective coordination and joint problem solving, it generates uncertainty when the task is conduced (Tushman & Nadler, 1978). The greater interdependence among different departments, the greater the uncertainty faced (Gattiker, 2007).As e-business will have to run across different organizational functions (e.g. manufacturing, distribution, customer service and support, etc), it brings about high task interdependence when traditional organizations attempt to coordinate activities across unit boundaries. As a result, organizations must deploy the information processing mechanism that is most suitable for managing the uncertainty that the organization confronts (Gattiker, 2007).

Information processing view suggests that organizations can proceed in either of two general ways to cope with uncertainty (Galbraith, 1974; Tushman & Nadler, 1978). Firstly, organizations can increase information processing capacity by applying the 'bridging strategy' (Bode et al., 2011). It involves attempts to deal with uncertainty through engaging in boundary spanning actions (Bode et al., 2011). Bridging strategy forestalls uncertainty by facilitating access to reliable and timely information that allow firms to make more informed decisions at the time of uncertain event (Mithas et al., 2011; Premkumar et al., 2005). For example, organizations can create lateral relations or invest in information systems to increase the capacity of

information processing (Galbraith, 1974; Tushman & Nadler, 1978). Lateral relations refer to joint decision processes which cut across lines of authority (Tushman & Nadler, 1978). Some of the lateral relations are direct contact, liaison roles, task forces, teams, integrating roles, and managerial linking roles (Galbraith, 1974). Lateral relations allow problems to be solved at the level they occur (Mani et al., 2010). Information systems provide the functions of automating and informating, facilitating information processing without overloading the firm's normal communication channels (Mani et al., 2010).

Secondly, organizations can reduce the information processing needs by applying the 'buffering strategy' (Bode et al., 2011). It implies acceptance of lower performance or redesigning tasks to simplify existing relationships (Srikanth & Puranam, 2011). For instance, organizations can establish slack resources to act as "shock absorbers", such as flexible production processes, larger inventories, and redundant suppliers (Tang, 2006). This approach might result in lower levels of performance or increased resource allocations for the organizations (Bode et al., 2011). On the other hand, organizations can redesign tasks to reduce uncertainty by creating self-contained units (Galbraith, 1974). Organizations can decompose a system of tasks into self-contained units, such that tasks within a self-contained unit are highly interdependent with one another, but there are few dependencies between tasks that are part of different self-contained units (Pan et al., 2007; Srikanth & Puranam, 2011; Baldwin & Clark, 2000; Langlois, 2002). This approach is also referred to as the modularity strategy. It is based on the creation of interfaces that describe how self-contained units interact with each other (Srikanth & Puranam, 2011). Interfaces in organizations include design rules, standard operating procedures, and plans and schedules that indicate what each self-contained unit must do in

order to achieve effective coordination (Tushman & Nadler, 1978; Galbraith, 1974).

4.2.3 Organizational Logic

Although existing literature informs us with the above information strategies that could be used to deal with high task interdependence of e-business transformation (Bode et al., 2011), the process through which they are implemented is not clear. To understand this process, I need a concept that can help rationalize and differentiate application of alternatives information strategies. So I turn to the concept of organizational logic. This concept refers to a cluster of axioms that act upon the cognitive activities of organizational members when they are conducting a specific problem-solving task (Spicer & Sewell, 2010). It helps explain the choice between bridging strategy and buffering strategy since characterizations of the organization (e.g. bridging or buffering) can be thought of as the aggregation of individual cognitive acts that are informed by the logic (Spicer & Sewell, 2010).For example, the approach that an organization buffers its technical core from environmental uncertainty is described by Boschken (1976) as an expression of 'a logic of an organizational system' which is ultimately expressed in a characteristic way of thinking about concrete problems. As organizational logic effectively prescribes how people ought to think as well as proscribes alternative ways of thinking (Hardy, 2004), it is valid to examine the role of organizational logic in influencing the implementation of information strategies.

4.3 Methodology

The case study method is adopted to address the research question regarding how to implement information strategies for e-business transformation. There are two reasons for choosing the case study method. Firstly, it is appropriate

for exploring a "how" question by applying the case research approach (Walsham, 1995). Secondly, it is more suitable to investigate the implementation of information strategies through relevant stakeholders' interpretations (Klein & Myers, 1999) rather than a quantitative approach, since the phenomenon is complex, multi-faceted, and embedded within an organizational context (Pentland, 1999).

Three criteria are developed for case selection. Firstly, the case company should be a traditional organization that has experienced successful e-business transformation, which constitutes the research context of this study. Secondly, the company should have implemented effective information strategy for e-business transformation, so that the theoretical phenomenon is significant. Thirdly, top management of the company should be willing to support a longitudinal case study, so that rich and embedded insights can be achieved. Two companies in the shortlist fit the criteria. They are 1) Haier, one of the largest Chinese household appliance manufacturers; and 2) Jeanswest, one of the largest Chinese apparel manufacturers. Both of them are traditional organizations that have entered Chinese e-business market and witnessed dramatic increase of e-business sales for the past three years. This allows me to conduct comparative analyses (see, e.g. Pan et al., 2012; Du & Pan, 2013). Top managements of both companies are supportive for this research. The initial communications with the gatekeepers of both companies confirmed the idea of examining the implementation of information strategies in e-business transformation.

4.3.1 Data Collection

The investigation lasted for over three years from May 2010 to August 2013. The theory-building process as prescribed by Eisenhardt (1989) was applied to

design and conduct this research. Before I started onsite data collection, an archival analysis was conducted to understand issues regarding e-business transformation in each company (e.g. challenges of e-business transformation for a traditional organization). I collected and analyzed a large amount of archival data from online documents, websites and books (e.g. Yong, 2008). The preliminary knowledge of the phenomenon generated through an archival analysis allows researchers to craft more relevant interview questions. This archival data, mixed with the qualitative data collected from onsite interviews, enhance reliability of the study (Yin, 2003). My understanding was also shaped by a preliminary literature review of relevant theory (i.e. information processing view). The purpose of conducting a preliminary literature review is to develop an initial set of pertinent themes (e.g. different types of information strategy) that help frame interview questions. This is consistent with Klein and Myers (1999)'s suggestion that a preliminary framework can serve as a "sensitizing device" to guide data collection and analysis.

I collected data during five visits to the companies, in July 2010 (Jeanswest), September 2010 (Haier), November 2011 (Haier), March 2012 (Jeanswest) and January 2013 (Haier). An interview protocol that included a brief introduction of the research objectives, a set of general interview questions, and resources needed was sent to the companies before each visit. I conducted a series of interviews with employees of the two companies, ranging from junior staff to top management team. Interview questions were designed to be open-ended to explore embedded knowledge of the implementation of information strategy. The initial set of pertinent themes abovementioned served a significant role in ensuring that a general direction and clear structure were followed by the open-ended interviews (Pan et al., 2007). All participants were assured of confidentiality of the interviews, especially when sensitive

information was sought (Walsham, 2006). In total, I conducted 56 interviews (see Appendix 7-8).

To facilitate extraction of knowledge and leverage flexibility offered by the case study method, preliminary data analysis was conducted in tandem with data collection (Eisenhardt, 1989). Since the case study method allows new concepts to emerge from data (Strauss & Corbin, 1990), I adjusted my direction once a new concept arose. This was achieved through a short discussion after each interview and a follow-up discussion after all the interviews every day to analyze information gathered and adjust interview questions for the coming interviews. Each interview lasted from 90 minutes to 2 hours. All interviews were recorded digitally and later transcribed and translated. Furthermore, I visited the facilities of both companies and observed their daily routines under their permissions. Secondary data including internal publications, organizational documents, and flied notes were collected onsite to corroborate the information gathered from interviews. This allows data triangulation that offers stronger substantiation of constructs and hypotheses (Eisenhardt, 1989).

4.3.2 Data Analysis

I applied three coding techniques (i.e. open coding, axial coding and selective coding) to facilitate analysis of interview data (e.g. Lim et al., 2012; Kirsch, 1997; Pan et al., 2006). Firstly, open coding technique was used to uncover general recurrent themes under the context of e-business transformation (Strauss & Corbin, 1990). It started by placing conceptual labels on the data and discovering repeated organizational activities that were relevant to the phenomenon of interest. After the raw data was organized by several conceptual labels, I started to use axial coding to link similar concepts into

theoretical constructs from information processing view (Strauss & Corbin, 1990). I sought associations among concepts primarily through referring to the initial set of pertinent themes and relevant literature, so that similar concepts could be merging into theoretical constructs. A meaningful comprehension of the phenomenon of interest was generated through axial coding (Lim et al., 2012). Finally, selective coding technique was used to integrate and refine concepts to achieve a coherent picture of the phenomenon observed (Strauss & Corbin, 1990). I first selected the implementation of information strategies to deal with task interdependence in e-business transformation as the core phenomenon of this research. Subsequently, I attempted to link the constructs identified from axial coding to the core phenomenon by examining back and forth the interview data, relevant literature and the emerging model. I presented the emerging model to a panel of academics and practitioners who were responsible for challenging the underlying logic and data accuracy. The iteration process of data collection and analysis went through the whole investigation and stopped until the emergent model reached theoretical saturation, meaning no newly collected data could dispute or improve the model (Eisenhardt, 1989).

4.4 Case Description

4.4.1 Jeanswest

Jeanswestis a multinational apparel chain store headquartered in Huizhou, Guangdong, PRC. It is owned and operated by Glorious Sun Group. The company originated in Australia and expanded to China in 1993. Nowadays, it has more than3000 chain stores distributed in over 300cities throughout China. Its annual revenue reached USD 700 million in 2012. The company started to enter Chinese B2C market since 2009. It established an official store in

taobao.com, one of the most popular B2C platforms in China. Since then, the revenue of its online sales soared dramatically from USD 0.21 million in 2009 to USD57.2 million in 2012. In 2012, the company joined a grand promotion called “Double Eleven Sales” hosted by taobao.com and generated sales transactions worth USD 9.28 million during the 24-hour promotional period. This sales volume ranked first in the same category. To further boost its online sales, the company established official stores in other B2C platforms, such as paipai.com, JD.com, and dangdang.com. Informed by the literature review on information processing view of the firm, I centered on implementation of information strategy for e-business transformation in the case organizations. I observed two relevant themes from the data: one relates to the alignment of e-business strategy and information strategy, the other concerns the implementation of information strategy.

In terms of the alignment of e-business strategy and information strategy, the piggyback e-business strategy and subsequently the bridging information strategy were adopted by the company. The piggyback e-business strategy refers to the strategy that focuses on leveraging established B2C platforms for online product sales. The company decided to adopt this strategy mainly due to top management team’s positioning of e-business as a new sales channel. They envisioned that a mature B2C platform could guarantee a significant amount of user traffic that could be converted into potential sales. The lack of sufficient capability and resource also restricted the company from developing an independent B2C website. The piggyback e-business strategy was followed by implementation of the bridging information strategy. This strategy is manifested in the company’s strong capability in controlling its e-business operation. The company managed to deliver 520 thousand items within three days during the “Double Eleven Sales” in 2012. This was hardly achieved by a

pure e-business company. This strong capability in controlling e-business operation relied on tight coordination across diverse functional units.

Table 4-1. Exemplary Quote and Codes Identified for Alignment in Jeanswest

Axial Codes	Exemplary Quote
The Piggyback E-Business Strategy	*Should we join a B2C platform or establish our own sales website? We decided not to develop our own sales website. On one hand, we are not good at development. On the other hand, it requires too many resources. We cooperated with taobao.com and paipai.com. We want to leverage mature third-party platforms to create our online store. This will solve the problem of low user traffic also.* –**Vice President**
	To us, e-business is a new sales channel. We adopted it to follow the trend of online retailing. We attempt to achieve the integration of online and offline operations so as to achieve channel integration. – **Senior Manager of E-Business Dept**
The Bridging Information Strategy	*(After the Double Eleven Sales) Manager of taobao.com came to consult us regarding how to fulfill a large amount of online orders in such a short time. Although the front-end website only displays a simple promotion page, the back-end operation is very complex. We coordinated activities of many units rapidly to fulfill online orders, such as the 13 warehouses. This allows us to achieve the integration of online and offline operations.* –**CIO**

In terms of the implementation of information strategy, it is composed of two processes: interpretation process and enactment process. The interpretation process concerns the selection of the particular kind of information strategy to deal with task interdependence of e-business transformation. After the company established an official store in taobao.com, an e-business unit was

established to solve the coordination issues across functional units. Top management team of the company ranked tight coordination as the most critical factor for e-business success. This knowledge was reinforced by an unsuccessful attempt during the "Double Eleven Sales" in 2010. Some severe problems, such as a lack of sufficient inventory and delay in shipment, took place during the promotion period. As a result, the company realized the pressing need to change the existing operation to catch up with the pace of e-business. Accordingly, the bridging information strategy was adopted for the purpose of increasing operational efficiency in e-business operation.

In the enactment process, the company concerned implementation of the bridging information strategy. The company started with establishing "e-business joint operation teams" within every relevant functional unit. The purpose of this action was to facilitate coordination between the e-business unit and other functional units. For example, since the delivery service of e-business relied on the 13 warehouses throughout China, an e-business joint operation team was created in warehouse management unit. This team was dedicated to solve any issues relevant to e-business operation, such as scheduling of shipment for an e-business order. In order to enhance operational efficiency, an e-business integration system was developed in-house to improve information flow between the front-end functions and the back-end operations. IT professionals of the company had developed strong business logic through many in-house system development projects. They were good at in-house system development. The system automated the process of order distribution and inventory replenishment so that the order fulfillment cycle was shortened.

In addition, Jeanswest attempted to achieve tight integration of online and offline operations through consolidating e-business processes. The company

aimed to continue the "fine management" approach from the offline process management into the e-business process management. In the offline setting, specification for each business process was clearly defined and control was conducted in every step of a business process. The company brought the "fine management" approach in the e-business process management through three mechanisms. Firstly, the company followed a plan-do-check-act cycle to implement new e-business processes. This systemic approach facilitated control and continuous improvement of e-business processes. Secondly, business intelligence was applied to analyze e-business processes and diagnose potential problem that influences performance. This was achieved with more system integrations and developments that generated a large amount of relevant information. Lastly, to achieve process automation, the company conducted process review periodically. It allowed the company to identify inefficient human decision process and replace it with efficient system decision process.

Table 4-2. Exemplary Quote and Codes identified for Implementation in Jeanswest

Axial Codes	Exemplary Quote
The Interpretation Process	*I believe that tight coordination across units is the key to e-business success. This is obvious. If there are ten thousand customers buying products within one hour, how do you guarantee sufficient inventory, how do you ensure products are delivered to different areas, how do you ensure all the payments are successful. All of these issues require tight coordination across units.* – **CIO**
	Online sales in taobao.com increased rapidly. It grew at a speed that was beyond your imagination. As a result, how to enhance operational efficiency of back-end operations becomes a big challenge. It is easy to do it in a brick-and-mortar store.

	The only thing we should do is to increase inventory levels or store products in a nearby location. However, this is hard to achieve in online setting as you cannot store all the products in one location. – **Manager 1 of IT Dept**
The Enactment Process	*Regarding online order delivery, we established an e-business joint operation team in warehouse management unit. We decided to deliver products based on area. If it is an order from customer in Shanghai, product will be shipped from the warehouse in Shanghai. Inventory can be replenished from nearby warehouse when it is insufficient. The e-business joint operation team in warehouse management unit is responsible for these issues. IT and consultant units will also work together to develop systems to support this process.* – **Vice President**
	After customer makes an order in taobao.com, our system starts to work. It will identify the geographic location of the customer and find out the closet warehouse. The system has recorded the inventory level and delivery status of every warehouse. It can replenish the inventory from a nearby warehouse if the level of inventory is low. It also generates record after customer signs up for product delivery. All the data are updated immediately. – **Project Manager 1 of IT Dept**
	We believe PDCA (plan-do-check-act) is very important to the organization. Every process needs a plan first. You need to follow the plan. After that, you need to do a review. You should know how to improve after review. After adjusting the plan, the way how you do it might become different. By doing this we can react to any changes. – **Manager 2 of IT Dept**
	Our online official store generates daily revenue up to four hundred thousand yuan. This relies on the e-business integration system. We are improving the system. Except for customer service, the system automates all the back-end operations. It generates clear data and diagrams to help

	analyze and trace every process. – **Senior Manager of E-Business Dept**
	We have process review for each step of a business process. The purpose of process review is to improve automation, so that it is easier to perform a business process. Process review allows us to examine whether a certain instruction generated by systems is desirable or not as well as whether it should be conducted manually or not. – **Project Manager 2 of IT Dept**

4.4.2 Haier

Haier Group is a multinational household appliance manufacturer headquartered in Qingdao, Shandong, PRC. Its product line that began with manufacturing fridge has expanded into 96 product categories with over 15,100 different specifications nowadays. The company has over 240 subsidiary companies, more than 110 design centers, plants and trading companies throughout the globe. Its annual revenue reached USD 25.8 billion in 2012. A statistics of Euro-monitor shows that Haier was ranked third in Global Major Appliances Millionaires Club 2010 ranking by unit volume, with the strongest growth of 13% among the top four appliance companies. The company started to enter Chinese B2C market since 2007. At the beginning, its products were sold in some large third-party B2C platforms, such as taobao.com. However, it made a great leap forward by launching an independent B2C website (i.e. ehaier.com) soon in 2010, which differentiated its e-business strategy from that of Jeanswest.

In terms of the alignment of e-business strategy and information strategy, the company adopted the stand-alone e-business strategy followed by the buffering information strategy. The stand-alone e-business strategy refers to the creation of an independent B2C website. This aggressive move of the

company was rooted in top management team's vision of e-business implications to a traditional organization. Instead of positioning e-business as a new sales channel, they portrayed e-business as a source of dramatic transformation to the traditional business model. They recognized a tremendous opportunity to leverage the existing establishment in supply chain, production, sales, logistics and customer service for competitive advantages when entering the B2C market. On the other hand, they also realized the need to change the existing structures and processes for a successful exploration. The stand-alone e-business strategy was followed by implementation of the buffering information strategy. This strategy is manifested in the conceptualization of the "node-network organization" that was composed by over two thousand "self-contained teams". This is an attempt to create a flat organization that offered the company with greater flexibility in responding to market changes brought about by the inception of e-business.

Table 4-3. Exemplary Quote and Codes Identified for Alignment in Haier

Axial Codes	Exemplary Quote
The Stand-Alone E-Business Strategy	*I don't think e-business is just a new sales channel. If you treat e-business as a sales channel, your understanding might not be complete. E-business is a transformation of business model rather than an extension of sales channel.* – **Executive Vice President of Haier Group**
	We don't want to join price war in e-business market. This is not our advantage. We are good at supply chain, research and development, sales, service, logistics, delivery. Through changing existing structures and processes, we can leverage our e-business platform to further enhance our advantages. It also allows us to better understand customer needs. –**Director of E-Business Company**
The Buffering	*We divided eighty thousand employees into two thousand*

Information Strategy	*self-contained teams during the e-business transformation. We rely on these self-contained teams to meet the changing customer needs in Internet age. It creates a network that is sensitive to market and customer needs.* –**Director of Group Strategy Dept**

In terms of the implementation of information strategy, it also consists of two processes: interpretation process and enactment process. In the interpretation process, top management team of Haier recognized the need to coordinate activities across diverse functional units (e.g. supply chain, production, sales, logistics and customer service units) when they entered B2C market. This requested changes to the existing structures and processes to fulfill the coordination need. Information strategy was chosen based on the decision to apply the stand-alone e-business strategy. It led the company to the application of buffering information strategy for the purpose of achieving flexibility in responding to market changes. The metaphor of big elephant and small elephant shows the manager's thinking that the organization should be decomposed into small self-contained teams for flexibility in e-business transformation.

In the enactment process, the company attempted to implement the buffering information strategy. At the beginning, the company defined a new organizational role as "interfacer". An interface was an organizational member responsible for encapsulating a package of specific services (e.g. e-business, logistics, and customer service). It simplified the coordination across functional units. Subsequently, the company created self-contained teams by gathering various interfacers to fulfilling a specific goal or customer needs. The self-contained team transcended formal hierarchies and was able to function independently. The result of goal achievement served as a crucial indicator for interfacer's performance evaluation. For example, to provide the

service of “assembly with delivery” which was normally separated by offline stores, a self-contained team was built up with interfacers from logistics, customer service, and e-business units. Each interfacer was in charge of a specific organizational function and all together they fulfilled the goal of “assembly with delivery”. Similarly, interfacers from financial, logistics and e-business units formed a self-contained team to provide the “delivery with order invoice” service.

Furthermore, the company enriched the mechanisms through which the self-contained team functions by configuring self-contained teams. The principle of “assembling and disassembling on demand” was created. It means that a self-contained team will be created when a new customer demand is identified and will be dismissed when the customer demand is fulfilled. This principle was institutionalized throughout the company and over two thousand self-contained teams were created. Subsequently, the company defined the “promise” mechanism through which interfacers coordinated within a self-contained team. An interfacer joining a self-contained team will need to promise the fulfillment of specific resource. Failure to achieve the promise will result in a negative record in performance evaluation. The company also defined the interfacer selection mechanism. A self-contained team can dynamically change its interfacers based on their performance and the need of resource. These mechanisms were established along with the configuration and reconfiguration process of self-contained teams.

Table 4-4. Exemplary Quote and Codes Identified for Implementation in Haier

Axial Codes	Exemplary Quote
The Interpretation Process	*We need to establish an end-to-end process during the e-business transformation. It goes through order receiving, sales planning, procurement, logistics, and delivery. We need the cooperation from the above units. We should decide which process should be changed and which one should not.* – **Senior Manager of Process System Integration Dept**
	We would like to achieve the advantage of a big company in integrating resources on one hand. On the other hand, we want to achieve the advantage of a small company in adjusting flexibly. Our company is like a big elephant. We need to decompose a big elephant into two thousand small elephants. Each small elephant can deal with market changes independently. It has autonomy in decision making. There are also some incentive mechanisms. This allows the company to maximize the gains. It is in favour of an independent sales website. – **Director of Haier University**
The Enactment Process	*I am an "interfacer" of logistic unit. I am responsible for providing logistic services to e-business unit. I need to handle any issues related to logistic for the e-business unit, through which I can earn my salary. This is beneficial to the e-business unit and the logistics unit. The original way of doing it is troublesome. If you need services from logistics unit, you might need to coordinate with 10 persons in 10 different positions. But now, you only need to communicate with me. I will handle any issues for you.* –**Interfacer of Logistics for E-Business**
	At that time, I bid for the project of logistic-e-business service. After I got the project, I needed to build up a self-contained team and had the autonomy in deciding my members and resources. Now internal coordination (of a self-contained team)

	relies on a contractual relationship. Units that can sign up for a contract include product line, quality management, marketing, HR, finance, strategy, planning, e-business, etc. – **Senior Manager of Logistics Dept**
	We called it "assembling and disassembling on demand". For a self-contained team, we should consider what we are going to create for users. After the goal is met, if there is a new requirement, we will gather again. If the project is done, we will be released from the self-contained team. It follows the principle of "assembling and disassembling on demand". Before this, we need to define what do we mean by "assembling" and "disassembling", when should we assemble and disassemble. – **Senior Manager of White Goods Dept**
	After we created two thousand self-contained teams, the challenge of coordinating interfacers to meet customer needs arose. This is solved by using "promise" as a coordinating mechanism of self-contained teams, such as the resource-exchange promise, the customization promise, and the objective-fulfillment promise. Among all of them, the connection between user resource and product resource is most important. – **Director of Haier University**
	Now members have the autonomy in deciding the composition of a self-contained team. We defined a mechanism that allows self-contained team members to select their own partners. For example, let's consider a self-contained team that is composed of only three employees. If one of them is not performing well and makes little contribution, then other members can replace this employee with employee that is more competent. So that the self-contained team as a whole will perform better. – **Director of Group Strategy Dept**

4.5 Discussion

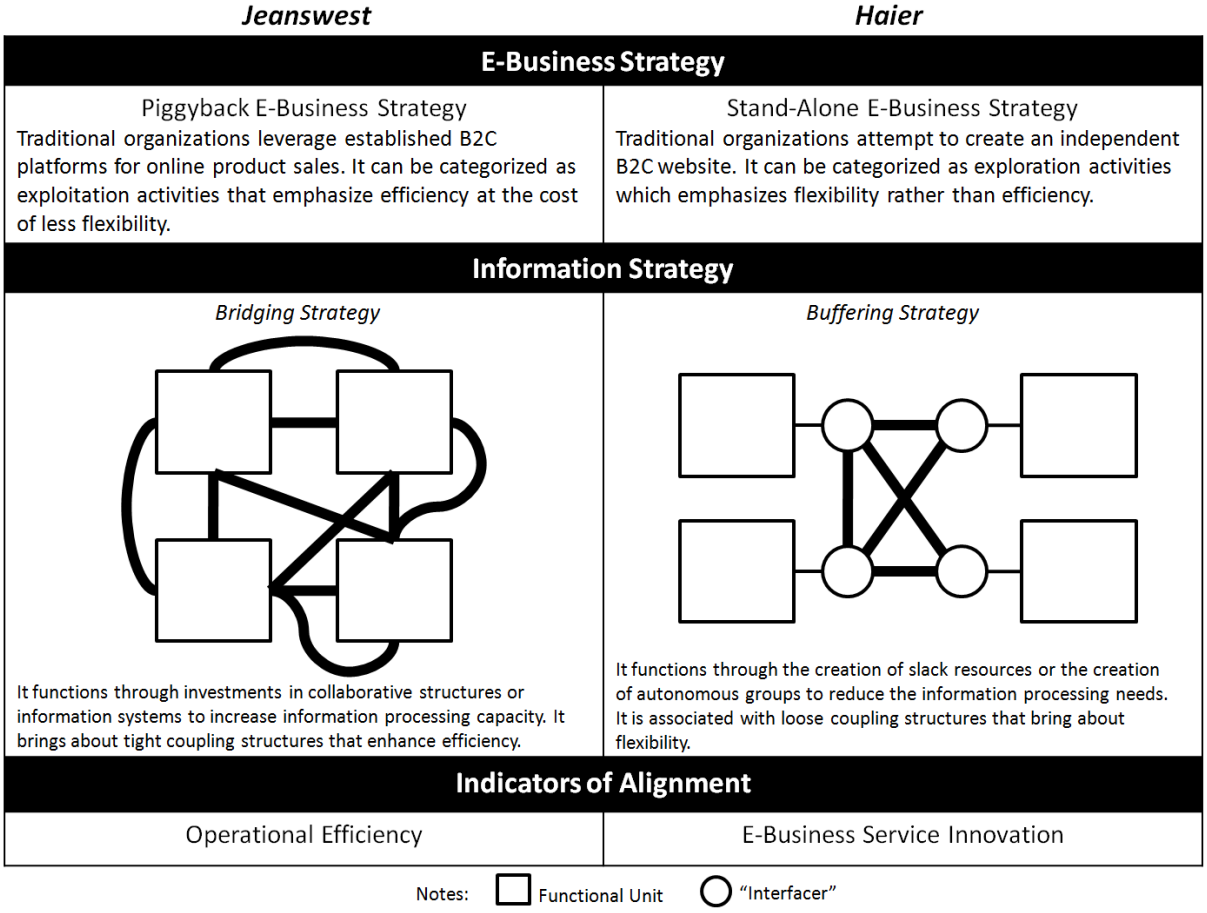
I inductively derived two models through an iterative analysis process between the relevant literature, the qualitative data, and the emerging models. The two models provide an explanation of how information strategy is implemented for e-business transformation. The first model concerns the alignment of e-business strategy and information strategy. The second model concerns the process of implementing information strategy. Given that the two models are inductively derived from empirical data, I will explain how they are corroborated by the existing literature.

4.5.1 Alignment of e-business strategy and information strategy

Two companies present two different forms of alignment (see Figure 4-1). Jeanswest adopted the piggyback e-business strategy due to top management team's positioning of e-business as a new sales channel. The company attempted to leverage established B2C platforms for online product sales. This strategy is adopted by many traditional organizations that are constrained by insufficient capability and resource. In Haier, however, the stand-alone e-business strategy was adopted. Top management team of the company envisioned e-business as a source of dramatic transformation to the traditional business model. So the company created an independent B2C website to explore this change. This strategy is adopted by relatively fewer companies as it consumes more resources and the risk of failure is higher. With regard to information strategy, Jeanswest attempted to rely on tight coupling of e-business and offline operations to achieve e-business transformation. The company centered on establishing more connections across unit boundaries so that efficient coordination can be achieved. This is exactly the bridging information strategy. In Haier, the buffering information strategy was

implemented. The company tried to use "interfacers" to construct loose coupling systems for e-business transformation. The "interfacers" allowed the company to configure self-contained units flexibly. This is exactly how the buffering information strategy works.

Figure 4-1. Alignment of E-Business Strategy and Information Strategy



Based on the empirical data, the e-business strategy and the information strategy are aligned neatly in each company. The piggyback e-business strategy allowed Jeanswest to enjoy the benefit of economies of scale. A well-established B2C platform normally comes with full-fledged e-business services that allow companies joining the platform to exploit this new sales channel easily. So when Jeanswest joined some B2C platforms (e.g. taobao.com), it only focused on integrating its offline operations with the front-end operations prescribed by the platforms (Zhu & Kraemer, 2005).This

e-business strategy can be categorized as exploitation activities (Raisch et al., 2009; Simsek, 2009) that emphasize efficiency at the cost of less flexibility (O Reilly & Tushman, 2004). The bridging information strategy helped achieve this goal. This information strategy functions by increasing information processing capacity to deal with uncertainty (Tushman & Nadler, 1978; Galbraith, 1974). It encourages investments in collaborative structures or information systems that will result in greater integration (Bode et al., 2011). This strategy brings about tight coupling structures that enhance efficiency (O Reilly & Tushman, 2004; Raisch & Birkinshaw, 2008). It fits the need of the piggyback e-business strategy. The alignment of the piggyback e-business strategy and the bridging information strategy is manifested in the increased efficiency in fulfilling online orders.

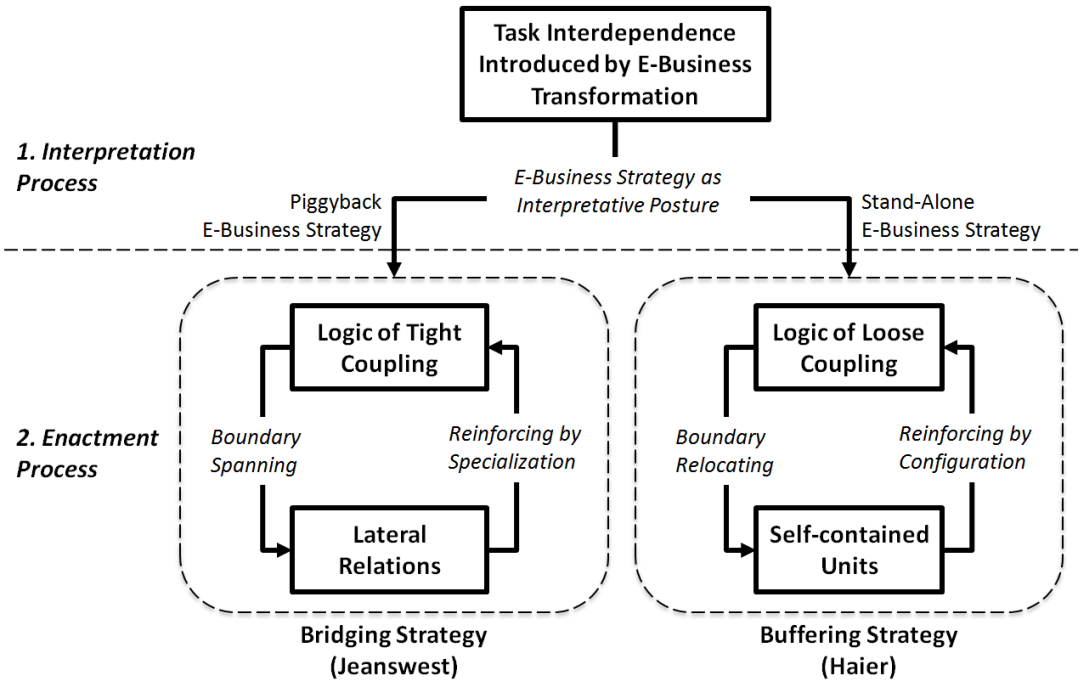
In Haier, the alignment of the e-business strategy and the information strategy shows a different pattern. The stand-alone e-business strategy provided the company with more flexibility in exploring the new business model. However, unlike joining mature B2C platforms, the company confronted the challenges of devising and implementing e-business services when it started to launch an independent B2C website. So the company focused on defining novel e-business services and leveraging the establishment in offline operations to implement e-business services. The strategic intent underlining this e-business strategy is resource exploration (Raisch et al., 2009; Simsek, 2009) which emphasizes flexibility rather than efficiency (O Reilly & Tushman, 2004). The buffering information strategy fits the need of this e-business strategy. The buffering information strategy refers to actions that reduce the information processing needs (Tushman & Nadler, 1978; Galbraith, 1974). It functions through the creation of slack resources or the creation of autonomous groups (Bode et al., 2011). This strategy is associated with loose coupling structures

that bring about flexibility (O Reilly & Tushman, 2004; Raisch & Birkinshaw, 2008).The alignment of the stand-alone e-business strategy and the buffering information strategy is manifested in the provision of novel e-business services on customer demands.

4.5.2 Process of implementing information strategy

The two companies followed a similar process to implement information strategy for e-business transformation. However, they differed in the actions conducted in each process (see Figure 4-2). Both of the companies recognized task interdependence generated by e-business transformation. As e-business will have to run across different organizational functions, it requires coordination across functional units for the success of e-business transformation (Zhu & Kraemer, 2005). When the two organizations attempted to deal with the task interdependence, their interpretations differed due to firm-specific interpretative postures (Bode et al., 2011; Gresov & Drazin, 1997). In Jeanswest, the piggyback e-business strategy served as interpretative posture that influenced the selection of information strategy. As the critical task of this strategy was to increase efficiency in resource exploitation, it guided the company toward designing tight coupling structures (O Reilly & Tushman, 2004). As a result, a cluster of axioms that centered on *integration* constituted the logic of tight coupling (e.g. Boschken, 1976). In Haier, on the other hand, the stand-alone e-business strategy acted as interpretative posture that influenced the selection of information strategy. This strategy concerned flexibility in exploration process and led the company to designing loose coupling structures (O Reilly & Tushman, 2004). Thus, the logic of loose coupling came with the formation of axioms that guide *self-contained teams* design.

Figure 4-2. Process of Implementing Information Strategy



In the enactment process, guided by the logic of tight coupling, Jeanswest engaged in boundary spanning activities to facilitate tight coordination between e-business unit and other functional units. The company designated boundary spanners and boundary object to span unit boundaries(Levina & Vaast, 2005). Boundary spanners are individuals who promote the sharing of expertise by connecting two or more groups of people separated by location, hierarchy, or function (Du & Pan, 2013). The "e-business joint operation teams" were designated as boundary spanners to solve cross-unit issues relevant to e-business operation. Boundary object refers to a broad range of artifacts that are shared and shareable across different problem solving contexts (Carlile, 2002). The company developed an e-business integration system as a boundary object to improve information flow between the front-end functions and the back-end operations. The lateral relations across unit boundaries were formed through these boundary spanning activities

(Galbraith, 1974). Furthermore, a reinforcement cycle to the logic of tight coupling was conducted through a specialization process. This process concerns about the refinement of existing processes and capabilities (Raisch & Birkinshaw, 2008). It was achieved by applying a systemic methodology for control and process improvement, applying process intelligence to monitor the operation, and conducting process review to identify operational bottlenecks. This specialization process brought about high synergistic specificity of relevant organizational functions to e-business (Schilling, 2000), which in turn led to operational efficiency.

In Haier, the logic of loose coupling led the company to boundary relocating activities that generate autonomous groups. The boundary relocating activities concern actions that change "the basis of the authority structure from one based on input, resource, skill, or occupational categories to one based on output or geographical categories" (Galbraith, 1974, p.31). Haier created the organizational role of "interfacer" that was responsible for encapsulating a package of specific functions. "Interfacers" from different functional units can be configured flexibly to form a "self-contained team" based on a specific goal. By doing this, the company shifted the boundary among functional units to the boundary between self-contained units that were organized by different customer demands. Self-contained units were given autonomy in decision making and task execution, which further supported flexibility (Raisch & Birkinshaw, 2008). Furthermore, a reinforcement cycle to the logic of loose coupling was conducted through a configuration process. This is a process that organizations migrate toward increasing modularity (Schilling, 2000). It was achieved by institutionalizing the principle of "assembling and disassembling on demand" for self-contained unit creation, defining the "promise" mechanism for interfacer coordination, and defining performance management

mechanism for interfacer selection. These mechanisms provided the company with flexibility (Hoetker, 2006) in e-business service innovation.

To sum up, this study develops two models that help explain how information strategy is implemented for e-business transformation. The first model concerns the alignment of e-business strategy and information strategy. It shows that, on one hand, the bridging information strategy is aligned with the piggyback e-business strategy, leading to operational efficiency in online order fulfillment; on the other hand, the buffering information strategy fits the stand-alone e-business strategy, generating flexibility in e-business service innovation. The second model concerns the process of implementing information strategy. Regarding the implementation of the bridging information strategy, the piggyback e-business strategy serves as interpretative posture that guides the company toward the logic of tight coupling. Lateral relations are generated through boundary spanning process and they reinforce the logic of tight coupling through the specialization process. Regarding the implementation of the buffering information strategy, the stand-alone e-business strategy serves as interpretative posture that leads the company to the logic of loose coupling. Self-contained units are generated through boundary relocating process and they reinforce the logic of loose coupling through the configuration process.

4.6 Conclusion

4.6.1 Theoretical Contributions

This research contributes to the literature in several ways. Firstly, I identify two e-business strategies that traditional organizations adopt for e-business transformation. On one hand, the piggyback e-business strategy refers to the strategy that leverages established B2C platforms for online product sales.

This strategy is popular among traditional organizations since it comes with full-fledged e-business services and the benefit of economies of scale. However, it might constrain the exploration in e-business service innovation since operations are normally standardized across sellers. On the other hand, the stand-alone e-business strategy refers to the creation of an independent B2C website. This strategy is adopted by relatively fewer companies as it consumes more resources and the risk of failure is higher. However, it provides the possibility to explore e-business service innovation that can become competitive advantages. I hope the discussion on the two e-business strategies will enrich the body of knowledge of e-business transformation.

Secondly, it deepens our understanding of the e-business transformation process. Existing research on e-business transformation primarily centers on identifying critical success factors of the transformation and business values of e-business to traditional organizations, neglecting the process through which e-business transformation is conducted. The knowledge of this process is crucial as it helps explain the variety of performance gain (e.g. operational efficiency and e-business service innovation) through e-business transformation. The current study shows that performance gain is achieved when there is an alignment between the e-business strategy and information strategy. Specifically, operational efficiency is achieved when the piggyback e-business strategy is aligned with the bridging information strategy, while e-business service innovation is enhanced when the stand-alone e-business strategy is aligned with the buffering information strategy.

Thirdly, this study contributes to information processing view of the firm by depicting the process through which information strategy is implemented for e-business transformation. Although the information strategy has been proposed since Galbraith (1973; 1974), the process of information strategy

implementation has been seldom discussed, especially in the context of e-business transformation. Most existing studies examining information strategy take it for granted, neglecting the process of information strategy implementation (e.g. Srikanth & Puranam, 2011; Bode et al., 2011). I attempt to fill this knowledge gap. The findings show that information strategy is implemented through interpretation process and enactment process. Implementation of different information strategies leads to different actions. Regarding the implementation of the bridging information strategy, the piggyback e-business strategy serves as interpretative posture that guides the company toward the logic of tight coupling. Lateral relations are generated through boundary spanning process and they reinforce the logic of tight coupling through the specialization process. Regarding the implementation of the buffering information strategy, the stand-alone e-business strategy serves as interpretative posture that leads the company to the logic of loose coupling. Self-contained units are generated through boundary relocating process and they reinforce the logic of loose coupling through the configuration process.

4.6.2 Limitations and Future Research

The current study has two main limitations. Firstly, in terms of the e-business strategy, my observation of the Chinese e-business market shows that some of the traditional organizations are adopting both strategies. For example, Li-Ning, a Chinese apparel and footwear company, has developed its own sales website while joining several large B2C platforms (e.g. JD.com and taobao.com). One of the case companies (i.e. Haier) also has its official stores in some B2C platforms, although its strategic focus is on the independent B2C website. This observation informs us a need to study a mix e-business strategy which has not been discussed by the current study. Secondly, although the bridging information strategy and the buffering information strategy constitute

independent approaches, they are not mutually exclusive (Bode et al., 2011). Organizations might adopt a mix information strategy that fulfills the need for operational efficiency and the need for flexibility in e-business service innovation simultaneously. A relevant stream of research is the organizational ambidexterity that highlights the balance of efficiency and flexibility (e.g. Raisch et al., 2009; O Reilly & Tushman, 2004; Raisch & Birkinshaw, 2008). However, this is not reflected in my cases. Future research should pay attention to the information strategy that mixes bridging and buffering information strategies.

5. CONCLUSION

5.1 Information Processing Capability (Haier Case)

The findings of the first study show that operational agility is achieved through developing information sensitivity, information synergy and information fluidity. Information sensitivity is the ability to detect changes in customer demands readily by collecting and analyzing information. It is developed by constructing the 'information star' and implementing the outcome and self controls. Information star is an information processing network characterized by high level of centralization and low level of hierarchy. Enterprise systems that enable the construction of information star include order management systems and intranet portals. Outcome control is executed by developing performance management program to evaluate employees' performance and providing incentives to desired performance (Eisenhardt, 1985). Self control is executed by providing organizational members with autonomy in decision making (Manz et al., 1987). As a result, organizations can achieve the information sensitivity. This capability helps organizations make accurate sales decisions. It further contributes to the sensing component of operational agility by enhancing the market intelligence capability (Overby et al., 2006).

Information synergy is the ability to integrate information for effective communication and collaboration across unit boundaries. It is developed by establishing 'information mesh' and implementing behavior and clan controls. Information mesh is an information processing network characterized by a low level of centralization and hierarchy. Electronic calendars, workflow systems, and knowledge management systems are examples of enterprise systems that enable the construction of information mesh. Behavior control is applied

through establishing a clear procedure to coordinate activities across departments and conducting regular meetings to facilitate planning (Eisenhardt, 1985). Clan control is executed by propagating the "one common goal" belief and cultivating the collective culture among departments (Ouchi, 1979; Ouchi, 1980). By doing this, organizations can achieve the information synergy. This capability helps organizations achieve cost economic coordination across diverse departments. It contributes to the sensing and responding components (Overby et al., 2006) of operational agility, in that it allows the organization to achieve a holistic understanding of environments and create a coordinated responding plan to guide organizational actions.

Information fluidity is the ability to facilitate efficient flow of information by automating information processing. It is achieved through constructing the 'information tree' and implementing the outcome and behavior controls. Information tree is an information processing network characterized by high level of centralization and hierarchy. Enterprise resource planning systems and supply chain management systems are examples of enterprise systems that enable the construction of information tree. To implement outcome control, employees' performance is evaluated, and incentives are provided to a desired outcome (Eisenhardt, 1985). Behavior control is executed by developing production plans to guide individuals' activities, utilizing a modularization method and establishing clear rules and procedures (Kirsch, 1997). As a result, the information fluidity can be achieved. This capability contributes to the responding component of operational agility by enhancing the production capability (Overby et al., 2006). Based on the above discussion, I derive the following research propositions:

Research Proposition 1a: *organizations with information sensitivity are more likely to achieve operational agility*.

Research Proposition 1b: *organizations with information synergy are more likely to achieve operational agility*.

Research Proposition 1c: *organizations with information fluidity are more likely to achieve operational agility*.

5.2 Information Processing Framework (Karta Case)

The second study identifies three types of customer agility: reactive customer agility, proactive customer agility, and coactive customer agility. It shows that customer agility is achieved by developing information processing framework that is composed of information processing structure, information processing capability and information processing culture.

Regarding reactive customer agility, it is the ability to respond to the needs raised by customers in a rapid manner (e.g. Jiang et al., 2010; Chen & Yen, 2004). It is achieved by establishing integration structure, developing configuring capability and instilling information efficiency. Integration structure refers to a set of integrated systems that enables information flow between the applications of different systems. It allows online retailers to achieve quality information and better information flows (Rai et al., 2006). Configuring capability refers to the ability to design information elements (e.g. product descriptions) and the interactive patterns of these elements in a website to meet the needs of customers (e.g. Albert et al., 2004). It enhances interactivity of a website. Information efficiency is an organizational value that advocates rapid actions to leverage information for seizing market opportunities. It speeds up the response process. As a result, online retailers can achieve reactive customer agility which is manifested in fast response to customer demands.

Regarding proactive customer agility, it is the ability to reveal customers' preferences and customize products or services accordingly (e.g. Xiao & Benbasat, 2007). It is achieved by establishing analytic structure, developing customizing capability and instilling information proactiveness. Analytic structure is a set of data management and analysis applications that allows firms to process massive amounts of data (e.g. Joshi et al., 2010). It augments firms' data analytical capability to gain new insights (Davenport & Harris, 2007). Customizing capability is the ability to tailor content, offerings, and services accord with customers' preferences (e.g. Ho et al., 2011). It leverages personalization technologies to "provide the right content in the right format to the right person at the right time" (Tam & Ho, 2005, p. 271). Information proactiveness is an organizational value that encourages members to actively seek out and respond to changes and to leverage this information to enhance products or services (Marchand et al., 2000). By doing this, the proactive customer agility is achieved as online retailers can fulfill customers' need before they realize it.

Coactive customer agility is the ability to elicit customers' participation and contributions in knowledge generation process (e.g. Nambisan, 2002). It is achieved by establishing relational structure, developing embedding capability and instilling information sharing among customers. Relational structure refers to virtual communities used to connect firms and their customers, as well as to facilitate interactions among customers (Nambisan, 2002). Online retailers can use virtual communities to establish ties with customer innovators who provide innovative ideas (Nambisan, 2002). Embedding capability is the ability to use firm's resources (e.g. information cues) so as to make participants perceive themselves as organizational insiders and foster participants' embeddedness (e.g. Porter & Donthu, 2008). Online retailers can

instill information sharing in virtual communities by offering incentives (Füller et al., 2006). Overall, these actions enhance online retailers' capability to elicit customers' participation to knowledge generation process, leading to coactive customer agility. Accordingly, three research propositions are derived based on the above discussion:

Research Proposition 2a: *online retailers with integration structure, configuring capability and information efficiency are more likely to achieve reactive customer agility*.

Research Proposition 2b: *online retailers with analytic structure, customizing capability and information proactiveness are more likely to achieve proactive customer agility*.

Research Proposition 2c: *online retailers with relational structure, embedding capability and information sharing are more likely to achieve coactive customer agility*.

5.3 Information Processing Strategy (Jeanswest and Haier Cases)

The third study shows that performance gains can be achieved when there is an alignment between the e-business strategy and information strategy. It presents two different processes through which information strategy is implemented to align with e-business strategy. In Jeanswest, the piggyback e-business strategy served as interpretative posture that influenced the selection of information strategy. As the critical task of the piggyback e-business strategy was to increase efficiency in resource exploitation, it guided the company toward designing tight coupling structures (O Reilly & Tushman, 2004). A cluster of axioms that centered on integration constituted the logic of tight coupling (e.g. Boschken, 1976). Guided by this logic, the company engaged in boundary spanning activities to facilitate tight

coordination between e-business unit and other functional units. It designated boundary spanners and boundary object to span unit boundaries (Levina & Vaast, 2005). Lateral relations across unit boundaries were formed through these boundary spanning activities (Galbraith, 1974). Furthermore, a reinforcement cycle to the logic of tight coupling was achieved through a specialization process. This process concerned about the refinement of existing processes and capabilities (Raisch & Birkinshaw, 2008). It brought about high synergistic specificity of relevant organizational functions to e-business (Schilling, 2000), which in turn enhanced operational efficiency.

In Haier, the stand-alone e-business strategy acted as interpretative posture that influenced the selection of information strategy. This strategy concerned flexibility in exploration process and led the company to designing loose coupling structures (O Reilly & Tushman, 2004). Thus, the logic of loose coupling came with the formation of axioms that guided self-contained teams design. Based on this logic, the company engaged in boundary relocating activities that generated autonomous groups. The boundary relocating activities concerned actions that changed "the basis of the authority structure from one based on input, resource, skill, or occupational categories to one based on output or geographical categories" (Galbraith, 1974, p.31). By doing this, the company shifted the boundary among functional units to the boundary between self-contained units that were organized by different customer demands. Self-contained units were given autonomy in decision making and task execution, which further supported flexibility (Raisch & Birkinshaw, 2008). Furthermore, a reinforcement cycle to the logic of loose coupling was achieved through a configuration process. This is a process that organizations migrate toward increasing modularity (Schilling, 2000). It was achieved by enriching and institutionalizing the principle of self-contained unit as well as

configuring and reconfiguring self-contained unit throughout the organization. These mechanisms provided the company with flexibility (Hoetker, 2006) in e-business service innovation. The above analysis leads to the following research propositions:

Research Proposition 3a: *organizations that align the piggyback e-business strategy with the bridging information strategy are more likely to achieve operational efficiency in e-business transformation.*

Research Proposition 3b: *organizations that align the stand-alone e-business strategy with the buffering information strategy are more likely to achieve flexibility in e-business service innovation in e-business transformation*.

5.4 Contribution

The thesis makes important theoretical and practical contributions in two general ways. Firstly, it contributes to IS literature by drawing on information processing theory to examine some unresolved IS issues. These issues either concern traditional organization's digitalization process and e-business transformation process, or concern the customer management process of e-business company. Findings from this thesis help IS scholars better understand how information processing contributes to improved organizational performance and lead them in the future exploration with this lens. Secondly, this thesis also contributes to the information processing literature. Specifically the thesis identifies and addresses some important theoretical gaps in information processing research. Next, I will discuss the contributions to IS and information processing literature in details.

5.4.1 Contribution to IS Literature

While previous IS studies center on how IT assets (e.g. IT applications, IT investment) influence various measures of organizational performance (e.g. productivity, profitability and customer satisfaction) (e.g. Mithas et al., 2012; Mithas et al., 2005; Bharadwaj et al., 1999), this thesis complements the literature by drawing attention to how information processing affects organizational performance. Few studies have investigated the impact of information processing on organizational performance (Mithas et al., 2011). Kohli and Grover (2008) point out that the way in which information processing capabilities should be developed to enhance digital business capabilities is an increasingly important topic, which has been under investigated. This thesis attempts to fill this gap from the following three aspects.

Firstly, the study of Haier informs us the critical role of information processing capability in the achievement of operational agility. Past research on operational agility mainly centers on identifying and validating the enablers or antecedents of operational agility (e.g. Raschke, 2007; Tallon, 2008). However, the process through which operational agility is developed has received little attention. This study empirically examines the process of operational agility development. It shows that operational agility is achieved through a two-step process—the construction of IT-enabled information processing network and the implementation of organizational control—to enhance the right information processing capability. Furthermore, this study identifies three types of information processing capability—information sensitivity, information synergy and information fluidity—that enable operational agility. By doing so, this study highlights the role of information processing capability in the digitalization process of traditional organizations.

It informs managers that in order to achieve improved firm performance from the digitalization process, traditional organizations should not only invest in IT assets, but also engage in developing information processing capability.

Secondly, the study of Karta reveals that customer agility can be achieved by developing an information processing framework. Despite the literature considering IT as a source of customer agility, the process through which customer agility is developed has not been studied previously. This might be due to the implicit assumption that equates the implementation of IT with the achievement of customer agility (e.g. Roberts & Grover, 2012). This study shows that customer agility is achieved by developing information processing framework that is composed of information processing structure, information processing capability and information processing culture. As a result, organizations can achieve three different types of customer agility, namely reactive customer agility, proactive customer agility, and coactive customer agility. By doing this, the study extends the existing conceptualization of customer agility. The typology of customer agility enhances our understanding of different approaches used by online retailers to sense and respond to customer-based opportunities (Roberts, 2009). It also opens the 'black box' between IT investment and the achievement of customer agility. Furthermore, the process model developed from the study is helpful in guiding online retailers to establish information management structure, develop information management capability and instill information management culture for better performance in customer management.

Lastly, the study of Jeanswest and Haier deepens our understanding toward traditional organizations' e-business transformation process. Existing research on e-business transformation primarily centers on identifying critical success factors of the transformation and business values of e-business to traditional

organizations, neglecting the process through which e-business transformation is conducted. The knowledge of this process is crucial as it helps explain the variety of performance gain (e.g. operational efficiency and e-business service innovation) through e-business transformation. This study contributes to the e-business transformation research from two aspects. Firstly, it depicts and compares two e-business strategies that traditional organizations adopt for e-business transformation. Secondly, it shows that performance gain is achieved when there is an alignment between the e-business strategy and information strategy. Specifically, operational efficiency is achieved when the piggyback e-business strategy is aligned with the bridging information strategy, while e-business service innovation is enhanced when the stand-alone e-business strategy is aligned with the buffering information strategy. The knowledge generated from this study informs managers the significance of aligning information strategy with e-business strategy. Many managerial implications can be developed from the two models developed.

5.4.2 Contribution to Information Processing Literature

This thesis also contributes to information processing literature. Specifically, it makes significant contributions in three aspects. Firstly, the study of Haier enhances our understanding toward information processing capability. It depicts three types of information processing capability, namely information sensitivity, information synergy and information fluidity. Furthermore, the study offers a process model and a five-step practical guide to show how information processing capability is developed. Secondly, the study of Karta brings about an integrative information processing framework. A process model is developed to show how the framework helps explain the development of other organizational capabilities. Lastly, the study of Jeanswest and Haier makes contributions by comparing the bridging and

buffering information strategies. In addition, it offers two models that help explain how information strategy is implemented for e-business transformation. Overall, this thesis contributes to information processing literature from the three research themes, namely information processing capability, information processing framework, and information processing strategy. Many novel information processing practices are observed and conceptualized through three in-depth case studies. It is hoped that these concepts can form a foundation for future research on the information processing.

5.4.3 Practical contribution

This thesis makes several practical contributions as well. Firstly, a process model is developed by study one to show how information processing capability is developed for operational agility. The study shows that both the information processing network and organizational control are crucial for the development of information processing capability. It informs practitioners that information processing is not only about IT, but also the organizational structure (e.g. organizational control) that supports it. Furthermore, a five-step practical guide of developing information processing capability for operational agility is provided for practitioners.

Secondly, study two offers instrumental implications for managing customer interactions in e-commerce companies. The three types of customer agility provide a clear direction for e-commerce companies to pursue. The process model of this study offers practitioners with useful instructions regarding leveraging information management for customer agility. Furthermore, the study shows that it is significant for e-commerce companies to develop integrated systems, invest in data mining and establish virtual communities, so

as to create better customer services in an increasingly competitive environment.

Thirdly, study three is valuable in guiding traditional organizations' e-business transformation. It identifies the significant issue of aligning information strategy with e-business strategy. The study shows that traditional organizations can achieve performance gains (e.g. operational efficiency or e-business service innovation) if there is an alignment between e-business strategy and information strategy. Furthermore, it offers practitioners with a process model which indicates how information strategy is implemented for e-business transformation in traditional organizations.

5.5 Final Remarks

This is an age featured by information explosion. The emergence and broad application of modern IT have brought about a dramatic increase of information in every aspect of organizational life. As the amount of available information grows, the management of information becomes a challenge to organizations. The thesis constitutes a valuable attempt to look at this challenge. This is achieved by conducting three case studies to examine some unresolved yet significant IS issues. Valuable theoretical implications are generated from this effort. As IT is the core of information processing in modern organizations, IS researchers bear an important responsibility to develop conceptual and theoretical frameworks of information processing. Meanwhile, the findings of this thesis inform managers the significant role of information processing in organizational life and provide practical instructions for them to improve the management of information.

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7. APPENDICES

Appendix 7-1. An Overview of the Research Design

Research Design	Detailed Description
Strategy	Case study
Main Data Collection Method	Semi-structured interviews, group and individual interviews
Organization	Haier group
Other Data Sources	Internal publications, organizational documents, and field notes
Informants	Total (15): *First visit (Sep. 2010)*: Top Management (1); Middle Management (7); Senior Staff (5) *Second visit (Nov. 2011)*: Top Management (1); Middle Management (1)
Theoretical Bases	Information Processing View of Firms and Operational Agility
Research Question	How to develop information processing capability for operational agility?
General Interview Questions	◆ How does the internal operation facilitate help the company sense and respond to market changes? ◆ What are the tasks and procedures of the internal operation? Who is involved? How does it proceed? ◆ What are the challenges of the internal operation? Why? How may these challenges be overcome? ◆ What is the role of IT in the internal operation? Why? ◆ What are the information systems involved in the internal operation? What are they used for? ◆ What are the information needs of the internal operation? Why? How are these needs fulfilled? ◆ How can it be ensured that the internal operation is functioning well? ◆ Which task do you attend? What is your job? ◆ Do you think the information systems fulfill the information needs of your daily job? How do they achieve this?

Appendix 7-2. Breakdown of Group / Individual Interviews

Group ID	No. of Interviewees	Level of Interviewees			Position of Interviewees	Relevance *
		TM	MM	JS		
1	**3**	0	3	0	Director of Strategy Department; Director of Department 1; Director of Infrastructure Operation and Maintenance Department	**66.0%**
2	**2**	0	2	0	Director of Infrastructure Operation and Maintenance Department; Director of IT Infrastructure Management Department	**63.2%**
3	**3**	0	2	1	Director of Department 1; Technical Leader of Department 1; Director of Strategy Department	**84.2%**
4	**2**	0	2	0	Director of Strategy Department; Director of Department 1	**96.4%**
5	**2**	0	1	1	Director of Department 2; Technical Leader of Department 2	**82.0%**
6	**4**	0	3	1	Director of Department 4; Project Manager of Department 4; Technical Leader of Department 4; Director of Strategy Department	**78.6%**
7	**3**	0	2	1	Director of Department 3; Technical Leader 1 of Department 3; Director of Strategy	**57.1%**

					Department	
8	**3**	0	1	2	Director of Department 3; Technical Leader 1 of Department 3; Technical Leader 2 of Department 3	**62.5%**
9	**4**	1	3	0	Chief Information Officer (CIO); Director of Strategy Department; Director of Department 1; Director of Department 3	**59.1%**
10**	**1**	0	1	0	Project Manager of Department 4;	**95.1%**
11**	**1**	0	1	0	Project Manager of Department 4;	**94.4%**
12	**2**	1	1	0	Director of Haier University; Director of Supply Chain Department	**85.2%**
Total	**30**	2	22	6	N/A	N/A

* Relevance represents the extent to which the content of a specific interview is relevant to the themes studied. It is calculated by dividing the number of individual statements relevant to the themes studied by the total number of individual statements made (see Appendix 7-3).

** Group 10 and Group 11 are individual interviews.

TM: Top Management; MM: Middle Management; JS: Junior Staff

Appendix 7-3. Summary of Axial Codes

Context	Axial Codes	Hits* (%)	Intensity**
Decision Making for Forecasting	Construct Information Processing Network (Information Star)	**83.3%**	**34**
	Implement Outcome Control	**75.0%**	**71**
	Implement Self Control	**75.0%**	**41**
	The Role of Information Processing Capability (Information Sensitivity)	**75.0%**	**29**
Decision Making for Planning	Construct Information Processing Network (Information Mesh)	**58.3%**	**32**
	Implement Behavior Control	**58.3%**	**34**
	Implement Clan Control	**58.3%**	**26**
	The Role of Information Processing Capability (Information Synergy)	**50.0%**	**25**
Decision Making for Production	Construct Information Processing Network (Information Three)	**50.0%**	**20**
	Implement Behavior Control	**58.3%**	**37**
	Implement Clan Control	**75.0%**	**26**
	The Role of Information Processing Capability (Information Sensitivity)	**50.0%**	**24**

* Hits represent the number of interviews (group interviews or individual interviews) that have mentioned about a particular theme (or axial code) out of the total 12 interviews.

** Intensity represents the total number of individual statements of all interviews that relate to a particular theme (or axial code).

Appendix 7-4. A Sample of "Statistics for Group-6 Interview"

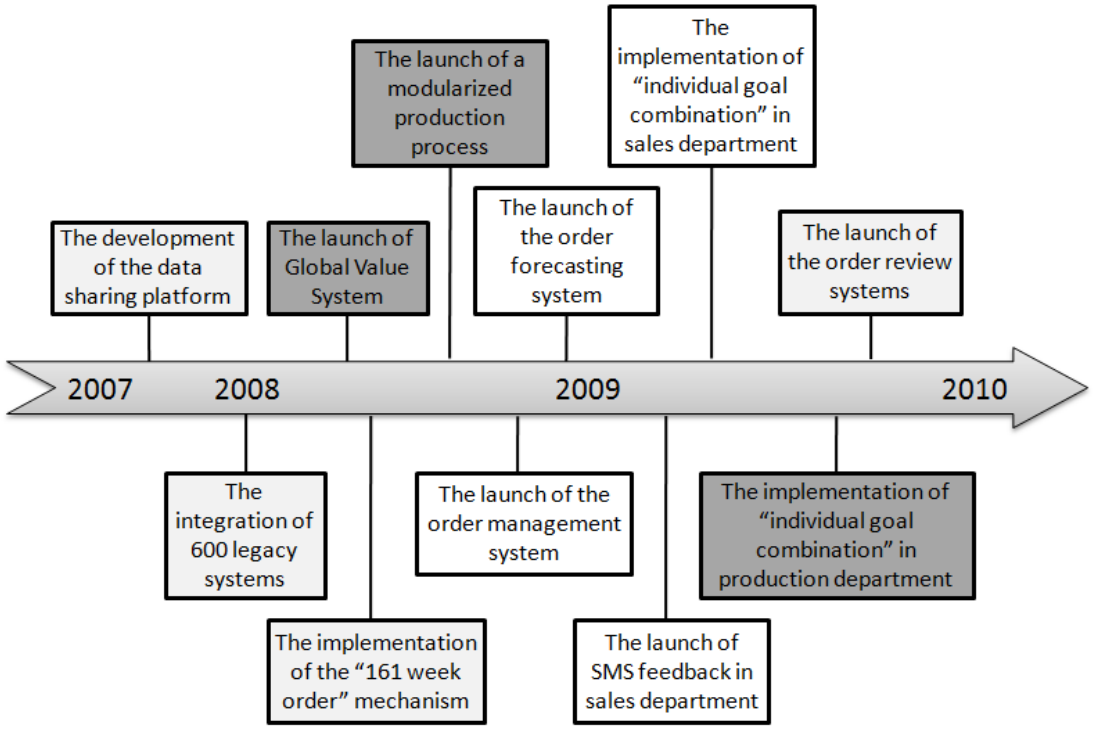
Open Codes	Axial Codes	Intensity*	Subtotal
Forecasting Task			
The needs of understanding the market accurately	Information processing requirements of forecasting	4	7
Complex sales network		3	
Implement system integration with downstream distributors	Construct information processing network (information star)	5	8
Establish multiple communication channels between salespersons and the headquarters		3	
Implement comprehensive performance evaluation and provide incentives based on performance	Implement outcome control	4	4
Individual empowerment	Implement self control	3	3
Achievement of accurate prediction	The role of information processing capability (information sensitivity)	2	2
Planning Task			
N/A	Information processing requirements of planning	0	0
Implement internal systems integration	Construct information processing network(information mesh)	3	3
Regular meetings	Implement behavior control	3	8
Implement internal systems integration		5	
Instill a common goal	Implement clan control	7	8
Forster collective actions		1	
N/A	The role of information processing capability (information synergy)	0	0

Production Task			
Complex product structure	Information processing requirements of production	2	3
The need for efficient production		1	
Establish an information hub	Construct information processing network(information tree)	2	2
Implement comprehensive performance evaluation and provide incentives based on performance	Implement outcome control	2	2
Strict schedule control	Implement behavior control	7	9
Modularized production process		2	
Improved operational efficiency	The role of information processing capability (information fluidity)	3	3
Demonstration of operational agility	**N/A**	4	4
Subtotal			**66**
Top management decision making	Irrelevant themes	2	18
Relationship with distributors		4	
Relationship with suppliers		1	
Business process reengineering		10	
IT project management		1	
Total			**84**
Relevance**			**78.6%**

* Intensity represents the total number of individual statements made that relate to a particular theme (or axial code).

** Relevance represents the extent to which the content of a specific interview is relevant to the themes studied. It is calculated by dividing the number of individual statements relevant to the themes studied by the total number of individual statements made.

Appendix 7-5. A Timeline of Order Fulfillment Process Changes in Haier



Notes:
The two-step process may not be obvious as we mixed the actions of forecasting, planning, and production task in a timeline. We use different colors of the box to differentiate the actions.
A while color box refers to an action that enhances information processing capability of the forecasting task.
A light gray color box refers to an action that enhances information processing capability of the planning task.
A dark gray color box refers to an action that enhances information processing capability of the production task.

Appendix 7-6. Research Protocol

Research Objectives: The current study attempts to investigate how customer agility is achieved by an online retailer. Drawing on the information management literature, we develop an integrative information management framework, composed of information management structure, information management capability and information management culture. The investigation will focus on the process by which information management enables online retailers to achieve customer agility.

Research Question: How does information management enable online retailers to achieve customer agility?

Theoretical Bases: Information Management and Customer Agility

Methodology: Case study

Main Data Collection Method: Semi-structured interviews

Other Data Sources: Internal publications, organizational documents, and field notes

General Interview Questions:

- What is your position? When were you hired? Please describe your day-to-day work.
- What has changed in the company since you joined? What has changed in IT department?
- What were the challenges encountered during the change of the company/IT department? How did you/the company overcome these challenges?
- How did the way IT used by the company evolve? Did the new technologies change the way how information was processed?
- As IT evolved, what kind of information management capability was developed? How did it happen?
- As IT evolved, what has changed in members' information management behaviors? How did this happen?
- As IT evolved, did new technologies change the way how the company interacted with its customers? How did this happen?
- Do you think the information systems are fulfilling the information needs of your daily job? How do they achieve this?

Appendix 7-7. List of Interviewees, Departments and Year of Employment

1. Director, Logistics System Development Division, IT Department, 2007
2. Director, Platform Architecture Division, IT Department, 2009
3. Director, Back-end Data Management Division, IT Department, 2010
4. Director, Back-end HR Division, IT Department, 2011
5. Director, Back-end Testing Division, IT Department, 2010
6. Director, Supply Chain Management Division, IT Department, 2011
7. Director, Website Data Management Division, IT Department, 2007
8. Director, Website Product Division, IT Department, 2004
9. Director, Software Quality Assurance Division, IT Department, 2011
10. Co-Director, Website Product Development Division (transaction systems), IT Department, 2007
11. Co-Director, Website Product Development Division (recommendation systems), IT Department, 2007
12. Director, Chendu Research Institute, 2011
13. Director, Human Resource Training Department, 2011
14. Assistant Director, Human Resource Training Department, 2011
15. Senior Manager, Human Resource Department, 2008

Appendix 7-8. An Overview of the Research Design

Research Design	**Detailed Description**	
Research Phenomenon	E-business transformation in traditional organizations	
Research Question	How do traditional organizations implement information strategy for e-business transformation?	
Theoretical Bases	Information strategy and organizational logic	
Strategy	Case study	
Main Data Collection Method	Semi-structured interviews, group and individual interviews	
Company Name	Jeanswest	Haier
Date of Visit	First visit: July 2010 Second visit: March 2012	First visit: September 2010 Second visit: November 2011 Third visit: January 2013
Number of Interviewees	22	34
Level of Interviewees	TM*: 5 MM*: 8 JS*: 9	TM: 7 MM: 13 JS: 14
Total Duration of Interview	20 Hours	47 Hours
General Interview Questions	1. What is your position? When were you hired? Please describe your day-to-day work. 2. When did the company start its e-business? 3. Why did the company enter e-business market? 4. What is the company's e-business strategy? 5. Why does the company choose this strategy? 6. What has been changed after the company entered B2C market? How to achieve it? 7. Do you think these changes fit the company's e-business strategy? Why do you think so? 8. Is your department related to e-business transformation? What is the role of your department to e-business? 9. How does your department cooperate with e-business department? (if applicable)	

*TM: Top Management; MM: Middle Management; JS: Junior Staff