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The Role of Information Technology Organizational Design in Firms' Ability to Innovate

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Walden University
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Abstract

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Abstract

Information technology (IT) organizations have become an integral part of many firms, with increasing strategic significance. Consequently, investments in IT represent a significant percentage of a firm's expenditure. Despite the investment, the business value of IT has been difficult to quantify, creating uncertainty about a firm's investments in IT innovation. The purpose of this nonexperimental study was to examine relationships between a firm's innovativeness and 3 IT organizational design factors: knowledge creation, dynamic capabilities, and communication structures. The research questions addressed the relationships between a firm's ability to innovate and specific design elements of the IT organization. The study was based on Nonaka's dynamic theory of organizational knowledge creation, Schumpeter's industrial market structure, and Wernerfelt's resource-based view of the firm. Data were collected from an online survey with 115 employees of firms that depend on IT to deliver their products or services. Pearson product-moment correlational analysis revealed statistically significant relationships between the IT organizational design factors and a firm's ability to innovate. The implications for positive social change stemming from this study affect managers of firms that rely on IT to deliver products or services. The findings suggest that the design of the IT organization influences the performance of the firm through cost reduction and its sustainability through innovation, both of which lead to community economic empowerment thus benefiting the general public.

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Dedication

To my wife, Marcia; my daughter, Sarah; and my son, Adam. Without their patience and support, this would not have been possible.

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Success of a dissertation is unlikely without the help of many people who provide encouragement and guidance throughout the process. My sincere gratitude goes to my committee chair Dr. Gould, who guided the dissertation research study; thank you for you guidance. My thanks to Dr. Lolas; your insightful feedback guided and identified opportunities for improvements. My thanks also go to Dr. Thakkar for his support throughout the program. My sincere appreciation goes to Walden University for enabling working adults to achieve their dreams. Many thanks to the doctoral advisors and several of Walden University's support members and the management program; I am grateful for all your help. Lastly, I am blessed to have my wife, Marcia, throughout this journey; your sacrifices are appreciated. Thanks to Sarah and Adam, who never complained when I missed an event that I should have attended. Thank you all.

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Chapter 1: Introduction to the Study

To survive, firms must execute in the present and adapt to the future (Beinhocker, 2006). To do both, firms must demonstrate agility, ability, quality, and simplicity. In an increasingly complex business environment, successful adaptation to rapidly changing market conditions is essential to survival (Pérez-Luño & Cambra, 2013). Competition, government regulation, advances in technologies, and customer and employee expectations are driving this increase in complexity (Mirchandani & Lederer, 2014). The transformation to the information age was driven by advancements in various technologies, especially information technology (IT) (Meroño-Cerdan & López-Nicolas, 2013). IT helps businesses become more efficient by automating business processes and solving complex problems (Schwertner, 2013).

IT has transformed the way firms do business (Bharadwaj, El Sawy,Pavlou, & Venkatraman, 2013). IT has become a necessary part of most firms, with increasing strategic significance (Bharadwaj et al., 2013; Crawford, Lori, & Jones, 2011). In addition, the role of IT has changed over the past 3 decades. The traditional role of IT focused on the functional-level strategy, as it provided support services to individual business units within the firm. The role of IT has evolved into one that is more critical in achieving the goals of the firm (Bharadwaj et al., 2013; Bjørn-Andersen & Raymond, 2014). Today, IT provides three key functions: synthesis of business objectives, analysis of the information needed to achieve those objectives, and implementation of information systems to provide that information (Bjørn-Andersen & Raymond, 2014; Moghavvemi et al., 2013). Along with the adoption of IT as a core component of the firm, information

systems (IS) and management literature have revealed that the use of IT can facilitate the flow of knowledge (McKay & Ellis, 2014), innovation (Dong, Kathade, Rai, & Xu, 2013), new product development (Schwertner, 2013), and how firms capture value from their innovation (James, Leiblein, & Lu, 2013).

This study focused on the challenge of empirically demonstrating the relationship between IT and a firm's innovativeness, specifically on how the design of the IT organization may affect how a firm innovates. It examined three key elements of the IT organization, namely, knowledge creation, dynamic capabilities, and communication structures. In addition, the study examined the leading academic and applied methodologies that have been developed to measure innovation and it synthesized these diverse methodologies into a holistic theoretical foundation from a broad range of disciplines.

This chapter is an introduction to the study. It starts with a brief introduction of the background of the study, followed by statement of the problem and purpose of the study. In addition, this chapter introduces the nature of the study as well as the theoretical support for the study. The remainder of the chapter includes the definition of terms, scope and delimitations, limitations, research questions, and significance of the study.

Background of the Study

In a diverse and changing marketplace, firms utilize information and technology to improve core competency and gain competitive advantage (Li & Tan, 2013). There is a strong relationship between strategy and IT. This relationship has enabled IT to become an integral part of a firm with increasing strategic significance (Melville, Kraemer, &

Gurbaxani, 2004). Nevertheless, the business value of IT continues to be questioned. IT business value (ITBV) has been a topic of study for both practitioners and scholars (e.g., Mendenhall et al., 2008; Welch, 2001). While practitioners have focused on the mechanics of producing value from an IT financial investment, scholars have focused more on how the investment can generate benefit that creates a strategic advantage and transforms the business. IT researchers have covered a range of subjects that demonstrate the ability of IT to improve business performance. Evidence cited by scholars to support this position includes the widely accepted notion that IT translates business objectives into solutions. Therefore, a fundamental value of IT is to enable a firm to achieve its objectives (Valacich & Schneider, 2010).

Investments in IT represent a significant percentage of a firm's expenditure. The investment in IT gradually increased from 19% of the overall business investment in the 1980s to over 40% of the total capital spending in the late 2000s (Cha et al., 2009). Despite the significant increase in IT investment, the business value of IT has been difficult to quantify (Crawford et al., 2011; Kim et al., 2011; Melville et al., 2004). Additionally, the economic slowdowns of the last decade put significant strain on many firms, which in turn put a strain on IT. At the same time, the demand on IT organizations has been increasing because IT has been challenged to deliver business solutions, on time and under tight financial conditions. This challenge is not industry specific, nor is it contingent upon geography or size of the business. The challenge is global and has gradually surfaced as businesses cut costs in an attempt to become lean and agile during

weak economic times. The perceived lack of response from IT to these challenges has prompted businesses to question its value.

Research has linked the inability of IT organizations to fulfill business needs to a number of failures. These failures include lack of strategy formation, misalignment between business and IT, and unmanaged IT capabilities, among others (e.g., Bharadwaj et al., 2013; Crawford et al., 2011; Hiekkanen et al., 2013; Lu & Ramamurthy, 2011; Mirchandani & Lederer, 2014; Nevo & Wade, 2010). Other scholars have suggested that IT failures may be due to a lack of modularity that has been proven to be key innovation (Grussenmeyer & Blecker, 2013; MacDuffie, 2013; Sanchez & Mahoney, 2013; Tilson, Sorensen, & Lyytinen, 2013). Another stream of research has emphasized the importance of knowledge creation through the transfer of existing knowledge (Akgün, Lynn, Keskin, & Dogan, 2014; Brusoni & Rosenkranz, 2014; Chilton & Bloodgood, 2010; Huang & Wang, 2011; von Krogh & Geilinger, 2014). These researchers have suggested that IT failures might be due to a lack of business knowledge within IT.

Table 1 offers descriptions of seven challenges facing IT. While these challenges do not represent a complete view of what IT faces today, they capture the areas viewed by scholars as significant challenges. Each challenge is documented in the information systems literature and has resulted in an emergence of new research perspectives in information systems theorizing. Each of the perspectives on the seven challenges facing IT is discussed in further detail below.

Table 1

Business Value of IT Research

IT failures	Scholars theorizing
Strategy formation	"The prevailing view of IT strategy is that it is a functional-level strategy that must be aligned with the firm's chosen business strategy… business strategy directed IT strategy" (Bharadwaj et al., 2013, p. 471).
Strategic alignment	"The goals of business-IT alignment include ensuring that the IT strategy is aligned to a company's broader goals and objectives, delivering effective and efficient IT services which meet company's needs, and to ensure IT offerings and services are aligned to the business goals" (Chong et al., 2011, p. 11).
Business agility	"Organizations responding to highly turbulent environments often seek flexibility through the implementation of new fluid work systems in place of old rigid structures" (Dunford et al., 2013, p. 85).
Modularity and communication structure	"There (is) a correspondence between the dependencies in the technical architecture of a complex system and organizational ties between the system's designers" (Colfer & Baldwin, 2010, p. 25). "When a firm's communication flows in product development processes become structured around a firm's current product architecture, the firm may have difficulty recognizing possibilities for innovating new architectures…" (Sanchez & Mahoney, 2013, p. 9).
Enterprise knowledge creation	"Organizational learning practices facilitate an organization's intelligence in collecting, sharing, and disseminating the market and entrepreneurial information effectively to become a market-driven and entrepreneurial-driven organization" (Huang & Wang, 2011, p. 567). "Knowledge is not generated at the organizational level, but by the individual" (Brusoni & Rosenkranz, 2014, p. 149).
Dynamic capabilities	"Dynamic capabilities as the capacity of an organization to purposefully create, extend, or modify its resource base" (Helfat & Peteraf, 2009, p. 94). "IT capability … ability to influence the agility of the firm … to respond to changes quickly" (Lu & Ramamurthy, 2011, p. 936).

Strategy Formulation

Strategy formulation is essential to the survival of a firm in an increasingly complex environment (Melville et al., 2004). Strategy formulation at the IT level is

viewed as an enabler of the business strategy and must align with a firm's overall business strategy (Bharadwaj et al., 2013). Traditionally, the business strategy drove and shaped the IT strategy. However, as IT continues to evolve from an administrative support function to an integral part of a business, strategic information systems planning should be given the same focus as business strategy formulation (Hiekkanen et al., 2013; Mirchandani & Lederer, 2014). Further, information systems planning and strategy debate should precede alignment between IT and the business. Understanding the importance of the IT strategy and its effect on the overall strategy of the firm is essential in leveraging information systems resources to create value (Bharadwaj et al., 2013; Nevo &Wade, 2010).

Strategic Alignment

It is widely acknowledged that the problem of ongoing strategic alignment cannot be solved by considering IT and business strategy independently (Li & Tan, 2013; Mirchandani & Lederer, 2014; Valorinta, 2011). The alignment of business and IT has been a persistent topic of discussion in the past 3 decades. The strategic management and information systems literature shows that IT–business alignment can enhance a firm's performance (Mirchandani & Lederer, 2014). Alignment means that the IT department ensures that its resources (hardware, software, networks, and human resources) are organized in a way that meets not only IT objectives but also the overall goals of the firm (Chong et al., 2011). Valorinta (2011) suggested that firms could improve IT–business alignment by transmitting knowledge and supporting collaboration between IT and business functions through cross-boundary activities. Pereira and da Silva (2012) found

that firms with a mature mix of structures and processes could achieve a higher degree of IT–business alignment. A low level of alignment between business strategy and IT strategy is a key reason why firms fail to exploit the full potential of their IT investment (Luftman & Ben-Zvi, 2010; Luftman et al., 2011).

Business Agility

It is well understood that that speed of product development is fundamental to competitive advantage. Therefore, firms have increased their efforts to improve product development cycle time, deliver innovative products to the market fast, and be the first movers in their industries (Goktan & Miles, 2011). The agility of a firm is tied to its ability to respond to changing environmental conditions by rapidly recombining components within product architecture to produce new solutions (Dunford et al., 2013). Therefore, agility is viewed as the primary factor that enables firms to adjust to changes in the business environment (Tseng & Lin, 2011). Strategic management literature has defined four attributes tied to agility: responsiveness, competence, adaptability, and speed (Tseng & Lin, 2011). However, firms primarily define themselves via formal structures, which dictate functional responsibility, communication flow, and overall culture. Agility, therefore, implies turning away from rigid procedures toward the autonomy and self-control of competent organizational units or individuals (Mattes, 2014). This contradiction poses a challenge to firms that, on one hand, need governance, while, on the other hand, requires agility. The management literature has addressed this challenge through the concept of ambidexterity, where both flexibility and structure can coexist (Dunford et al., 2013; Mattes, 2014; Tseng & Lin, 2011).

Modularity and Communication Structure

Some IT failures have been attributed to lack of module enterprise architecture that provides the firm with the flexibility needed to innovate. *Modularity* refers to the way in which a system can be divided into different parts. It is widely accepted that lack of modularity leads to complexity, which affects the success of new product development, and thus the competitiveness of a firm (Grussenmeyer & Blecker, 2013). The literature indicates that complex systems—such as products, services, and organizations—are adaptable if they are modular (Colfer & Baldwin, 2010). In their seminal paper, Henderson and Clark (1990) argued that a system with many interdependencies is difficult to control. Modular designs, generally characterized by loosely coupled dependencies, reduce system complexities and provide a high level of flexibility and specialization (Sanchez & Mahoney, 2013). Research conducted by MacDuffie (2013) and Sanchez and Mahoney (2013) on modularity emphasized both component architecture and the integration points associated with each component as key to establishing a simple link between system components.

Enterprise Knowledge Creation

Knowledge creation is the foundation of innovation. It results from developing, acquiring, and reconfiguring existing or new knowledge in unique ways for the firm (Brusoni & Rosenkranz, 2014; Huang & Wang, 2011). Firms are forced to learn new knowledge to develop new products in order to satisfy new demands (Huang & Wang, 2011). Akgün et al. (2014) asserted that information acquisition and dissemination have a positive effect on a firm's performance, which is represented in speed to market, lower

development cost, and operational effectiveness. Brusoni and Rosenkranz (2014) suggested that information gets formulated into new knowledge only when individual, group, and organizational learning are linked. Controls, represented by communication structures, are designed to manage knowledge flows within a firm efficiently and effectively. These controls are are important in directing the transfer of knowledge within a firm. They may also govern communication patterns and limit where and when the transfer of knowledge occurs (von Krogh & Geilinger, 2014).

Dynamic Capabilities

According to Helfat and Peteraf (2009), *dynamic capabilities* enable an organization to adjust the process of leveraging its resources as the business environment changes. Dynamic capabilities, which have received considerable research attention since Teece, Pisano, and Shuen's (1997) seminal paper, enable firms to achieve their objectives by applying skills and competencies that are adaptable to changing circumstances. Similarly, IT capabilities have been identified as critical abilities that affect the agility of the firm. Lu and Ramamurthy (2011) explained that IT capabilities, such as high-speed information transfer via modern information systems, enhace a firm’s ability to respond to market changes. Other IT competencies, including professional talent and soft skills, create a strategic advantage by transforming resources into solutions (Crawford et al., 2011).

Problem Statement

Beinhocker (2006) noted that while many firms may execute well on their current strategy, most are unable to adapt those strategies to the fast-changing environment

through innovation. Firms use information to gain competitive advantage; thus, there is a strong relationship between a firm's performance and its IT capabilities (Melville et al., 2004). Moreover, many previous studies found a relationship between innovation and improving a firm's performance (Jiménez-Jiménez & Sanz-Valle, 2011; Noruzy et al., 2013). The problem was that a firm's investments in IT may not enable innovation if specific IT elements are not designed to support the innovation expected by the firms. To address this problem, I tested hypotheses that could enable researchers to empirically link IT organizational design to a firm's ability to innovate. The IT organizational design elements examined in this study were knowledge creation, dynamic capabilities, and communication structures. My objective was to develop insights that could guide management practices to take into account the design factors of an IT organization that might drive a firm to innovate.

Purpose of the Study

The purpose of this quantitative study was to examine the correlation between IT organizational design and a firm's innovativeness. I developed and tested hypotheses that could enable researchers to empirically link IT organizational design to a firm's ability to innovate. Hypotheses with statistically significant results could enable managers to identify an appropriate design for their IT organization to achieve a specific type of innovation.

Today, firms confront the challenge of having to allocate significant financial investment in IT in order to compete. However, many IT organizations have not been able to address the business demand for solutions. The inability of IT to help firms

innovate was at the core of both this study and the social change mission of Walden University, that is, a commitment to postive social change through the application of ideas and the promotion of social development (2012).

In summary, I attempted to achieve three goals in this study: make a scholarly contribution to the study of innovation, enable practitioners to identify the most appropriate design for their IT organization in order to drive their firm to innovate, and promote social change by providing a methodology to understand the link between IT organizational design and a firm's ability to innovate.

Research Questions and Hypotheses

I examined how organizational design strategies relate to a firm's innovation in terms of its ability to deliver business solutions. The central question was as follows: Is there a correlation between the design of the IT organization and a firm's innovativeness? The following five research questions guided the study:

1. To what extent, if any, is knowledge creation in IT organizations related to a firm's innovativeness?
2. To what extent, if any, are dynamic capabilities in IT organizations related to a firm's innovativeness?
3. To what extent, if any, are communication structures within IT related to a firm's innovativeness?
4. To what extent, if any, are IT communication structures more strongly related to a firm's innovativeness than is IT knowledge creation?

5. To what extent, if any, is IT knowledge creation more strongly related to a firm's innovativeness than are IT dynamic capabilities?

The study was designed to examine three IT organizational design constructs: knowledge creation, dynamic capabilities, and communication structures. Each of these constructs was measured along multiple dimensions, and each of the dimensions was a composite measure of several attributes. An attribute was mapped to a survey question. The conceptual model in Figure 1 shows the relationships investigated.

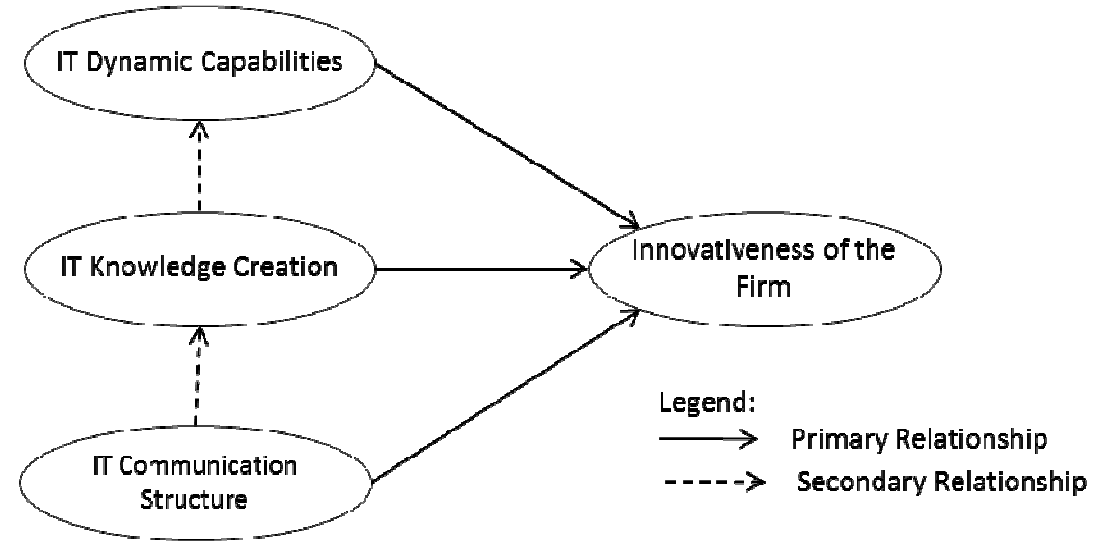

Figure 1. Conceptual model of the study constructs

Hypothesis 1: IT Knowledge Creation

The knowledge creation process is defined as the generation of new ideas through purposeful activities (Mitchell & Boyle, 2010). The knowledge management literature considers it to be a resource and a product of four activities: socialization, integration, publishing, and application (Nonaka et al., 2000; Sabherwal & Becerra-Fernandez, 2003). According to Tsoukas (1996), an individual's knowledge may consist of (a) role-related

normative expectations, (b) dispositions formed in past socialization, and (c) local knowledge of a particular context. Management literature treats knowledge as a resource. However, a new stream of research in the management literature is treating knowledge as a capability. For example, Mitchell and Boyle (2010) characterized knowledge as a critical capability that can be exploited to develop applications that improve performance. I contend that the characterization of knowledge as a resource or a capability depends on the nature of knowledge. In the context of IT, business knowledge is a resource that becomes a capability only when it is applied. Thus, I hypothesize that IT–business knowledge creation affects the dynamic capabilities of IT. Therefore,

$H1a_0$: IT–business knowledge creation is not correlated with IT dynamic capabilities.

$H1a_1$: IT–business knowledge creation is correlated with IT dynamic capabilities.

Knowledge is the most valuable asset of the firm because it represents the culture created by the firm, which includes the processes and systems developed over the life of the organization (Mishra et al., 2013). A firm's knowledge, especially the implicit type, is difficult to imitate and can produce sustainable advantage over competitors. Therefore, IT–business knowledge creation is fundamental for the creation and sustaining of a firm's innovativeness. I hypothesize that IT–business knowledge creation improves innovativeness of firms; hence,

$H1b_0$: IT–business knowledge creation is not correlated with a firm's innovativeness.

$H1b_1$: IT–business knowledge creation is correlated with a firm's innovativeness.

Hypothesis 2: IT Dynamic Capabilities

A widely accepted definition of dynamic capabilities is the ability of an organization to deliberately adjust the process of leveraging its resources, both human and non-human, as the environment changes (Helfat & Peteraf, 2009). Dynamic capabilities enable firms to achieve their objectives by applying skills and competencies that are adaptable to changing circumstances (Teece et al., 1997). Thus, the concept of dynamic capabilities was measured in this study along three dimensions: sensing, seizing, and reconfiguring (Helfat & Winter, 2011; Makkonen et al., 2014; Pavlou & El Sawy, 2011).

Sensing involves recognizing and managing service opportunities and threats (Kindström, Kowalkowski, & Sandberg, 2013). Four factors are considered in defining and measuring sensing: business knowledge, skills, client orientation, and market orientation. *Seizing* involves exploiting opportunities and resisting threats (Makkonen et al., 2014; Van Der Heijden, 2001). Three factors are considered in defining and measuring seizing: knowledge integration, IT–business collaboration, and IT partnerships. *Reconfiguring* is the capability to use and deploy an existing resource in a new situation, allowing the firm to replicate an operational capability in a new market (Bowman & Ambrosini, 2003; Pavlou & El Sawy, 2011; Van Der Heijden, 2001). I hypothesized that the dynamic capabilities of the IT organization affect a firm's ability to innovate. Hence,

$H2_0$: IT dynamic capabilities are not correlated with a firm's innovativeness.

$H2a$: IT dynamic capabilities are correlated with a firm's innovativeness.

Hypothesis 3: Communication Structures

The construct communication structures was measured along three dimensions: complexity, centralization, and formalization (Khaleghi, Alavi, & Alimiri, 2013; Kim et al., 2013; MacCormack, Rusnak, & Baldwin, 2012). The *complexity* dimension is a measure of administrative intensity and number of hierarchical layers in the organization (Khaleghi, Alavi, & Alimiri, 2013; Kim et al., 2013). The measure of the complexity dimension was constructed as the product of four attributes: number of hierarchical layers, group size, group geographic dispersion, and volume of tasks. I hypothesized that IT organizational complexity affects IT knowledge creation and IT dynamic capabilities. Hence,

$H3a_0$: IT organizational complexity is not correlated with IT knowledge creation.

$H3a_1$: IT organizational complexity is correlated with IT knowledge creation.

$H3b_0$: IT organizational complexity is not correlated with IT dynamic capabilities.

$H3b_1$: IT organizational complexity is correlated with IT dynamic capabilities.

The *centralization* dimension is the extent to which organizational decision-making authority is concentrated at the center of an organization. Four constructs measure the centralization dimension, namely, interaction, specialization, collaboration, and consensus. I hypothesized that the degree of IT centralization affects knowledge creation and dynamic capabilities. Hence,

$H3c_0$: IT centralization is not correlated with IT knowledge creation.

$H3c_1$: IT centralization is correlated with IT knowledge creation.

$H3d_0$: IT centralization is not correlated with IT dynamic capabilities.

$H3d_1$: IT centralization is correlated with IT dynamic capabilities.

The *formalization* dimension is related to procedures in the organization and measured by the level of governance and approval process (Khaleghi, Alavi & Alimiri, 2013). I hypothesized that formalization of the IT organization affects knowledge creation and IT dynamic capabilities. Hence,

$H3e_0$: IT formalization is not correlated with IT knowledge creation.

$H3e_1$: IT formalization is correlated with IT knowledge creation.

$H3f_0$: IT formalization is not correlated with IT dynamic capabilities.

$H3f_1$: IT formalization is correlated with IT dynamic capabilities.

Hypothesis 4: Communication Structures and Knowledge Creation

To understand the relative effect of communication structures and knowledge creation on innovativeness, I tested the following hypothesis:

$H4_0$: IT knowledge creation has an equal or greater correlation with a firm's innovativeness than IT communication structure.

$H4_1$: IT communication structure has a greater correlation with a firm's innovativeness than IT knowledge creation.

Hypothesis 5: Knowledge Creation and Dynamic Capabilities

To understand the relative effect of knowledge creation and dynamic capabilities on innovativeness, I tested the following hypothesis:

$H5_0$: IT dynamic capabilities have an equal or greater correlation with a firm's innovativeness than IT knowledge creation.

$H5_1$: IT knowledge creation has a greater correlation with a firm's innovativeness than IT dynamic capabilities.

Nature of the Study

Because this study used a correlational design, the focus was on examining the covariation between factors. The goal of a correlational design is to determine the extent to which two factors are related and to identify predictive relationships by using advanced statistical techniques. In this study, three IT organizational design factors—knowledge creation, dynamic capabilities, and communication structures—were examined in relation to certain aspects of innovation. A survey instrument and advanced analytical techniques were used to examine whether and to what extent individual factors of organizational design related to certain aspects of innovation. Participants in this study were managers of firms that relied on IT to provide products or services. The surveys, which targeted both IT and non-IT managers, consisted of questions on IT organizational design and a firm's ability to innovate.

Theoretical Base

To measure the role IT organizational design plays in enhancing a firm's ability to innovate, it is important to use a holistic design methodology. A holistic approach enables researchers to capture the interdependencies between various factors that contribute to a firm's innovation. Therefore, the theoretical foundation incorporated the following dimensions:

1. IT organizational knowledge creation that enables firms to recombine technology to create new products or reconfigure an existing product for a new purpose
2. IT organizational dynamic capabilities, both tangible and intangible, that give IT the capacity to perform a particular activity in a reliable and satisfactory manner
3. IT organizational communication structures within the IT organization and across the firm that constrain the organizational capabilities
4. A firm's innovativeness, which results from IT organizational knowledge creation, dynamic capabilities, and communication structures

The underlying theories that explain the relationship between IT organizational factors and a firm's ability to innovate guided the research question for this study. These theories included (a) Conway's law (1968), which was later termed *the mirroring hypothesis*; (b) Nonaka's (1994) dynamic theory of organizational knowledge creation; (c) the innovation and industrial market structure advanced by Schumpeter (1934, 1942); and (d) the resource-based view of the firm (Wernerfelt, 1984). More details about the different theories and models, and how they apply to research on innovation, are given in Chapter 2.

Definition of Terms

Alignment: a term used in contemporary firms to describe the sociotechnical relationship, specifically the gap, between the business and the IT organization within a firm (Bharadwaj et al., 2013; Crawford et al., 2011)

Autonomy: Autonomy is a description of how an entity operates within the enviornment. It describes the ability to make decisions at the individual or organizational level by acquiring freedom through decentralization (Lumpkin & Dess, 2001).

Communication structure: The social structure of the organization, which directs communication patterns between individual and teams and shapes knowledge sharing (Conway, 1968; MacCormack et al., 2012).

Disruptive innovation: Disruptive innovation creates a new market for a new kind of product or service that might be simpler, more convenient, or less expensive than currently available products or services (Christensen et al., 2006; Huang, Chou, & Lee, 2010).

Dynamic capabilities: A dynamic capability is one that enables a firm to change the process of utilizing resources and producing products or services to adjust to changing circumstances. Teece (2007) divided dynamic capabilities into three categories, namely: (a) sensing capabilities that enable a firm to recognize and deal with opportunities or threats, (b) seizing capabilities that enable a firm to exploit opportunities and manage threats, and (c) reconfiguring capabilities that enable firms to maintain competitiveness through skills and competencies.

Flexibility: The capacity to respond to changing environmental conditions in order to enhance organizational performance (Dunford et al., 2013).

Imitation: Applying a concept at one organization in the same manner as has been applied by other organizations (Huang, Chou, & Lee, 2010).

Innovation: The ability of an organizational entity to integrate individual knowledge in novel ways and advance the novel ideas towards practice and value creation (Grant, 1996).

Innovativeness: The creation of new product, services, or process that in turn produces value and enhances the performance of the firm (Damanpour & Aravind, 2012).

Information technology business value (ITBV): The value a firm attributes to using IT which includes both operational efficiency and competitive advantage (Melville et al., 2004; Wiengarten et al., 2013).

IT resources: The assets controled by an IT organization, which comprises tangible and intangible assets. Tangible resources include systems, hardware, and software, while intangible resources include competencies and skills (Melville et al., 2004; Wiengarten et al., 2013).

Knowledge creation: Knowledge creation results from developing, acquiring, and reconfiguring existing or new knowledge in unique and innovative ways to the firm (Grant, 1996).

Modularity: A design pattern that focuses on hierarchically ordering complex systems into quasi-separable subsystems. This pattern may be applied recursively to subsystems until the lowest level of elementary components is reached (Sanchez & Mahoney, 2013).

Organization for Economic Co-operation and Development (OECD): The Oslo Manual was developed jointly by Eurostat and the OECD and constitutes a widely used, well-known methodology in studying innovation (OECD, 2005).

Recombinant capabilities: The ability to recombine known, and often available, technologies to generate new markets or new products, or enhance an existing product (Carnabuci & Operti, 2013).

Reconfiguration create: The ability to recombine known technologies that have never been combined before (Carnabuci & Operti, 2013).

Reconfiguration reuse: The ability to refine known combinations of technology to solve new problems or develop new applications (Carnabuci & Operti, 2013).

Strategic innovation: A process that redefines customers, the value offered, and the delivery methods (Govindarajan & Trimble, 2005).

Assumptions

The theoretical foundation, which was based on the synthesis of several theories and instruments from multiple disciplines including management and information systems, served as the theoretical basis for this research. In this study, I examined the relationship between IT organizational design and a firm's ability to innovate. Thus, the results may apply only to firms that rely on IT for the delivery of their products or services.

Organizational design is a vast discipline that covers numerous aspects of the organization that range from core vision and mission to leadership, strategy, and technology. In this study, the focus was on three elements of organizational design: knowledge creation, dynamic capabilities, and communication structures. It was assumed that these three elements of organizational design contribute the largest share of influence on the overall organizational design. The second assumption was that the inclusion of

participants from a wide range of industries and occupations would yield the degree of variation in the data that was necessary to achieve depth in emergent concepts and themes.

Scope and Delimitations

This study involved only factors related to the IT function. It did not involve other factors within the firm, such as design or structure of other functional areas. In order to assess the relationship between IT organizational design and a firm's innovativeness, the study was bounded by three organizational design elements, namely, knowledge creation, dynamic capabilities, and communication structures. It was also limited to firms in the United States that relied on IT to deliver their products or services.

Limitations

The study was limited in terms of design, geography, time, and instrument used. The study used a correlational design. The primary limitation of the correlation approach is the inability to establish cause and effect between variables. The study focused on organizations in the United States and was conducted once over a short period. Although existing survey instruments were adapted and used, the individual instruments may have inherent limitations, such as misinterpretation of statements or questions on the survey due to language deficiencies.

I focused on firms that relied on IT to deliver products or services; hence, the study was limited by the meaning of IT within the context of this study. For example, firms that used IT as a utility to manage network, E-mail, and computers were not considered in this study and findings of this study may not apply to those firms. Another

limitation of the study was its assumptions about the environment. The study did not account for the role of the environment, such as external factors unrelated to organizational design that could affect innovation. For example, market conditions and competition for talent may shift skills (human resources) from one organization to another, or even across industries. This shift in talent may affect the ability of a firm to innovate. In addition, sociological and psychological factors were not considered in this study. For example, employee motivation may have a role in how individuals within the firm approach innovation.

Significance of the Study

The focus of this study was on a significant challenge facing firms today: how to create an innovative environment using IT organizations. The study sought to examine how an IT organizational design may affect the performance of firms through its ability to innovate. Innovation includes the ability of a firm to create new products or services, either by combining existing technologies or reconfiguring existing combinations of technologies. Therefore, I synthesized theories from numerous disciplines to develop quantitative evidence of the effect of the IT organizational design on innovation. Hence, the significance of this study to the field of management was its focus on measuring various IT organizational design elements and analyzing their effect on a firm's ability to innovate. Consequently, the aim was to develop insights into the link between IT and innovation that could guide managers to take into account IT organizational factors that could enable the firm to innovate.

Theoretical Contributions of the Study

This study makes three contributions to the management literature. First, much of the literature treats innovation and IT organizational design separately. These streams of literature include dynamic capabilities, communication structures, and the knowledge-based view of the firm as well as innovation. This study unifies these streams to examine the relationship between organizational design and innovation. Second, this research contributes to the discussion of the creation and management of competitive advantages through sustainable models of IT organizations. Third, this study provides new insights into organizational innovation by correlating IT organizational design and innovation. The goal was to better understand the effects of underlying design elements on four types of innovation (imitation, recombinant reuse, recombinant create, transformation), a focus that has received little empirical assessment. Finally, the managerial implications of the results of this research could help to inform organizational design practices, which are important for innovation and the competitive advantage of the firm.

Practical Contributions of the Study

Evidence of correlation between the three IT organizational design strategies (knowledge creation, dynamic capabilities, and communication structures) and a firm's innovativeness may help management choose more effective design strategies to increase the likelihood of creating an innovative environment. Therefore, the significance of this study to the field of management is its focus on measuring various IT organizational design elements and analyzing their effects on innovation.

Contributions of the Study to Positive Social Change

The results of this study could effect positive social change in the innovation domain by drawing attention to the relationship between IT organization and a firm's innovation and by illuminating the importance of knowledge creation, dynamic capabilities, and communication structures. The findings are expected to provide organizations with information that could be used to develop strategies and practices that increase the effectiveness of IT.

Summary and Transition

IT organizations have become an integral part of many firms, with increasing strategic significance. Consequently, investments in IT represent a significant percentage of a firm's expenditure. Despite the investment, the business value of IT has been difficult to quantify. The problem is that a firm's investments in IT may not enable innovation if specific IT elements are not designed to support innovation. The purpose of this nonexperimental study was to examine relationships between a firm's innovativeness and three IT organizational design constructs: knowledge creation, dynamic capabilities, and communication structures. The study was based on Nonaka's dynamic theory of organizational knowledge creation, Schumpeter's industrial market structure, and Wernerfelt's resource-based view of the firm. The implications for positive social change stemming from this study affect managers of firms that rely on IT to deliver products or services.

This introduction chapter presented the background of the study, statement of the problem, and purpose of the study. In addition, the chapter introduced the nature of the

study as well as the theoretical support for the study. Moreover, the chapter introduced definitions of terms, as well as the study's scope and delimitations, limitations, research questions, and significance.

In Chapter 2, a comprehensive literature review of selected peer-reviewed journals (and books) is presented. The review includes current research on knowledge creation, dynamic capabilities, communication structures, and innovation. For each of the four subjects, the chapter provides a theoretical foundation based on current literature as well as theories by seminal researchers. The literature review also includes a detailed review of the key theoretical issues and challenges associated with the link between IT organizational design and the ability of firms to innovate.

Chapter 3 outlines the study's methodology; it explains the rationale for using a correlational design to address the research questions and the procedures used to support or reject the null hypotheses. The chapter also covers data collection techniques, data analysis procedures, and the statistical methods used for accurate measurement.

Chapter 4 covers the following topics: a description of the pilot study and a discussion of the validity and reliability of the survey; a presentation of data collection procedure, including the population, the sample, their demographic characteristics; the results of the study. Chapter 5 covers the following topics: a discussion of the results, conclusions, recommendations for action and further study; and finally, the implications for social change, for the literature, and for managers.

Chapter 2: Literature Review

Firms use information to gain competitive advantage; thus, there is a strong relationship between business strategy and IT (Melville et al., 2004). Previous studies focused on the drivers of the firm's performance (Naranjo-Valencia, Jiménez-Jiménez, & Sanz-Valle, 2011). Many of these studies found a relationship between innovation and improving a firm's performance. However, there is limited information in the literature on the empirical relationship between the IT and a firm's ability to innovate. To address this problem, I tested hypotheses that could enable researchers to empirically link IT organizational design to innovation. The elements of IT organizational design examined in this study were knowledge creation, dynamic capabilities, and communication structures. The objective of the study was to develop insights into organizational innovation that could guide managers to take into account their IT organization's design factors that might enable innovation.

The challenges that many firms face result from a combination of economic, sociological, and sociotechnical factors that lead to stagnation and lack of innovation. Those challenges are multidimensional and require examination of several information systems and management theories, both historical and contemporary. Thus, this chapter discusses concepts from the dynamic theory of organizational knowledge creation (e.g., Argote & Miron-Spektor, 2011; Davenport, 1998; Nonaka, 1994; Nonaka et al., 2014; Tsoukas & Vladimirou, 2001), the mirroring hypothesis (Conway, 1968; Baldwin et al., 2014; Herbsleb & Grinter, 1999; Parnas, 1972), creative destruction theory (e.g., Schumpeter, 1949; Damanpour, 1991; Damanpour et al., 2009), and the resource-based

view of the firm (e.g., Barney, 1991; Wernerfelt, 1984). This chapter also includes a detailed literature review of the key theoretical issues and challenges associated with the link between IT organizational design and innovation of the firm. It also covers research on innovation, knowledge creation, dynamic capabilities, and communication structures. Table 2 presents an outline of the literature review and provides a brief description of each section of this chapter.

Table 2

Literature Review Structure

Section	Description
Literature search strategy	This section includes a definition of the literature search strategy used in this study including libraries used, keywords and search terms, scope and type of literature reviewed both seminal work as well as current peer-reviewed literature.
Theoretical foundation	This section includes the theories, sources of theory, and description of theoretical proposition and major hypotheses. The section also provides a literature- and research-based analysis of how the theory is used by similar studies.
Literature review	This section includes the literature review for the study. It focuses on the contemporary firm and the modern day dynamic environment that necessitates sustainable innovation. This section elaborates on the concept of innovation and examines both types and outcomes of innovation in order to develop a measurement of innovation. In addition, this section presents a detailed literature review of IT theory including organizational design, dynamic capabilities, knowledge creation, and communication structure.
Conclusions	The last section of the chapter provides a summary of major themes in the literature on the topic of study. It then presents a description of how the study fills gaps in the literature. The section concludes by connected the gap to the methods described in Chapter 3.

Literature Search Strategy

Most of the research for this study came from the following databases: EBSCOhost, ProQuest Central, Science Direct, InfoSci, the IEEE Digital Library, Google Scholar, and SAGE Publications. The review includes current peer-reviewed articles, highly cited working papers, seminal work, and scholarly books. Most of the work was published within the last 5 years.

The foundation of this review was based on 394 articles, which I identified using keywords (see Table 3). I scanned the references of significant articles for additional sources. The set of 394 articles was refined by verifying (a) that the article was published in a top-tier information systems or management journal, (b) that it represented a highly cited paper, and (c) that the study focused on innovation along with one or more of three disciplines: dynamic capabilities, knowledge creation, or communication structures. This process eliminated 177 articles. The remaining 217 articles were used in this study (see the References section for the complete list of articles cited in this dissertation).

Table 3

Search Keywords and Synonyms

Keywords	Search phrase
Innovation	Innovative and collaboration Creation for organizational values Imitative innovation and strategy Innovation and firm performance Service innovation and strategy Innovation and strategy Innovation management innovation diffusion

Organizational Design	Management and organization Information and organizational design Organizational innovation Collaboration and co-creation Organizational structure and post-bureaucracy Team and flexibility Organizational flexibility
Information Technology	Business value of IT Value creation and information and systems Information systems strategy Decentralization and IT organization IT innovation adoption IT organization and shared services IT organization and center of excellence IT–business alignment
Dynamic Capabilities	Corporate social responsibility Organizational agility Organizational climate and culture Technological capabilities Formal organizational relationships Strategic resources Competitive strategy
Knowledge Creation	Knowledge management and knowledge creation Knowledge integration and knowledge transfer Learning orientation and entrepreneurial orientation Knowledge search and innovation
Communication Structure	Conway's Law Mirroring hypothesis Modularity and architecture and information

The subject of innovation was used as the entry point for the literature review, followed by a review of organizational design literature. Drawing on a literature review techniques (see, e.g., Adams, Bessant, & Phelps, 2006; Webster & Watson, 2002), I used a two-phase approach to review, critique, and synthesize the literature. In the first phase, I identified innovation as a multidisciplinary subject that integrates knowledge, capabilities, and communication to enable strategic advantage. In the second phase, I linked the innovation literature to IT, specifically IT organizational design, in order to

provide a rich and relevant account of multidisciplinary organizational design in innovation and management literature. This phase of the search used results from the first phase of search to include literature relevant to one or more of the following areas: organizational design, IT, knowledge creation, dynamic capabilities, and communication structure.

Theoretical Foundation

The literature on innovation models specific aspects of innovation and makes assumptions regarding other dimensions of innovation. In addition, the subject of innovation has largely focused on product development. Moreover, innovation literature has covered various subjects, but those subjects are fragmented. Nevertheless, the innovation literature provides foundational pieces, which can be used to develop a multidisciplinary and a more integrative perspective on innovation.

The theoretical foundation for this study was based on three IT design constructs and innovation. These IT organizational design constructs are used to empirically correlate IT organizational design to a firm's innovativeness. The underlying theories that explain the relationship between factors of the design of the IT organization and the firm's ability to innovate guided the research question for this study. These theories include (a) creative destruction theory advanced by Schumpeter (1934, 1942), (b) Nonaka's (1994) dynamic theory of organizational knowledge creation, (c) Conway's law (1968), which was later termed *the mirroring hypothesis*, and (d) the resource-based view of the firm (Wernerfelt, 1984).

Schumpeter's Creative Destruction

The foundation for innovation theory is derived from Schumpeter's idea that creative destruction is the process of creating new technologies that render existing technologies obsolete; therefore, it causes the creation of new economic structures (Schumpeter, 1934; 1942). Schumpeter's arguments were further developed and refined by him and other researchers. Schumpeter described innovation as a key driver to economic growth. Hence, organizations should innovate in order to renew the value of their assets (Schumpeter, 1949).

Recent theories promoted incremental innovations that can be viewed as a series of evolutionary enhancements. However, in today's dynamic global economy, incremental innovations may not be sufficient to create competitive advantage for the firm. Today's investors are inpatient and expect a significant return on investment, which may not be possible without breakthrough innovation. These demands force firms to develop new sources of value in order to maintain a solid competitive position and to achieve profitability (Johannessen et al., 2001).

Dynamic Theory of Organizational Knowledge Creation

According to Nonaka (1994), the creation of firm-level knowledge is a dynamic process of knowledge transformation. Nonaka's theory is based on basic principles, which include (a) knowledge creation results from the social interaction between individuals who possess knowledge; (b) knowledge transition occurs through socialization, integration, publishing, and application; (c) firm-level knowledge creation requires knowledge transition; and (d) the context of knowledge creation is important at

the firm's level (Bratianu, 2011). Other researchers (e.g., Grant; 1996; Tsoukas, 1996; Tsoukas & Vladimirou, 2001) supported Nonaka's arguments and further developed his theories.

Tsoukas (1996), Grant (1996), and Tsoukas and Vladimirou (2001) considered explicit and tacit knowledge inseparable, and that the basic unit of knowledge is an individual. According to Tsoukas (1996), an individual's knowledge may consist of norms related to the role the individual plays, dispositions formed in past socializations, and knowledge of particular context. Davenport (1998) believed that knowledge is a complex flow of structured experiences, values, and information. Argote and Miron-Spektor (2011) highlighted the significance of the interaction between experience and context in order to create firm-level knowledge. This was exemplified by Nonaka et al. (2014) who argued for a dynamic synthesis of knowledge exploration and exploitation in order to enable sustainable knowledge transformation across the diverse boundaries within organizations and their environments.

Wernerfelt's Resource-Based View of the Firm

Management literature has often considered a firm's resources as the key source of its competitive advantage. Wernerfelt (1984) developed the concept of the resource-based view (RBV) of the firm to establish a link between the resources of the firm and the firm's performance. The foundation of RBV is based on the principle that unique resources and capabilities maybe leveraged to improve the performance of firms that possess them. Barney (1991) and Teece et al. (1997) distinguished those unique resources and capabilities as sources of advantage for the firm that possesses them. However, these

advantages can only become strategic if the resource is unique and could not be reproduced easily (Mishra et al., 2013).

Some scholars in the field of strategic management (e.g., Leiblein, 2011; Teece et al., 1997) criticized the RBV for its static nature as it assumes the resource, regardless of how it is used, is what provides strategic advantage. In his review of the resource based theory, Leiblein (2011) explained that while resources can create a strategic advantage, the ability to manage resources vary among firms; thus, pointing out an important limitation of the resource-based theory. The concept of dynamic capabilities, first introduced by Teece et al. (1997), attempts to address the limitations with the RBV, specifically its static nature.

Conway's Law

It is widely accepted that a complex system should be divided into smaller loosely coupled subsystems in order to better manage it. This approach reduces the communication overhead within the system by making the subsystems as independent as possible (Kwan, Cataldo, & Damian, 2012). The approach has been labeled Conway's Law or the mirroring hypothesis. Conway (1968) argued communication structures within an organization dictate the designs of its products, services, or processes. This theory suggests that organizational structure and team makeup, which may constrain or facilitate communication, could affect the design of the product and hence affect a firm's ability to innovate.

Conway's arguments were further developed by other researchers such as Parnas (1972), Herbsleb and Grinter (1999), and Baldwin and Clark (2000). Recently, the

Conway concepts were applied to sociotechnical systems to enhance productivity and quality (Baldwin & Clark, 2000; Colfer & Baldwin, 2010). More recently, Baldwin, MacCormack, and Rusnak (2014) advanced these concepts within technology management and system design by using them to characterize the architecture of large systems.

Literature Review

Today, firms face increased competition and changing customer needs, which lead to rapid obsolescence of products (Bernstein & Singh, 2008; Damanpour et al., 2009; Goktan & Miles, 2011; Kessler & Chakrabarti, 1996; OECD, 2005). This constant change in demand requires constant innovation to adapt to change (Gopalakrishnan et al., 2014). Innovation is a critical source of competitive advantage and economic growth (Schumpeter, 1949). It affects many social and economic aspects of our lives (Ganter & Hecker, 2014). The need for innovation is well understood by many firms, espceially as changing technologies have increasingly diminished the value of existing products and services (Gunday et al., 2011). The adoption of innovation is an important atecendent for organizations to achieve their goals in an enviornment where change is the norm (Boyne et al., 2003; Jansen et al., 2006).

The Contemporary Firm

The global financial sector is designed to expect firms to maximize shareholder value. The rise of shareholder activism, as defined by Goranova and Ryan (2014), has changed the view of the firm to an entity owned by shareholders and set the expectations to maximize shareholder value. This expectation shifted business focus away from the

customer toward shareholders and transformed the management team into a body driven by financial metrics and short term gains (De Matos & Clegg, 2013; Denning, 2012; Goranova & Ryan, 2014). As a result, many firms started to engage in cost containment and efficiency enhancements in an attempt to show immediate profitability.

The tension between external demands and internal strategy of the business have become increasingly complex due to rapid changes in technology, fierce competition, and globalization, yet the ability to contribute to short-term profit continues to be the main focus of many firms. Firms face increased competition and changing customer needs, which shortens product life cycles and leads to a rapid obsolescence of products (Bernstein & Singh, 2008; Kessler & Chakrabarti, 1996). Firms are overwhelmed by environmental complexities and instability, which resulted from globalization, economic uncertainty, competition, rapid technological change, and changing consumer demands (Handel, 2014). In this new environment, competitive advantage necessitates faster decisions times, innovation, and flexibility. While management literature suggests building competitive advantage through people, a new trend of research is shifting focus to innovation-based competitive advantage (Sheng et al., 2013).

Engaging in innovation activities such as reducing transaction costs, improving workplace satisfaction, gaining access to capabilities, or reducing costs of supplies increases the performance of the firm (Meroño-Cerdan & López-Nicolas, 2013). While cost cutting is important, firms cannot rely solely on operational effectiveness to compete. The management literature has warned firms against depending solely on efficiency improvements to stay competitive (Teece, 2007; Tse, 2013). It suggested that

firms should improve their performance by shifting focus to revenue growth through strategic innovation (Berman, Christner, & Bell, 2010; Govindarajan & Trimble, 2005).

Strategic innovations require the firm to manage difficult challenges. Strategies are typically formulated around creating competitive advantage based on some of its unique competencies such as resources, technologies, or knowledge. However, many of these, once unique, competencies are being commoditized (Chesbrough, 2011). For example, it is widely acknowledged that technology enables innovation; however, opportunities created by technologies are available to all competitors (Ganter & Hecker, 2014; Hollen et al., 2013). Therefore, the process of using the available technologies may become the differentiator. Naranjo-Valencia et al. (2011) asserted that the challenges facing many firms today require different management practices, simplified product architectures, new competencies, and focused technology investments. These challenges are compounded by an increasingly turbulent business landscape described by Hollen et al. (2013) as the new competitive dynamics. Those dynamics are driven by the rapid technological, regulatory, and economic changes. In order to deal with these dynamics, innovation must be at the forefront (Crossan & Apaydin, 2010).

The Different Views on Innovation

The literature described the concept of innovation in one of four dimensions, namely, innovation types (e.g., Carnabuci & Operti, 2013; Damanpour et al., 2009; OECD, 2005), capabilities of a firm (e.g., Crawford et al., 2011; Helfat & Peteraf, 2009), knowledge management (e.g., Brusoni & Rosenkranz, 2014; Huang & Wang, 2011), and sociotechnical stakeholders (e.g., Kim et al., 2013; MacCormack et al., 2012). These four

dimensions are outlined in Table 4 along with the scope of each dimension of innovation and recent research studies in the area. The basic foundation of these four innovation research types is derived from Schumpeter's idea of creative destruction. The concepts advanced by Schumpeter argue that creating new technologies render existing technologies obsolete; therefore, causing the creation of new economic structures (Schumpeter, 1934; 1942).

Table 4

Dimensions of Innovation Research

Dimension	Scope	Study
Innovation types	Deals with the various types of innovations	Carnabuci & Operti, 2013; Damanpour et al., 2009; OECD, 2005
Capabilities	Relates the technological competences of a firm to innovation	Crawford et al., 2011; Helfat & Peteraf, 2009
Knowledge management	Associates knowledge creation to innovation	Brusoni & Rosenkranz, 2014; Huang & Wang, 2011
Sociotechnical stakeholders	Examines stakeholders' communication structures	Kim et al., 2013; MacCormack et al., 2012

Innovation is a multidisciplinary concept; consequently, the definition of innovation has been described as an elusive task as it could be described in different ways (Gopalakrishnan et al., 2014). Schumpeter (1934) defined innovation as a process and an output that results from novel combinations of existing ideas. Other scholars defined the concept of innovation from their specific point of view. For example, Knight (1967) described innovation as an adoption process that introduces new ideas to the firm. Damanpour and Evan (1984) used a similar definition; but they focused on implementation as opposed to Knight, who focused on adoption. Tushman and Nadler

(1986) defined innovation as a creative process while Drucker (2002) defined it as means used to create wealth-producing resources.

More recently, definitions of innovation became more generic as it included adoption, assimilation, and exploitation of novel ideas. These definition also expanded the scope of innovation to include enhanced or improved concepts (Camisón & Villar-López, 2011; Crossan & Apaydin, 2010). Meroño-Cerdan and López-Nicolas (2013) further expanded the definition of innovation to include activities that were not considered innovation before. They added new types of innovations (organizational and marketing), which are discussed in detail in the Oslo Manual and are considered enablers to technological innovation (Meroño-Cerdan & López-Nicolas, 2013; OECD, 2005). Different types of innovation are necessary in different organizations, but most firms address different types of innovations at the same time (Armbruster et al., 2008).

The Nature of Sociotechnical Innovation

Innovation is a broad and multidisciplinary concept. It can mean scientific inventions, technological breakthroughs, or even a simple new way to do things. The main reason to innovate is to create value for the stakeholders of the firm such as customers, suppliers, communities, and governments (Battistella et al., 2012; Lee et al., 2012). Therefore, innovation positively affects value creation and directly improves societies at all levels.

Innovation can be technological, often referred to as product innovation, or administrative, such as organizational innovation (OECD, 2005). The type of innovation has become important for researchers and practitioners. Innovation research describes

innovation types based on their focus, nature, orientation, scope, determinants, and effects (Damanpour et al., 2009). Historically, research focused on technological innovations as it was assumed that research and development (R&D) was the primary focus of the firm. The OECD (2005) included the most commonly accepted classifications of innovation including: product, process, marketing, and organizational innovation.

Table 5

Comparison of Product and Process Innovation

	Product	Process
Definition	A new or improved concept that becomes a product or is used to enhance an existing product	A new or improved method that creates efficiencies in the manufacturing or delivery of products
Focus	Primarily market driven	Internal focus
Result	Creates a new offering to the consumer	Improves the manufacturing or delivery of products to the consumer
Drivers	Consumer demand for better products and global competition for markets	Cost reduction through increase efficiency of production operations

Note. Information from "Organizational Innovation and Performance: The Problem of Organizational Lag," by F. Damanpour, and W. M. Evan, 1984, *Administrative Science Quarterly*, 29, p. 405, and "Extent and Scope of Diffusion and Adoption of Process Innovations in Management Accounting Systems," S. Sisaye, and J. Birnberg, 2010, *International Journal of Accounting and Information Management*, 18(2), p. 127.

Product and process innovations are types of technological developments (see Table 5 for a summary of a comparison between product and process innovation). Product innovation involves a new or an improved concept; accordingly, a change in characteristics or intended use of a product is considered innovative (OECD, 2005). Product innovations rely on technological advances, but they are driven by competition and changing consumer demands. Process innovations, on the other hand, focus on the

methods and technique of manufacturing and delivery of products. The focus of these types of innovation is on efficiency and effectiveness (Damanpour et al., 2009) and can be facilitated by the technical resources or the social system of the organization (Damanpour & Evan, 1984).

Table 6

Comparison of Technological and Administrative Innovation

	Technological	Administrative
Definition	Improvements in the technical system of the organization to enhance consumer offering	Improvements in the social system of the organization to enhance technological innovation
Characteristics	Viewed as a key to a firm's performance	Viewed as complex and difficult to measure or sustain its results
Focus	Products and services the firm offers to its consumers	The way the organization performs basic work activity
Process	Bottom-up as working levels create innovations	Top down as management designs and reinforces organizational behavior
Scope	Limited to the particular tasks or structures. It may not influence other parts of the organizational social systems	It has direct impact on the social system and indirect impact on the technical system, i.e. changes in the social system leads to changes in the technical system.
Result	Modify organizational systems, products, or processes.	Modify the organization's management systems
Drivers	Competition and time to market and increase in operational efficiency	Organizational structure needs due to complexities associated with the nature of work

Note. Adapted from "Extent and Scope of Diffusion and Adoption of Process Innovations in Management Accounting Systems," S. Sisaye, and J. Birnberg, 2010, *International Journal of Accounting and Information Management*, 18(2), p. 127, and "Organizational Innovation and Performance: The Problem of Organizational Lag," by F. Damanpour, and W. M. Evan, 1984, *Administrative Science Quarterly*, 29, p. 405.

Administrative innovations refer to improvements in the social system of the organization (see Table 6 for a comparison between technological and administrative innovation). Administrative innovations produce new management methods or enhance

existing ones (Birkinshaw et al., 2008). Therefore, administrative innovations affect the way work is performed by changing the internal controls, organizational structures, policy and procedure, and communication structures (Sisaye & Birnberg, 2010).

A firm's ability to explore and exploit market opportunities is a crucial core competence. This competence, operationalized as marketing ideas, tactics, and strategies is conceptualized and termed as marketing innovation in innovation research. OECD (2005) defined marketing innovation as the adoption of new marketing methods in exploring market opportunities and meeting these opportunities with the right product or service. Marketing innovations aim to address customer needs better, establish new markets, or increase a firm's sales.

Organizational innovations refer to the design and implementation of new structures that improve the organization's ability to perform activities associated with business practices (Damanpour & Gopalakrishnan, 1998). These improved structures affect the social system within the organization and how individuals and teams work together and interact with external social systems. Organizational innovations are intended to enhance the performance of a firm by reducing transaction costs, improving efficiency and effectiveness, and enhancing employee satisfaction (OECD, 2005).

Scolars have agrued that to maximize the benefits of innovation, technological and organizational innovations should be integrated (e.g., Damanpour & Aravind, 2012; Hollen et al., 2013). The dependencies between organizational and technological innovations is well documented in the management literature (e.g., Battisti & Stoneman, 2010; Damanpour et al., 2009). Organizational innovations ensure foundational elements

for the R&D processes exist while simultaneously increase the efficiency of these processes; therefore, the level of organizational and technological innovation should be significantly correlated.

Organizational Innovation

The innovation literature states that organizational innovation is a critical output for firms, a source of value creation, and an indicator for the diffusion of organizational practices (Armbruster et al., 2008). Organizational innovations involve changes in organizational practices, the structure of the organization, and external relations (Meroño-Cerdan & López-Nicolas, 2013; OECD, 2005). Damanpour and Gopalakrishnan (1998) defined organizational innovation as the implementation of new communication structures that improve the organization's ability to perform activities associated with business practices.

According to the OECD (2005), organizational innovation is a critical source of competitive advantage. However, organizational innovation remains poorly understood as highlighted by Kato and Owan (2011) who explained that the literature has little to offer on the interaction between tasks and the firm's choice of bundling of human resources. Moreover, technological conditions of the firm may play a crucial role in determining the firm's choice of a specific approach to task coordination within the organization, and hence its selection of a specific organizational design.

The management literature has not offered a unified definition of organizational innovation (Camisón & Villar-López, 2014). The primary reason for the lack of a clear definition of this concept is that organizational innovation literature is scarce compared to

the literature on technological innovation (Armbruster et al., 2008; Camisón & Villar-López, 2014; Mol & Birkinshaw, 2009). Apart from some early contributions, the importance of organizational innovation as a distinct discipline is new (Camisón & Villar-López, 2014). Early studies focused on administrative innovation, which was concerned with human resources (Damanpour & Evan, 1984). More recent studies referred to organizational innovation as management innovation, managerial innovation, and organizational innovation (OECD, 2005). Alänge and Steiber (2011) characterized organizational innovation by organizational boundaries, learning process, and decision criteria. The OECD's (2005) recognition of organizational innovation as independent from the other types expanded the concept of organizational innovation (Camisón & Villar-López, 2014).

Measuring Innovation

The innovation process represents a change from one state to another. The innovation literature suggests that the type of change associated with organizational innovations is dependent on its effect on decision-making in the firm (Alänge & Steiber, 2011; Ariss & Deilami, 2012; Damanpour & Aravind, 2011). Two types of changes were discussed in the innovation literature, incremental and radical. For example, Damanpour and Aravind (2011, as cited by Ariss & Deilami, 2012) described the incremental change as minimalistic and evolutionary while radical change as a fundemental reordering of the norm. Many scholars (e.g., Alänge & Steiber, 2011; Ariss & Deilami, 2012; Damanpour & Aravind, 2011) agree that major advances in many fields were conceived by radical innovation.

Christensen et al. (2006) suggested that disruptive innovations change the socioeconomic landscape. They argued that these types of innovations create new consumers who, historically, may not have been able to access similar products due to cost or skill. Disruptive innovation creates a new market for a new kind of product or service that might be simpler, more convenient, and less expensive than currently available products or services (Huang et al., 2010). Although these products or services may not initially meet the needs of mainstream customers, by which these firms can catch the next wave to potentially disruptive technologies and have a chance to overcome hindrances when technologies or markets change.

Imitative innovation. Imitative innovation is defined as applying innovation in a similar manner as in another firm (Huang et al., 2010). It is widely acknowledged that innovation is about doing things differently (Crossan & Apaydin, 2010). However, doing things the same, as they have been done before, is impractical (Hansen & Wakonen, 1997 as cited by Crossan & Apaydin, 2010). Accordingly, imitation is a form of innovation.

Firms that imitate other firms do so to avoid the high costs associated with research and development of new ideas, avoid the uncertainty of scientific investigations, and minimize the risks of being first to market (Naranjo-Valencia et al., 2011). Those firms are imitation-oriented, and they only act as market followers that imitate proven ideas (Huang et al., 2010). Those firms refer to innovation as being something new to their firm rather than something new to the industry (Huang et al., 2010; Naranjo-Valencia et al., 2011).

Recombination. Disruptive and imitative innovations are two extreme measures of innovation. A great deal of innovation falls between these two extremes and uses existing technology to create innovation. Carnabuci and Operti (2013) explained that innovativeness of a firm is generally determined by its ability to evolve existing ideas through combining of existing technologies. They distinguished between two types of recombination, creation and reuse. The organizational processes involved in creation or reuse are different and the capabilities required for each necessitate different operational challenges (Carnabuci & Operti, 2013). Most technological innovations are based on recombining or reconfiguring existing technologies in ways that produce better consumer experience or open up new market potential (Carnabuci & Bruggeman, 2009).

Exploration and exploitation. Two forms of organizational activities have been recognized in the management literature, exploration and exploitation. In his seminal work, March (1991) described the exploration and exploitation as two behaviors organizations engage in to innovate. Exploration activities involve experimentation, research, and development; therefore, they produce more disruptive results when they are successful. Exploitation activities, on the other hand, involve adjustments and evolution of existing technologies; therefore, they produce less disruptive results (Lavie et al., 2010). Table 7 includes a comparison between exploration and exploitation orientations based on six common organizational attributes including composition, knowledge required, and scope of activities.

Table 7

Exploration vs. Exploitation

Organizational attribute	Exploration	Exploitation
Composition	New comers	Old timers
Scope of activities	Generate new knowledge	Reuse existing knowledge
Knowledge	Diversification	Deep experience
Orientation	Disruptive	Imitative
Focus	Renew knowledgebase by creating new knowledge	Enhance short-term performance by reusing existing knowledge
Results	Disruptive if successful, but it can be costly	Incremental innovation, but may lead to inability to act when significant change is needed

I conceptualize exploration–exploitation as a continuum with four overlapping activities: imitation, recombinant-reuse, recombinant-create, and transformation as presented in Figure 2. Each of the four activities depends on specific organizational factors; specifically, the firm's ability to acquire knowledge and use it to create new knowledge relative to the firm's current knowledgebase (Brunner, Staats, Tushman, & Upton, 2009). Experimenting with new technology involves exploration activities and organizational designs that enable the pursuit of the creation of new knowledge. This type of exploration requires new thinkers who possess diversified knowledge. As the organization develops expertise at exploration and start applying the newly acquired knowledge, its activities turn exploitative in nature especially when the organization becomes more familiar with a specific knowledge and its skills become deep.

Innovative orientation			Imitative orientation
Exploration	Recombinant		Exploitation
Transformation	Recombinant create	Recombinant reuse	Copy
Ability to create a new market for a new kind of product or service that might be simpler, more convenient, and less expensive than currently available products or services (Huang et al., 2010)	Ability to envision and create combinations using technologies that they have never combined before to create new applications (Carnabuci & Operti, 2013)	Ability to refine and reuse systematically known technological combinations to solve new problems and develop new applications (Carnabuci & Operti, 2013)	Applying innovation in the same way in another organization (Huang et al., 2010)
Strategic, and responsible for major advances in almost every field	Emergence and diffusion of new features	Replacement of existing product	Sharing market
Change begin with major breakthrough	Change begin with emergence of novelty	Change begin on basis of cost and performance	Change begin on the basis of market demand
Novel/Radical High costs High risk	Incremental	Evolutionary	Imitative Low costs Low risk

Figure 2. Innovation orientation.

The term innovation used in this study followed the following definition: an integrated process of enhancing the technology frontier, transforming this into the best commercial opportunities, and delivering the commercialized product/process innovation in a competitive market with widespread use (Wonglimpiyarat, 2005). I recognize four basic approaches to innovation in the literature: imitation, reconfiguration, creation, and transformation.

The Role of the IT Organization in Firms

IT refers to both systems and people, which together translate business objectives into solutions. The term IT is commonly used to refer to an activity involving three key elements: users as subjects using the IT system, IT features as building blocks or components of IT artifacts, and tasks as functions performed by an IT professional.

Drawing on prior research, IT use is defined as the interplay between users, IT artifacts, and work activities (Burton-Jones and Straub 2006).

IT has become a fundamental component of modern firms. Moghavvemi et al. (2012) explained that the adoption of IT is a necessity that resulted from the increased competition and demand for real-time information. They argued that IT has positive effect on overall performance of the firm as it has the potential to enhance profitability and market share. Firms use information to gain competitive advantage, so there is a strong relationship between strategy and IT (Melville et al., 2004). Knowledge about societal problems, market conditions, and the competitive landscape is essential to the business. IT enables the business to create a competitive advantage by enabling the business to understand the problem, market, and competition quickly.

IT provides strategic technology that enables the business to create shareholder value. Traditionally, the role of IT is to provide support services to the business units within an organization. Over the last 2 decades, the role of IT has evolved into a more strategic function that enables the enterprise to achieve its goals (Chin, Brown, & Hu, 2004). Chin et al. (2004) suggested that the traditional role of IT providing support services to individual business units has evolved into one where IT plays a broader role within the firm. This evolution led to the formalization of the role of the chief information office (CIO) and the establishment of the modern IT organizational structure. Today, IT provides three key functions: synthesis of business objectives, analysis of the information needed to achieve those objectives, and implementation of information systems to provide that information (Wilson, 1989).

The business value of IT. In recent years, IT investment has achieved multiple times the growth rate of investment in other areas; as a result, firms have been investing heavily in IT. The scale of IT investment has reached over 40% in total capital investment (Camisón & Villar-López, 2014). Therefore, the effect of information systems investment on the firm's performance has become a matter of interest to both academics and practitioners alike. While heavy investment in IT continues, studies reported mixed findings on the effect of expenditures on a firm's performance (Camisón & Villar-López, 2014). These findings point to the fact that IT investments can improve business performance under many market conditions. Moreover, mixed findings are documented in IS literature about the relationship between IT investment and firm profitability, which is often called as profitability paradox. Recent studies attend to resolve this paradox by investigating the mediating mechanisms through which IT investment may or may not generate rent (Dong et al., 2013).

Research on IT effects on organizational performance is known in the literature as IT business value (ITBV) research (Kohli & Grover, 2008; Melville et al., 2004; Wiengarten et al., 2013). Early studies of ITBV examined the effect of IT investment on business performance. These studies have demonstrated the importance of IT to the creation of business value and competitive advantage (Melville et al., 2004). However, issues regarding the nature of the business impact and how to measure it still exist (Jacks et al., 2011; Mithas et al., 2011). Moreover, a significant factor in the value IT brings to the business is sustainable competence (Crawford et al., 2011). The dynamic nature of IT,

however, makes it difficult to sustain this important attribute, which in turn limits the effectiveness of IT.

Many studies (e.g., Brynjolfsson & Brown, 2005; Cao et al., 2011; Kohli & Grover, 2008; Melville et al., 2004) have demonstrated that the value of IT could not be determined by studying information systems alone. These studies suggested that IT must be combined with other business and organizational factors to assess the value of IT. For example, Brynjolfsson and Brown (2005) contended that the value IT contributes to the business performance in negligible if IT is viewed as standalone organiation. Cao et al. (2011) suggested that as IT continues to integrate into the business and boundaries between the business units and IT become less defined, the appraoch to understanding the value of IT must include sociotechnical integration with the business.

The IT challenge. IT organizations are affected by two technological challenges, technology obsolescence, and demand for innovation (Bergek, 2013; Dao & Zmud, 2013). The first challenge is that existing technologies reach obsolescence much quicker than anticipated thereby leading to outdated enterprise architecture (Bergek, 2013). The second challenge is that as technology evolves, demand for product innovation intensifies (Dao & Zmud, 2013). Consequently, IT organizations are looked upon to deliver on both demands, evolve the architecture, and yet continue to deliver innovative business solutions. However, many IT organizations have not proven they can fulfill those business demands (Nevo & Wade, 2010).

IT organizations struggle in meeting business demand for solutions. As a result, IT organizations continue to be viewed by the business as slow, expensive, and

ineffective (Jorfi et al., 2011; Masli et al., 2011; Melville et al., 2004; Nevo & Wade, 2010; Van Der Heijden, 2001). Information systems researchers have addressed the value IT brings to the firm from several perspectives. For example, Chatzoglou et al. (2011) found that the alignment between IT and strategic orientation can positively affect business performance. Chong et al. (2011) investigated employee alignment and its influence on the business-IT alignment in organizations. Crawford et al. (2011) found that worker tenure and worker composition play a critical part in influencing IT success. Cao et al. (2011) developed a contingency resource-based view (RBV) to conceptualize IT business value. However, the relationship between the design of the IT organization and the value IT brings to the firm has not been fully explored (Burton et al., 2011; Kwan et al., 2012; Yoo, 2013).

IT competence. IT competence is defined as knowledge and skills required to manage information systems (Lee, Trauth, & Farwell, 1995). IT human resources' stability plays an increasingly important role in enabling IT competence. Crawford et al. (2011) examined the relationship between human resources and IT competence and found that IT human resources are important to eliciting long-term value from IT investments. They suggested that worker tenure and worker composition play a critical part in influencing technical ability, business relationships, and IT–business knowledge.

Many of the unique IT competencies are being commoditized (Chesbrough, 2011). Many of those competencies have enabled firms to innovate, but as a result of the commoditization of those competencies, they are no longer a source of competitive advantage. For example, while technology is an important factor in innovation, it is

available to all competitors (Ganter & Hecker, 2014; Hollen et al., 2013). Therefore, how a firm capitalizes on its IT competencies is the fundamental issue. Consequently, I argue that IT competencies should be unique to the firm based on its objectives, and in order to create such an IT, focus on the IT organizational design is necessary.

In Chapter 1, six areas of IT challenges and the corresponding research streams were discussed. Strategic formulation, strategic alignment, and business agility are three pillars of the business discourse and management excellence. They are essential to the survival of the firm in an increasingly complex environment (Melville et al., 2004). The information systems literature (e.g., Akgün et al., 2014; Brusoni & Rosenkranz, 2014; Colfer & Baldwin, 2010; Crawford et al., 2011; Grussenmeyer & Blecker, 2013; Teece et al., 1997) has established links between each of the three business constructs and IT design elements. For example, business strategy has generally directed IT strategy, but as IT continues to evolve from a support function to an integral part of business, strategic information system planning should be given the same focus as business strategy formulation (Hiekkanen et al., 2013; Mirchandani & Lederer, 2014). Other examples from the literature include the assertion by Colfer and Baldwin (2010) that complex systems like organizations are adaptable if they are modular, which means that strategic alignment is dependent on the communication structure of IT. The relationship between those constructs and how each construct relates to an IT competence is presented in Figure 3. I developed Figure 3 to graphically illustrate the business-IT relationship and map a business construct to an IT competence. Each IT competence is represented by an

IT organizational design element, namely, communication structure, knowledge creation, and dynamic capabilities.

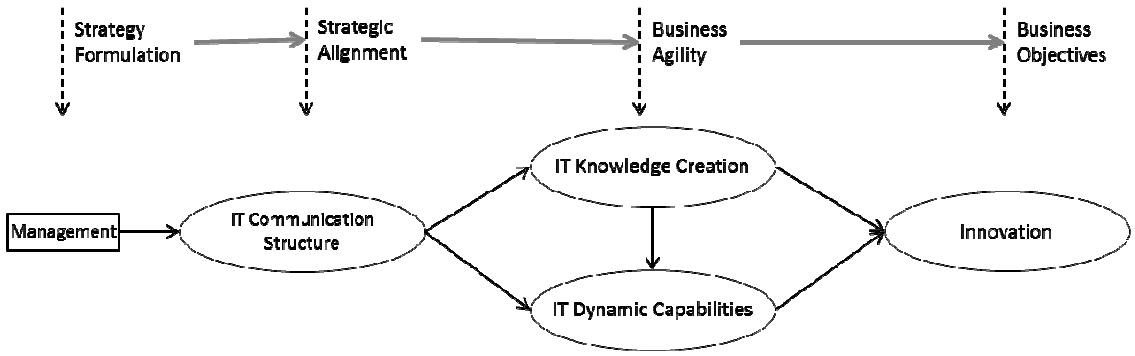

Figure 3. Achieving business objectives of the firm through IT competencies.

The IT Organizational Design

In the 1980s and 1990s, lean management gained popularity in business management and became a subject of academic research. Practitioners (e.g., Welch, 2001) and researchers (e.g., Mendenhall et al., 2008) have cited the need to cut managerial overhead and to reduce the layers of hierarchies for faster decision-making. For decades, the benefits of bureaucracy were promoted in organizational theory literature, but today many scholars and practitioners consider bureaucratic organizations inefficient. There is broad agreement across different perspectives that the bureaucratic organizations do not support current enterprise complexities. Despite differences in research findings, there is an implied agreement that organizations that have flat hierarchies are better adapted to changes in the business environment (Handel, 2014).

Management literature argues for lean management that is characterized by a flat hierarchy and decentralized decision-making. Lean management as an outcome of organizational innovation involves substantial changes in organizational practices,

structures, and external relations (Meroño-Cerdan & López-Nicolas, 2013; OECD, 2005). These organizational innovations can lead to technical innovations. This argument, which is the foundation of this dissertation, is depicted graphically in Figure 4 to show the relationship between organizational and technical innovation.

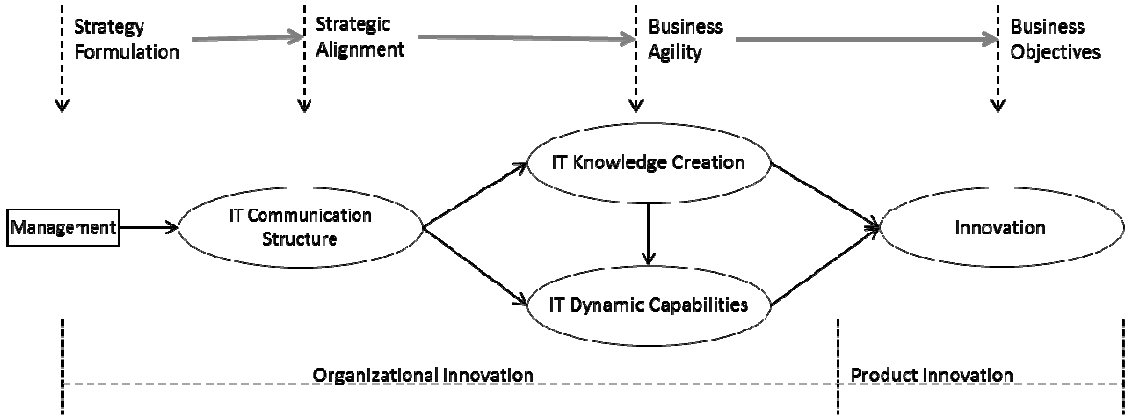

Figure 4. Organizational innovation leads to technical innovation.

Lean management. The information systems literature uses agility and flexibility interchangeably. The use of these terms interchangeably may be due to lack of clarity around the concept of flexibility in literature as terms such as agility are often confused with flexibility and adaptability. Recently, some effort has been made to distinguish between agility and flexibility (Dunford et al., 2013). For example, Swafford et al. (2006) viewed flexibility as a narrow concept that focuses on the internal ability to deal with foreseeable change. Agility, on the other hand, is viewed as an external concept used to describe a firm's ability to deal with uncertainty. Tseng and Lin (2011) used the terms flexibility and adaptability interchangeably and considered them as attributes of organizational agility.

Agility of the firm is a concept that has been studied in detail in the management literature (e.g., Pavlou & El Sawy, 2010; Tseng & Lin, 2011). These studies have confirmed a link between agility and business performance. Tseng and Lin (2011) argued that agility is considered an important attribute for well-performing firms, especially in dynamic and uncertain business environments. However, for a firm to be agile, certain behaviors, such as responsiveness, speed, and adaptability, must exist at all levels within the firm (Dunford et al., 2013; Pavlou & El Sawy, 2010). Therefore, the foundation of agility starts with the design of the organization.

Flexibility has become a core capability and presented as a critical characteristic of organizations that have to deal with turbulent environments. Evans (1991) defined flexibility as the ability to do something that was not intended. Volberda (1997) and Golden and Powell (2000) defined flexibility as the capacity to adapt via dynamic capabilities. Similarly, Dunford et al. (2013) defined flexibility as the capacity to respond to changing business environment. Phillips and Tuladhar (2000) added another dimension to the definition by asserting that the characterization of flexibility can only be applied if it encompasses many changes over time and not just a single change.

Organizations responding to changing environment seek flexibility through structural change to the organization. Structural elements of the organization such as standardization, specialization, formalization, and centralization are important factors in the design of the organization as they affect the capacity for flexibility, particularly in complex and unstable environments. Flexible workplaces are characterized by limited boundaries and hierarchies according to Palmer et al. (2007). Therefore, the most

prominent change is usually associated with management practices, which include a shift from hierarchy, centralized bureaucracy and formalized procedures (Dunford et al., 2013) to simple and limited routines and regulations. The tension between flexibility and formalization is a classical problem in organizing innovation (Mattes, 2014). The structure of an organization defines the relationship between various stakeholders within the organization and outside of its boundaries. Formalization defines process and policy, which govern the stakeholders' relationship while flexibility implies moving away from predefined procedures towards the autonomy and self-control of organizational units and individuals (Mattes, 2014).

Table 8

Flexibility Typology

Golden and Powell flexibility dimensions	Volberda (1997) flexibility typology		
	Operational	Structural	Strategic
Definition	Respond to planned changes to processes, structures and goals	Alter direction through communication and decision-making	Respond to significant change in external environment
Focus	Internal	Internal or external	External
Intension	Proactive small changes	Proactive change within a set structure	Reactive change within the firm
Range	Short	Short or medium	Long
Temporal	Quick	Quick	Long
Examples	Resource reallocation, staff augmentation, or outsourcing	Altering team direction, realignment with external stakeholders	Change in market conditions, alliances, or funding

Note. Information from "Flexibility as the Rationale for Organizational Change: A Discourse Perspective," 2013, R. Dunford, S. Cuganesan, D. Grant, L. Palmer, and C. Steele, *Journal of Organizational Change Management*, *26*(1), p. 89; "Towards a Definition of flexibility: In Search of the Holy Grail?," 2000, W. Golden, and P. Powell, *Omega*, *28*(4), p. 375; "Building Flexible Organizations for Fast-Moving Markets," 1997, H. W. Volberda, *Long Range Planning*, *30*(2), p. 171.

Volberda (1997) and Dunford et al. (2013) described three dimensions of flexibility, namely, operational, structural, and strategic. Operational flexibility is the ability to respond to planned changes to processes, structures and goals. Structural flexibility is the ability to alter direction through communication and decision-making within a set structure, while strategic flexibility is the ability to respond to significant change in external environment by adoption of new norms, values, and responsibilities. Golden and Powell (2000) categorized flexibility based on four dimensions: focus (internal vs. external), intension (proactive vs. relative), range (short vs. long), and temporal (quick vs. long). Table 8 summarizes Volberda's flexibility typology based on the four dimensioned developed by Golden and Powell.

Resource-based view. The resource-based view (RBV) of the firm is a concept developed by Wernerfelt (1984) and evolved by Barney (1991). The foundation of RBV is based on the principle that unique resources and capabilities maybe leveraged to improve the performance of firms that possess them. Thus, the RBV has been used in the information systems literature to link the performance of the firm to IT business value (Newbert, 2007). However, recent studies of the link between ITBV and RBV provided mix results (Wiengarten et al., 2013).

According to the resource-based view, firms are viewed as resources (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). However, resources are managed in different ways within the firm and amongst firms, and as such, they produce varying results. Thus, only firms that have unique abilities to manage those resources can gain an advantage and improve business performance (Camisón & Villar-López, 2014). Some scholars (e.g.,

Damanpour et al., 2009; Sanchez & Mahoney, 2012) suggested that a resource can facilitate competitive advanatge only if it is unique. The services provided by the resources depend on the usage of those resources or the combination of those resources with other resources (Camisón & Villar-López, 2014; Wiengarten et al., 2013). The role of management is to decide on resource combination and usage. As such, the management of resources and the services they render is the key to competitive advantage.

Knowledge creation view. Knowledge management seeks to identify, share, and apply the collective knowledge of the firm to solve business problems and create shareholder value. A firm's success is contingent on its ability to transform data into knowledge that can be used to create a strategic advantage. IT plays an essential role in knowledge management as it enables firms to create, store, analyze, and disseminate knowledge through information systems (Noruzy et al., 2013).

Knowledge is dynamic, as it is dynamically created in social interactions. It is context-specific and has both an active and subjective nature. In essence, what matters for new knowledge to be created is the ability of a firm to integrate knowledge possessed by individual in novel ways (Grant, 1996; Hacklin & Wallin, 2013). Integration of knowledge is a critical challenge to innovation management (Hacklin & Wallin, 2013). This challenge is often true when integrating specialized and distributed knowledge within a multidisciplinary field.

Innovation type depends on the type of knowledge and the orientation of the firm. For example, Chilton and Bloodgood (2010) found that firms characterized as imitators

or adaptors of innovation are likely to use explicit knowledge while those characterized as innovators are likely to prefer more tacit knowledge. These preferences are important as they further shape innovative orientation of the firm. Making the appropriate type of knowledge available to the right mix of adapters and innovators may influence organizational performance. Accordingly, managing knowledge within the firm should be a dynamic process that supports the business strategy of the firm. Nonaka et al. (2000) and Sabherwal and Becerra-Fernandez (2003) characterized this dynamic process by activities that include socialization, integration, publishing, and application.

Management literature treats knowledge as a resource (e.g., Nonaka et al., 2000; Sabherwal & Becerra-Fernandez, 2003). However, a new stream of research in the management literature is treating knowledge as a capability. For example, Gaimon (2008) argued that a firm's knowledge represents its capability. Mishra et al. (2013) characterized knowledge as a critical capability that can be exploited to improve business performance through applications. Furthermore, knowledge is a key requirement for adaptability (Fichman & Kemere, 1999). Dinur (2011) argued that while highly complex, organizational knowledge is a driving force of a firm's performance, the transfer of knowledge is crucial in capitalizing on existing resources. Modern firms are heavily dependent on information. Success, however, is contingent on the firm's ability to transform data into knowledge that can be used to solve business problems and create a strategic advantage. This transformation requires identifying and leveraging the collective knowledge of the firm.

The use of knowledge requires an understanding of knowledge transfer (Ansell, 2007). However, past research has shown that two main barriers to knowledge transfer are knowledge stickiness and knowledge ambiguity. Knowledge stickiness, or the inability or unwillingness to transfer knowledge, is one factor that keeps knowledge from flowing and has been cited as the major reason for knowledge transfer failure (Sheng et al., 2013). In addition, knowledge transfer relies on many factors such as people, communication structure, culture, process and strategy, and IT to overcome knowledge barriers.

Dynamic capabilities view. The resource-based view (RBV) of the firm has been criticized for being static (Teece et al., 1997). The concept of *dynamic capabilities* aims to address that problem. It was defined by Helfat and Peteraf (2009) as the ability of an organization to deliberately adjust its method of leveraging its resources as the environment changes. The main argument of the dynamic capabilities views is that firms should continue to reconfigure and renew their resources in order to sustain competitiveness and encourage innovation (Camisón & Villar-López, 2014). Mishra et al. (2013) outlined two levels of capabilities, dynamic and operational. Operational capabilities enable firms to carry out daily work activities. These capabilities may become rigid over time, especially when the business environment changes. Dynamic capabilities, on the other hand, enable a firm to adapt its resources, through its capabilities, to changing consumer and market demands (Teece, 2007). The core argument of the capability-based theory is that systematic actions of firms can create

unique capabilities, which enable firms to gain competitive advantages and improve their performance.

The concepts of dynamic capabilities have become a major focus in the mainstream strategic innovation literature (e.g., Camisón & Villar-López, 2014; Mishra et al., 2013). Unlike operational capabilities, dynamic capabilities are learned behaviors by individuals and groups within organizations that lead to a deliberate change to improve operations (Teece, 2007). Therefore, a key element of a capability is how individuals and groups adapt it to produce value. Teece (2007) identified three organizational activities that enable dynamic capabilities; they are sensing, seizing, and reconfiguring. Sensing capabilities enable the firm to recognize and deal with opportunities and threats while seizing capabilities help exploit the opportunities and defend against the threats. Reconfiguring capabilities enable firms to compete through enhancing, combining, protecting, and operational capabilities. These three types of dynamic capabilities are necessary for firms to introduce meaningful change (Helfat & Peteraf, 2009).

IT capabilities depend on two other organizational constructs, human resources, and knowledge management. Studies (e.g., Hiekkanen et al., 2013; Lu & Ramamurthy, 2011) have shown that IT capability normally requires a complementary firm-level capability, namely, knowledge management. Other studies focused on the human resource effect on IT capability (Crawford et al., 2011; Gao, Wiengarten, & Humphreys, 2011). Crawford et al. (2011) found that worker tenure and worker composition play a critical part in influencing IT technical resources, IT business relationships, and IT

business knowledge. Cao et al. (2011) developed a contingency resource-based view (RBV) to conceptualize IT business value through its unique resource and dynamic capabilities. Kim et al. (2011) found a positive relationship between competences in key IT functions and the organization's ability to effectively address changes.

Newbert (2007) analyzed existing empirical research on the resource-based view and found that among all resource-based approaches, the dynamic capabilities view is the least empirically examined stream. Arend and Bromiley (2009) criticized the dynamic capabilities view as they argued that the concept does not provide consistency, clarity or empirical rigor that explains how an organization could take advantage of dynamic capabilities. They identified several key problem areas that limit the potential contribution of the dynamic capabilities research stream to strategy and management scholarship. For example, Arend and Bromiley (2009) argued that it is unclear whether the value is created via the dynamic capabilities or other attributes of the firm. This lack of clarity may be due to a lack of coherent theoretical foundation for the dynamic capabilities theory. Further, there is an overall lack of strong empirical evidence that supports the claims that dynamic capabilities have positive effects on organizational performance. Furthermore, it is unclear how dynamic capabilities affect management decisions.

Communication structures. Studies (e.g., Colfer & Baldwin, 2010; MacCormack et al., 2012; Sanchez & Mahoney, 2012; Yoo, 2013) have suggested that a relationship exists between product design and organizational structure. The *mirroring hypothesis* suggests that the organization of a new product development project will

correlate to the product architecture (Colfer & Baldwin, 2010). Specifying the communication structure between designers of different components of the system within industries, firms, or groups can influence the product architecture of technological interdependencies that exist between components of the product. MacCormack et al. (2012) observed two extremes, commercial software firms and open source software communities. Commercial software firms are characterized by functional structures that operate in silos. Each functional structure operates based on specific goals, which lead to specific behaviors by the members of the structure. Participants of open source software communities are structured in a manner that promotes a single goal and encourages collaboration. Consequently, these two different organizational forms will produce different architectures.

Studies have suggested that when a firm's communication flows become structured around a firm's current product architecture, the firm may have difficulty recognizing possibilities for innovation. Designing an organization to produce the next technological innovation is a goal shared by many organizations. New solutions are introduced to organize new product development projects inside or outside the boundaries of a single firm. However, for the development of a complex system, creativity may be counterbalanced by constraints associated with product architecture. Therefore, coordinating the design of complex systems requires close correspondence of organization and product architecture through modularity (Sanchez & Mahoney, 2012).

Yoo (2013) maintained that information systems practitioners have primarily played the role of the recipient of the theory of modularity. Modularity as an architectural

concept provides general rules that define the components of complex systems and how those components interconnect and communicate with one another (Yoo, 2013). These rules imply that modularity simplifies complex systems by dividing it into subsystems that can be owned, designed, and implemented by multiple entities. Effectively, modularity enables division of labor among different actors. Schilling (2000) found that modularity enables organizations to customize their product offering. Accordingly, modularity influences the evolution of the product and its lifecycle. It also affects the way firms and industries are organized. Langlois and Robertson (1992) showed that a modular architecture enabled the emergence of specialized component developers. Similarly, modularity has been observed to have an effect on organizational structure in the software and telecommunication industries. Consequently, it has been observed that an organizational shift from vertically integrated hierarchies to networks of distributed and specialized firms, teams, and individuals have emerged.

Strategic alignment focuses on resource management and neglects organizational design variables such as delegation, departmentalization, specialization, and formal communication structures. Views regarding optimal organizational structure have changed dramatically in the past 30 years. While many early researchers promoted the benefits of bureaucracy, today there is a broad agreement within the organizational researchers that bureaucratic organizations do not support current enterprise complexities (Handel, 2014). Organizational structure is believed to be associated with firm profitability (Meijaard et al., 2005). Spanos et al. (2004) indicated business structure significantly influences a firm's profitability while Tang et al. (2006) found that the

characteristics of organizational structure affect organizational performance. Meirovich et al. (2007) found that formalization improves organizational performance, which is also supported by Kim (2007) and Wang (2003) who argued that when a firm is characterized by high formalization, it can perform better than its competitors.

The structures of many organizations reflect the technical requirements of the business and control over environmental uncertainties (Handel, 2014). The structure of the organization is a key in the ability to adapt to the external environment. Beinhocker (2006) explained that large organizations often find it harder than small ones to adapt. He noted that organizations evolve in response to problems they have to solve. The IT structure is critical to its ability to deliver. As the work flows across the boundaries of the functional groups, each of the groups must be equipped to handle the inflow of requests; otherwise, it becomes a bottleneck.

IT continues to have a significant effect on how the business operates. The management literature (e.g., Handel, 2014; Spanos et al., 2004) suggested that the structure of the organization is an indicator of how lasting the configuration of tasks and activities are. Most modern IT organizations are centralized as decision-making is at the top level of the central organization. Many scholars, however, have argued that decentralized organizational structures are conducive to organizational effectiveness and overall improved performance of the firm (Schmitt et al., 2015). Schmitt et al. reported that studies have found that decentralized structures promote communication and elevate employee motivation. Structures can influence organizational processes through the

pattern and frequency of communication between organizational members as well as IT and the business.

Summary and Transition

Innovation is recognized as the engine of capitalism (Schumpeter, 1939). The modern firm is about continuous innovations, in products, design, methodology, management, and human thinking. Firms without innovation will have difficulty achieving sustainable growth (Boldrin & Levine, 2008). Without a thorough understanding of those factors that enable firms to innovate, it is difficult to create or apply innovation within the firm to its best advantage. Technological advance, globalization, competitive pressure, increasingly demanding customers, and shortening product life cycle are the drivers of innovation. Knowledge, capabilities, and communication are the innovation enablers, which were elaborated in this literature review.

The review revealed that the contemporary firm faces constant change in demand and therefore requires constant innovation to adapt to change (Gopalakrishnan et al., 2014). However, because innovation is a multidisciplinary concept, innovation discourse generally falls into one of four categories: typology, capabilities, knowledge, and stakeholders (Camisón & Villar-López, 2011; Crossan & Apaydin, 2010). Innovation can be technological, often referred to as product innovation, or administrative, such as organizational innovation (OECD, 2005). Organizational innovations involve changes in organizational practices, the structure of the organization, and external relations (Meroño-Cerdan & López-Nicolas, 2013; OECD, 2005). These changes require implementation of

new communication structures that improve the organization's ability to perform activities associated with business practices, which could lead to technological innovations.

I draw upon Nonaka's (1994) dynamic theory of organizational knowledge creation, the resource-based view of the firm (Wernerfelt, 1984), and the mirroring hypothesis originated by Conway (1968) to test the role of knowledge creation, dynamic capabilities, and communication structure in enabling firms to innovate. This research focuses on three theoritical themes: (a) IT use enables firms to innovate, (b) the use of IT to innovate is dependent on the IT organizational design, and (c) key elements of IT organizational design that affect innovation are: knowledge creation, dynamic capabilities, and communication structures.

Chapter 3, the research method, includes a description of the research design, population, sample and setting, and variables. The chapter also includes a detailed description of the survey instrument used in the study as well as the data analysis plan applied. The chapter concludes with a discussion of threats to validity and how the study could minimize those threats.

Chapter 3: Research Method

This quantitative study was designed to examine the extent to which a firm's innovativeness is related to IT organizational design. The three goals were to (a) contribute to the literature by linking IT organizational design elements to the innovativeness of the firm; (b) help managers choose more effective organizational design strategies to increase the likelihood of creating the desired innovative environment; and (c) promote social change by providing a methodology for understanding the correlation between IT organizational design and a firm's ability to innovate.

Chapter 3 covers the following topics: the rationale for using a correlational design to address the research questions, the procedures used to support or reject the null hypotheses, the population, data sampling, collection procedures and rationale, the instrument and it's the reliability and validity, and data analysis techniques and how they fit the research design.

Research Design and Rationale

Research involves selecting one of many design approaches. Each design approach has strengths, weaknesses, and a set of assumptions about the nature of knowledge (Thomas, 2003). Understanding human behavior in its natural setting often requires a qualitative method of research, as opposed to a quantitative method, which requires a more structured scientific approach (Aliaga & Gunderson, 2005; Creswell, 2009). Quantitative methods involve writing questions for surveys and learning to quantify responses, and statistically analyzing collected data. A researcher may choose to

adopt an existing instrument that has been accepted as valid and reliable for the study, but a researcher may also adapt an existing instrument to a specific study or develop a new instrument. Research design experts (e.g., Corbin & Strauss, 2008; Creswell, 2009) have argued that the research questions should guide the selection of a suitable method of inquiry. Hence, research questions must come first (Cohen, Manion, & Morrison, 2007). This principle guided the selection of an appropriate research design for this study.

The purpose of this quantitative study was to understand the correlation between IT organizational design and innovation. The study was designed to examine how individual elements of the organizational design relate to certain aspects of innovation. The study addressed three IT organizational design elements: knowledge creation, dynamic capabilities, and communication structures. The central question was as follows: "What is the correlation between the design of the IT organization and a firm's innovativeness?" I examined how organizational design strategies relate to a firm's innovation in terms of its ability to deliver business solutions. The following five research questions guided this study:

1. To what extent, if any, is knowledge creation in IT organizations related to a firm's innovativeness?
2. To what extent, if any, are dynamic capabilities in IT organizations related to a firm's innovativeness?
3. To what extent, if any, are communication structures within IT related to a firm's innovativeness?

4. To what extent, if any, are IT communication structures more strongly related to a firm's innovativeness than is IT knowledge creation?
5. To what extent, if any, is IT knowledge creation more strongly related to a firm's innovativeness than are IT dynamic capabilities?

The five research questions were used to establish hypotheses. These hypotheses required the collection of quantitative data and the use of advanced statistical techniques to decide whether or not to reject or provisionally accept those hypotheses. Accordingly, these research procedures could be accomplished only with a quantitative approach that otherwise would not be possible with a qualitative one. Further, the primary interest of research questions was to study the relationship between variables; consequently, the correlational approach was most appropriate.

A correlational design is a type of descriptive quantitative research that involves examining possible relationships among variables (Leedy & Ormrod, 2010). It is a statistical technique that can determine the degree of relationship between two variables (Coolidge, 2000). Relationships between two variables can vary from strong to weak. The strength of the relationship is determined by the correlation coefficient. A correlation coefficient close to zero is an indication of weak or no correlation between variables; hence, knowing the value of one variable does not provide any information about the value of the other variable. On the contrary, correlation coefficients close to 1.00 mean the variables are strongly correlated.

A correlational design aligns with a postpositivist worldview that supports the use of scientific methods to gain an understanding of complex social phenomena by

numerically measuring constructs and testing hypotheses (Creswell, 2009). Quantitative studies may apply correlational designs to determine the extent to which two factors are related and identify predictive relationships by using advanced statistical techniques. Thus, the correlation design was the most appropriate design because the purpose of the study was to examine the relationships between variables within an existing theoretical framework.

Other designs were considered but were not be used. For example, experimental and quasi-experimental designs were considered; however, the intent of this study was not to apply a treatment or manipulate any variables to determine causation, instead data was examined to identify the existence of a correlation. In addition, qualitative designs were considered. Qualitative designs involve observing what people do and how they interact socially. They explore new subjects by becoming involved in the environment where people carry out their activities (Balnaves & Caputi, 2001; Parker & Rea, 2005; Thomas, 2003). In other words, qualitative designs are appropriate if the goal of the research is to understand human behavior in its natural setting; hence, qualitative designs were not be used.

Methodology

The research design for this study was correlational and used a survey data collection instrument. Participants in the study were managers of firms that relied on IT to provide products or services. The surveys targeted both IT and non-IT managers to participate in this study.

Population

The study addressed the relationship between three IT organizational design elements and innovation. Hence, the target population for the study was managers of firms who have knowledge of IT and its relationship to innovation. The target population was identified based on the following criteria: (a) the participants must be employees of firms that rely on IT to deliver their product or service, (b) the participants must be employed by the firms for at least 2 years, (c) participants must be managers who deal directly with IT, and (d) the population will be limited to firms in the United States. A simple random sampling strategy was recommended for this study as members of the LinkedIn CIO group have an equal probability of being selected for this study (Cozby & Bates, 2012). The size of the population in the United States exceeds 5 million IT professionals.

Sampling and Sampling Procedures

A researcher may study an attribute of the population by examining the characteristics of a sample. The findings must be generalized in order to provide scientific value. However, generalizations are typically based on a relatively small number of samples, as the basis for inference about all the populations (Frankfort-Nachmias & Nachmias, 2008).

Sampling strategy. The research design for this study was correlational and used a survey instrument to collect data. The survey included questions designed to collect data from the study participants on IT organizational design and their firm's ability to innovate. The simple random sampling technique was used as it allows the researcher to

form a sample by choosing participants from the population at random (Cozby & Bates, 2012; Singh, 2007). This type of sampling strategy is typically representative of the population.

Singh (2007) outlined several advantages and disadvantages to using simple random sampling. Four of the advantages identified by Singh include: (a) minimum knowledge of the population is needed, (b) no subjectivity or personal error, (c) data collected is appropriate for most purposes, and (d) findings may be used for inferential purposes. While simple random sampling is representative of the population, Singh (2007) argued that representativeness is difficult to prove. In addition, knowledge about the population is not used. Furthermore, the inferential accuracy of the findings typically depends on the sample size.

Sample size. Cozby and Bates (2012) emphasized that sample size can be determined using a mathematical formula that takes into account the size of the confidence interval and the size of the population being studied (p. 144). Cozby and Bates (2012) provided a table of sample size and precision estimates at 95% confidence level for precision estimates of ±3%, ±5%, and ±10%. For the purpose of this study, I used a confidence interval of 95% and a precision estimate of ±5%. Based on the population identified earlier, the sample size necessary to produce a ±5% precision was 111.

The response rate in a survey is the percentage of people in the sample who actually completed the survey. Potential participants were contacted through LinkedIn CIO group. The purpose of the study and criteria for participation were outlined in the

vitiation sent to potential participants. The potential pool was over 100,000 members and individuals who agreed to participate in the study gained access to the online survey via the URL link provided to participate in the invitation.

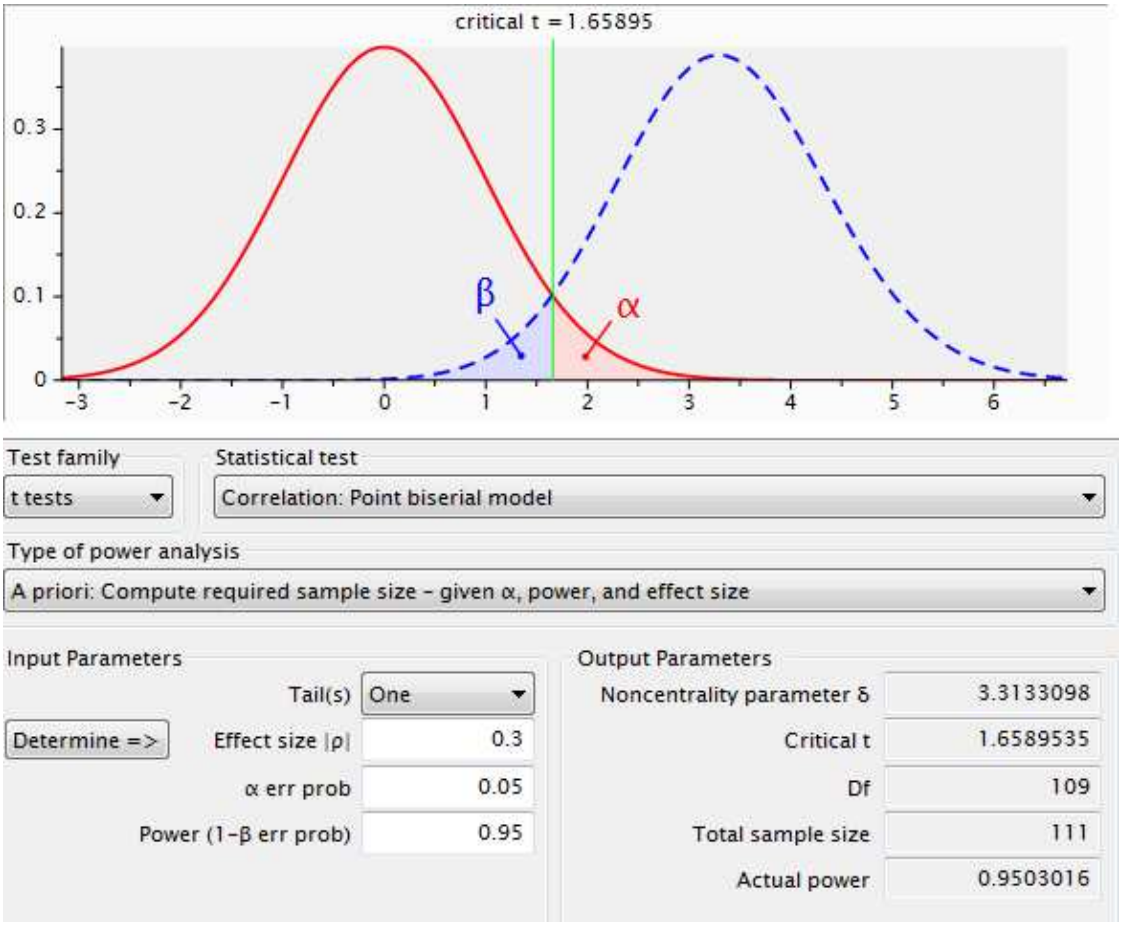

Figure 5. GPower sample size calculation results.

A sample size calculator was used to calculate the minimum sample size for this study. Specifically, the sample size was obtained by using power analysis conducted using GPower 3.0 software. Table 9 contains the factors used to determine sample size. In the analysis, a medium effect size of $\rho = .3$ was used along with alpha α error

probability of 0.05 and a 0.95 statistical power (1- *B* error probability). As shown in Figure 5, the resulting sample size was 111 participants.

Table 9

Statistical Factors Used to Calculate Sample Size

Factor	Input Parameter	Description
Alpha level	.05	Known as the p value or Type I error rate
Effect size	.3	Effect size of.3 is considered medium
Statistical power	.95	.95 is conventional value used in similar studies

Procedures for Recruitment, Participation, and Data Collection

An online survey was used to collect data for this study. Surveys are common in social science research and used to collect data for the purpose of generalizing or suggesting findings to a larger population (Creswell, 2009). The use of an online survey facilitates the collection of data from IT professionals in different geographic regions of the United States.

Recruitment and participation. Members of the LinkedIn CIO group received an invitation to participate in the study, see Appendix A for the pilot test invitation and Appendix B for the Invitation to the main study. The invitations (a) explained the purpose of the study, (b) outlined criteria for participation, (c) ensured anonymity, and (d) provided a URL for participants to access the survey. The survey was made available online for 30 days. LinkedIn messages were sent to remind potential participants to complete the survey. Nardi (2003) and Singh (2007) suggested that multiple contacts with potential participants would increase the number of responses. Accordingly, the

LinkedIn members of the CIO group were reminded twice a week during the soliciting period. Figure 6 includes the complete process.

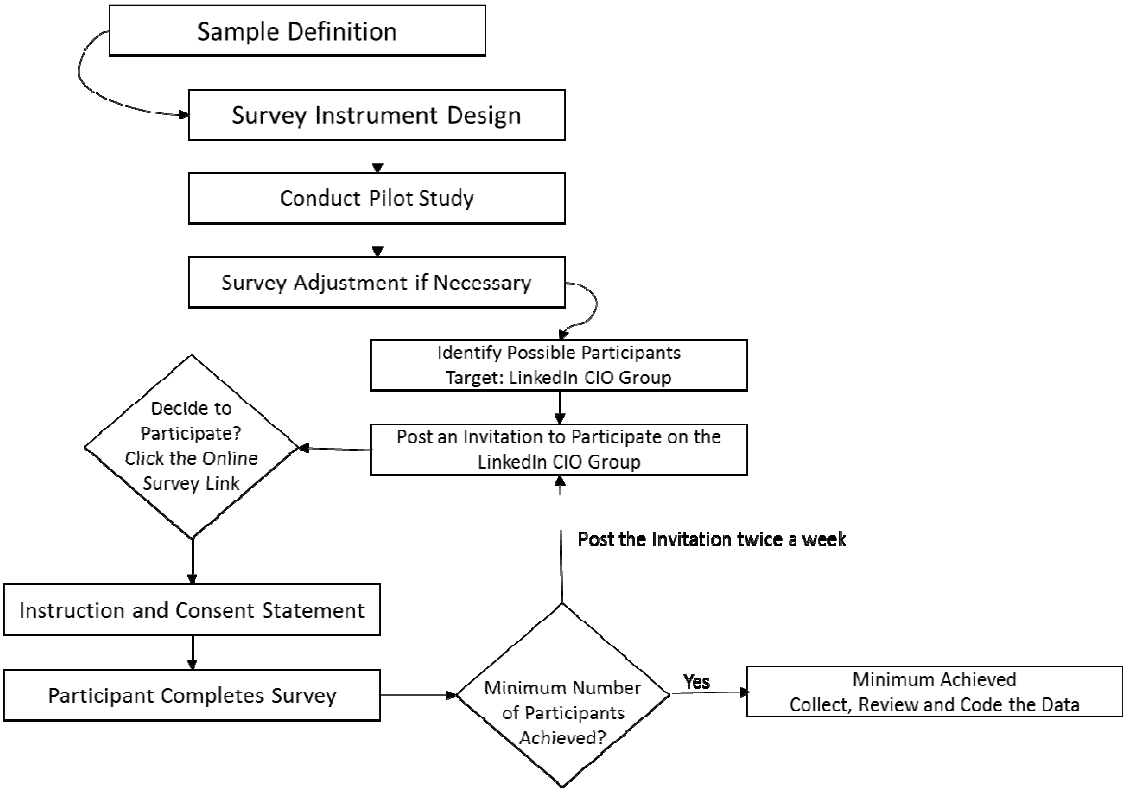

Figure 6. Procedure for recruitment, participation, and data collection.

Informed consent. LinkedIn CIO group members who decided to participate in the study were required to click on the link provided to participate in the invitation. This link redirected the participant to the survey's landing page, which contained the consent form. The consent form presented the qualifications for participation and clearly stated that clicking *next* and completing the survey implied acceptance of the consent statement.

Confidentiality. The informed consent form outlined to the participants how the anonymity and the confidentiality of their response were going to be ensured. Anonymity is assured when there is no way of connecting any identifying information with the

person completing the survey (David & Sutton, 2004). To achieve this level of anonymity, participants were not asked to give any names or codes linked to their names in their response. Not revealing to any person, or placing in any document, information that identified any respondent, further maintained confidentiality. All research records and datasets, electronic and paper, will be stored in a private, secure storage area for 5 years, to which only the researcher can access. After 5 years, the data files will be destroyed via deleting and shredding so that data will be no longer legible or accessible.

Geography. The target geography of the study was the United States. Along with simple random sampling techniques, LinkedIn made this geography possible. LinkedIn provides a convenient access to a broad population of participants from various sizes of firms.

Data collection. Data was collected with a composite survey instrument. Figure 6 represents the process used to recruit participants. A 6-point Likert scale was used to collect participants' responses. Responses for all variables were collected using the same survey and at the same time. The survey was administered electronically using an online survey provider and the collected data were downloaded into spreadsheets. Only I have access to the online survey account and data download from that site. In return for participation, I agreed to share the statistical results via posting on the LinkedIn site. The data collected was imported into the SPSS version 21 software program for statistical analysis.

Pilot Study

The data collection process typically begins with a pilot test; however, a pilot test can be skipped due to the research time constraints, especially if the instrument used in the study has been validated in a previous study (Cooper & Schindler, 2008). The data collection instrument for this study was a composite survey developed based on the research questions. Existing surveys were used to develop the instrument. Minor changes to the survey were made in order to accommodate the specific objectives of this study.

Table 10

Discriminant Validity of Base Instruments

Measure	Instrument	Items	Loading	Description
Innovation speed	Goktan and Miles (2011)	6	>0.5	One question was excluded due to low loading factor
Innovation level	Goktan and Miles (2011)	6	>0.72	Two questions related to material consumption and energy consumption were excluded
Risk and process control	Goodate et al. (2011)	7	>0.65	All questions were used as designed by Goodale et al.
IT knowledge creation	Plugge et al. (2013)	15	NA	This measure was developed by the researcher based on knowledge creation literature (March, 1991; Mitchell & Boyle, 2010; Popadiuk, 2012; Zhuang, 1995)
IT dynamic capabilities	Plugge et al. (2013)	16	>0.75	The original instrument contained 21 questions, only 16 questions will be used to measure IT capability effect on innovativeness
IT communication structures	Plugge et al. (2013)	18	>0.75	All 18 questions in the original instruments will be used in this study to measure communication structure effect on innovativeness

The pilot study was conducted to examine and improve the quality of the questions. The pilot study used a small representative sample. A total of 13 participants completed the online survey for the pilot study. Cronbach's alpha analysis was conducted to determine the reliability of the survey scale. The composite instrument used a 6-point Likert scale. Existing surveys used in developing the instrument for this study were adjusted to use a 6-point Likert scale. Their authors assessed the validity of baseline instruments; each reported a minimum-loading factor of 0.5 or higher (see Table 10). Permissions to modify and use existing instruments were obtained from the original authors.

Instrumentation and Operation of Constructs

An online survey instrument was used to collect data. Table 11 summarizes the constructs and factors that comprised each of the subscale used in this study, the number of survey questions per subscale, and a description of each subscale. A total of 68 survey questions were used in the study as described in Appendix D.

Instrument design. Instrument design process began by examining the published instruments used in the studies cited in the literature review chapter. Five studies (Goktan & Miles, 2011; Goodale et al., 2011; Plugge et al., 2013; Zhuang, 1995) included survey instruments that were relevant to this study (see Table 12 for details). These instruments were modified for the purpose of this study. Permissions to modify and use existing instruments were obtained from the original authors (see Appendix E). The baseline research instruments were based on a 7-point Likert scale that represents ordinal data and ranges between 1 (*strongly disagree*) and 7 (*strongly agree*). These instruments were

modified and synthesized into a uniform survey instrument that addresses knowledge creation, dynamic capabilities, communication structures, and innovativeness.

Table 11

Constructs and Factors

Study construct Factors	Number of items	Description of the scale
Innovativeness of the firm		
Innovation speed	6	Measures the speed of innovation
Innovation level	6	Measures the relative newness of innovation
Risk control	4	Measures a firm's tolerance to risk
Process control	3	Measures a firm's control of its operations
Knowledge creation		
Socialization	5	Measures the degree to which IT encourages knowledge sharing through social interaction
Integration	3	Measures the degree to which IT enforces integration of knowledge
Publishing	4	Measures the degree to which IT adopts practices and technology that promotes knowledgebase adoption
Application	3	Measures the degree to which IT applies knowledge by learning
Dynamic capabilities		
Sensing	5	Measures the degree to which IT is able to sense changing business circumstances
Seizing	6	Measures the degree to which IT is able to seize opportunities to support the business
Reconfiguring	5	Measures the degree to which IT is able to reconfigure resources, technology, and process to support the business
Communication structures		
Complexity	4	Measures the degree to which IT is able to adapt to external environment
Centralization	8	Measures the degree to which IT enables IT employees to make decisions
Formalization	6	Measures the degree to which IT uses policies and procedures

The variables were measured using a 6-point Likert-type survey instrument designed to assess each of the variables. I approached the study from a neutral perspective with the objective of ascertaining whether correlations existed each of the three IT organizational design variables and the firm's innovativeness. While there is no agreement among researchers on the number of scale point to be used, most studies use 4 to 7 point scale (Cummins & Gullone, 2000; Chang, 1994; Leung, 2011). The use of a 6-point scale reduces bias. Garland (as cited in Leung, 2011) showed that eliminating a middle or neutral point may reduce social desirability bias, and retaining the neutral point may distort the results.

Table 12

Instrument Design

Researcher	Instrument	Contribution to instrument design
Zhuang (1995)	Innovation process survey	Zhuang (1995) provides a framework to examine innovation process based on attitude and activity
Goktan and Miles (2011)	innovation speed and radicalness survey	Goktan and Miles (2011) provide a framework to measure the relationship between innovation speed and innovation radicalness
Goodale et al. (2011)	Risk control scale	Goodale et al. (2011) provide a framework to measure a firm's propensity to risk
Plugge et al. (2013)	Core IT concepts	Plugge et al. (2013) provide scales to measure IT concepts such as capabilities, organizational structure, and performance

Survey design. An online survey hosted by SurveryMonkey.com was used to collect participants' answers for this study. This approach of data collection is an economical, efficient, and convenient to both research and participants. The survey consisted of 5 sections. The survey began with a short introduction that explained the

purpose of the study. Each of the survey sections began with a statement that explained the purpose of the section. Table 13 includes a summary of the survey sections.

Table 13

Survey Sections

Survey	Description	Base Instrument
Demographic information	Includes two sections that cover basic background information about the participant and the company (Appendix C)	Zhuang (1995)
Innovativeness of the firm	Includes three sections that cover innovation speed (Table F1), innovation level (Table F2), risk control (Table F3), and process control (Table F4)	Zhuang (1995), Goktan & Miles. (2011), and Goodale et al. (2011)
IT knowledge creation	Include four section that cover knowledge sharing (Table F5), knowledge publishing (Table F6), knowledge combination (Table F7), and knowledge application (Table F8)	March (1991), Mitchell & Boyle (2010), Popadiuk (2012), and Zhuang (1995).
IT dynamic capabilities	Includes three sections that cover sensing (Table F9), seizing (Table F10), and reconfiguring (Table F11)	Plugge et al. (2013)
IT communication structures	Includes four section that cover complexity (Table F12), centralization (F13), and formalization (Table F14)	Goodale et al. (2011), and Plugge et al. (2013)

The first section captured demographic data such as age, gender, tenure, and role. Demographic data was used to identify characteristics of the participants and determine whether relationships existed between demographic factors and other variables (Zhuang, 1995). Demographic characteristics are common sources of extraneous variance and, therefore, the effects of these variables must be controlled to enhance internal validity (Kerlinger & Lee, 2000). Most studies of innovation control for industry, firm's size, and

age of the firm (Goktan & Miles, 2010), therefore, these measures were included in the survey. Twelve demographic items were included in the survey to allow for statistical analysis of such factors as tenure and role (see Appendix C).

The second section of the survey examined innovativeness of the firm, which was a composite of four elements: innovation speed, innovation level, risk control, and process control. Both innovation speed and innovation level surveys were adopted from existing scales developed by Goktan and Miles (2011). The two scales were modified to use a 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*). Items 4 and 6 in the innovation speed survey were reverse coded, and the scores on the six items were added to measure innovation speed. Higher scores indicated higher innovation speed in the firm. The most radical innovations are innovations that are new to the world. Hence, innovation level survey measures the relative newness of innovation. The scores on the first two items were added to measure radical product innovation. The scores of items 3 to 6 were added to measure radical process innovation. Higher scores indicated greater innovation level as perceived by the respondent.

The need for strategic innovation through entrepreneurship was outlined in the literature review chapter. Goodale et al. (2011) argued that entrepreneurship-oriented firms are typically flexible. Therefore, both risk control and process control surveys developed by Goodale et al. (2011) were adopted for this study to measure corporate entrepreneurship. The risk control survey used in the study (see Figure D4 in Appendix D) included the four original questions developed by Goodale et al. (2011). Three changes were made to the original survey. First, the context of the survey was changed

from a business unit to a firm. Second, the scale was changed to use a 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*). Third, the original language was edited to reflect the new context and the new scale. Participants were asked to report their observation of the degree to which top managers in their firm are satisfied with how the firm has performed over the last two years. The scores of the four items were reversed and added. Higher scores signaled higher availability of the specific attribute (Goodale et al., 2011).

The process control survey used in the study (see Figure D4 in Appendix D) included the three original questions developed by Goodale et al. (2011). Changes made to this survey were the same as those were made to the risk control survey described in the previous paragraph. Participants were asked to indicate the degree to which management philosophy favors specific activities. The scores of the three items were reversed and added. Higher scores indicated stronger tolerance for risk, which is also an indicator of entrepreneurial orientation of the firm (Goodale et al., 2011).

The third section addressed IT knowledge creation, which was a composite of four elements: socialization, publishing, integration, and application. This section of the survey was developed based on knowledge creation literature (e.g., March, 1991; Mitchell & Boyle, 2010; Popadiuk, 2012; Zhuang, 1995). Participants were asked to indicate on a 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*) the degree to which the IT organization within their firm satisfied each of the survey criteria over the last 2 years. The scores of each survey were added. Higher scores indicated a stronger presence of knowledge creation within the IT organization. The fourth section

examined IT dynamic capabilities, which was a composite of three elements: sensing, seizing, and reconfiguring. *Sensing* measured IT organizations' ability to sense changing business circumstances. *Seizing* measured IT organizations' ability to seize opportunities to support the business, while *reconfiguring* measured the flexibility of the IT organization. This part of the survey was developed from an existing scale developed by Plugge et al. (2013). The scale was modified to use a 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*). Participants were asked to indicate the degree to which the IT organization within their firm satisfied each of the criteria over the last 2 years. The scores of each survey were added. Higher scores indicated stronger presence of a specific capability.

The last section examined IT communication structure, which was a composite of three elements: complexity, centralization, and formalization. *Complexity* measured the relative complexity of the IT organizational structure. *Centralization* measured the degree of command and control within the IT organization while *formalization* measured the relative adherence to policies and procedures. This section of the survey was adapted from an existing scale developed by Plugge et al. (2013). The scale was modified to use a 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*). In each of the three surveys, participants were asked to indicate the degree to which the IT organization within their firm satisfied each of the survey criteria over the last 2 years. The scores of each survey were added. Higher scores indicated stronger presence of a specific attribute.

Data Analysis Plan

The central question that this study addressed was the following: Is there a correlation between the design of the IT organization and a firm's innovativeness? In this study, I examined how organizational design strategies relate to a firm's innovation in terms of its ability to deliver business solutions. The following five research questions guided the study:

1. To what extent, if any, is knowledge creation in IT organizations related to a firm's innovativeness?
2. To what extent, if any, are dynamic capabilities in IT organizations related to a firm's innovativeness?
3. To what extent, if any, are communication structures within IT related to a firm's innovativeness?
4. To what extent, if any, are IT communication structures more strongly related to a firm's innovativeness than is IT knowledge creation?
5. To what extent, if any, is IT knowledge creation more strongly related to a firm's innovativeness than are IT dynamic capabilities?

In this study, I addressed three IT organizational design constructs: knowledge creation, dynamic capabilities, and communication structures. Each of these constructs was measured along multiple dimensions, and each of these dimensions is a composite measure of several attributes. An attribute was then mapped into a survey question. Figure 7 represents the model of the relationships between study variables.

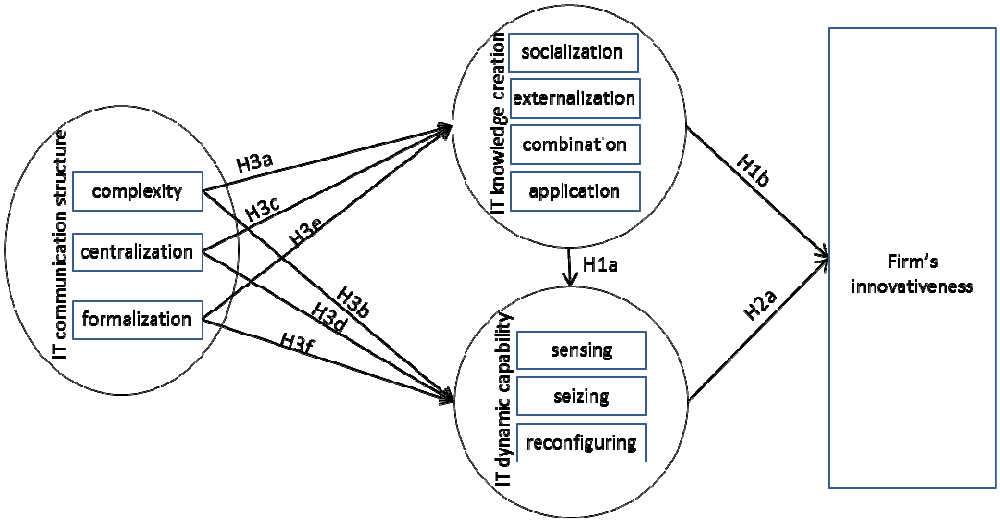

Figure 7. Structural model of the relationship between study variables.

Hypothesis 1: IT Knowledge Creation

The *IT knowledge creation process* is defined as the generation of new ideas through purposeful activities (Mitchell & Boyle, 2010). The knowledge management literature described four activities that characterize knowledge creation: socialization, integration, publishing, and application (Nonaka et al., 2000; Sabherwal & Becerra-Fernandez, 2003). According to Tsoukas (1996), an individual's knowledge may consist of (a) role-related normative expectations, (b) dispositions formed in past socialization, and (c) local knowledge of a particular context. Management literature treats knowledge as a resource. However, there is a new trend in the management literature that involves treating knowledge as a capability. For example, Mitchell and Boyle (2010) characterized knowledge as a critical capability that can be exploited to develop applications that improve performance. I contend that the characterization of knowledge as a resource or a capability is dependent on the nature of knowledge. In the context of IT, business

knowledge is a resource that becomes a capability only when it is applied, and thus I hypothesize that IT–business knowledge creation affects the dynamic capabilities of IT; therefore,

$H1a_0$: IT–business knowledge creation is not correlated with IT dynamic capabilities.

$H1a_1$: IT–business knowledge creation is correlated with IT dynamic capabilities.

Knowledge is the most valuable asset of the firm because it represents the culture created by the organization, which includes processes and systems developed over the life of the organization (Mishra et al., 2013). A firm's knowledge, especially the implicit type, is difficult to imitate and can produce sustainable advantage over competitors. Therefore, IT–business knowledge creation is fundamental to the creation and sustaining of a firm's innovativeness. I hypothesize that IT–business knowledge creation positively affects the innovativeness of the firm; hence,

$H1b_0$: IT–business knowledge creation is not correlated with a firm's innovativeness.

$H1b_1$: IT–business knowledge creation is correlated with a firm's innovativeness.

Hypothesis 2: IT Dynamic Capabilities

A widely accepted definition of dynamic capabilities is the ability of an organization to deliberately adjust the process of leveraging its resources, both human and non-human, as the environment changes (Helfat & Peteraf, 2009). Dynamic capabilities enable firms to achieve their objectives by applying skills and competencies that are adaptable to changing circumstances (Teece et al., 1997). Thus, the concept of

dynamic capabilities was measured along three dimensions: sensing, seizing, and reconfiguring (Helfat & Winter, 2011; Makkonen et al., 2014; Pavlou & El Sawy, 2011). *Sensing* involves recognizing and managing service opportunities and threats (Kindström, Kowalkowski, & Sandberg, 2013). Four factors are considered in defining and measuring sensing: business knowledge, skills, client orientation, and market orientation. *Seizing* involves exploiting opportunities and resisting threats (Makkonen et al., 2014; Van Der Heijden, 2001). Three factors are considered in defining and measuring seizing: knowledge integration, IT–business collaboration, and IT partnerships. *Reconfiguring* is the capability to use and deploy an existing resource in a new situation, allowing the firm to replicate an operational capability in a new market (Bowman & Ambrosini, 2003; Pavlou & El Sawy, 2011; Van Der Heijden, 2001). Three factors are considered in defining and measuring reconfiguration: ability to adjust or reallocate resources, ability to adjust strategy, and ability to adjust architecture. I hypothesized that the dynamic capabilities of the IT organization affect firms' ability to innovate; hence,

$H2_0$: IT dynamic capabilities are not correlated with a firm's innovativeness.

$H2a$: IT dynamic capabilities are correlated with a firm's innovativeness.

Hypothesis 3: Communication Structures

The construct *communication structures* was measured along three dimensions: complexity, centralization, and formalization (Khaleghi, Alavi, & Alimiri, 2013; Kim et al., 2013; MacCormack, Rusnak, & Baldwin, 2012). The *complexity* dimension is a measure of administrative intensity and number of hierarchical layers in the organization (Khaleghi, Alavi, & Alimiri, 2013; Kim et al., 2013). The measure of the complexity

dimension was constructed as the product of four attributes: number of hierarchical layers, group size, group geographic dispersion, and volume of tasks. I hypothesized that IT organizational complexity affects IT knowledge creation and IT dynamic capabilities; hence,

$H3a_0$: IT organizational complexity is not correlated with IT knowledge creation.

$H3a_1$: IT organizational complexity is correlated with IT knowledge creation.

$H3b_0$: IT organizational complexity is not correlated with IT dynamic capabilities.

$H3b_1$: IT organizational complexity is correlated with IT dynamic capabilities.

The *centralization* dimension is the extent to which organizational decision-making authority is concentrated at the center of an organization. Four constructs measure the centralization dimension, namely, interaction, specialization, collaboration, and consensus. I hypothesized that the degree of IT centralization affects knowledge creation and dynamic capabilities; hence;

$H3c_0$: IT centralization is not correlated with IT knowledge creation.

$H3c_1$: IT centralization is correlated with IT knowledge creation.

$H3d_0$: IT centralization is not correlated with IT dynamic capabilities.

$H3d_1$: IT centralization is correlated with IT dynamic capabilities.

The *formalization* dimension is related to procedures in the organization and measured by the level of governance and approval process (Khaleghi, Alavi & Alimiri, 2013). I hypothesized that formalization of the IT organization affects knowledge creation and IT dynamic capabilities; hence,

$H3e_0$: IT formalization is not correlated with IT knowledge creation.

$H3e_1$: IT formalization is correlated with IT knowledge creation.

$H3f_0$: IT formalization is not correlated with IT dynamic capabilities.

$H3f_1$: IT formalization is correlated with IT dynamic capabilities.

Hypothesis 4: Communication Structures and Knowledge Creation

To understand the relative effect of communication structures and knowledge creation on innovativeness, I tested the following hypothesis:

$H4_0$: IT knowledge creation has an equal or greater correlation with a firm's innovativeness than IT communication structure.

$H4_1$: IT communication structure has a greater correlation with a firm's innovativeness than IT knowledge creation.

Hypothesis 5: Knowledge Creation and Dynamic Capabilities

To understand the relative effect of knowledge creation and dynamic capabilities on innovativeness, I tested the following hypothesis:

$H5_0$: IT dynamic capabilities have an equal or greater correlation with a firm's innovativeness than IT knowledge creation.

$H5_1$: IT knowledge creation has a greater correlation with a firm's innovativeness than IT dynamic capabilities.

Analysis Strategy

Data collected through an online survey was imported into SPSS version 21 for statistical analysis to determine whether correlations exist between the IT organizational design variables and a firm's ability to innovate. The instrument developed for this study used three types of scales: nominal, ordinal, and interval. The demographic information

questions used a combination of nominal, ordinal, and interval scales to collect general background about the participant and the company. The other four sections of the survey used 6-point Likert-type scaled designed to assess each of the variables (Table 14 includes the details for each survey).

Table 14

Survey Scale

Survey	Category	Scale
The Innovativeness of the firm	Innovation speed of the Firm	Ordinal
	Innovation Level of the Firm	Ordinal
	The firm's risk control	Interval
	The firm's process risk	Interval
The IT knowledge creation	Sharing through social interaction	Ordinal
	Publishing leaned knowledge	Ordinal
	Combination and integration of knowledge	Ordinal
	Application of knowledge	Ordinal
The IT dynamic capabilities	Sensing	Ordinal
	Seizing	Ordinal
	Reconfiguring	Ordinal
The IT communication structure	Complexity of the IT organization	Ordinal
	Centralization of the IT decision-making	Ordinal
	Formalization of the IT processes	Ordinal

The correlation between two variables is distinct from the causation of one variable by a second variable. A causation suggests that the a change in one variable causes a change in the other variable over time, while correlation means that the variables occur together in some specified manner without implying that one causes the other (Naoum, 2013).The most frequently used bivariate correlational procedure is called

Pearson's correlation, and is designed for the situation in which (a) each of the two variables is quantitative in nature, and (b) each variable is measured so as to produce raw scores.

The nature of the data and purpose of the study guided the determination of the most appropriate statistical procedures. The data collected from the electronic survey was analyzed using several quantitative data analysis techniques. The first round of analysis included descriptive statistics to compute the mean, standard deviation, median, and mode of the responses to the demographic items. Pearson's correlation tests were performed to examine whether a relationship between IT organizational design variables and the firm's innovativeness exists. A correlation coefficient near +1.00 means that the variables have a strong positive linear relationship. A correlation coefficient of -1.00 means that there was a strong negative correlation between the variables, such that as one decreases or increases the other moves in the opposite direction. In contrast, a correlation coefficient of 0 indicates no association among the variables. To address the potential for Type I and II errors, a p value of less than 0.05 supported rejecting the null hypothesis with a 95% confidence level.

Threats to Validity

Similar to other social sciences, practical limitations in information systems may prevent researchers from manipulating many of the variables under study. As a result, social scientists usually study the relationship between property such as a characteristic of a person, and the corresponding disposition or attitude (Frankfort-Nachmias & Nachmias, 2008). Frankfort-Nachmias and Nachmias (2008) explained that designs that are strong

on internal validity such as experimental design tend to be weak on external validity. They further explained that designs that are weak on internal validity are also weak on external validity. Newton and Shaw (2013) defined four types of standard validity: content, predictive, concurrent, and construct. Content validity means that the instrument measures how an individual would perform at present in a given universe of situations. Frankfort-Nachmias and Nachmias (2008) described two common types of content validity, face validity and sampling validity.

External Validity

External validity determines the extent findings maybe generalized to other settings. This study used a survey as an instrument. It ensured external validity by extending existing surveys and comparing the final survey with similar instruments to ensure the use common language to reduce misinterpretation of the questions. I adapted the existing survey instrument and the simple random sampling methods used in the original studies to replicate validity and reliability.

Internal Validity

To ensure internal validity, a study must be designed in such a way that rival hypotheses are ruled out, and artificial covariance is minimized or removed (Goktan & Miles, 2011). This study used a survey instrument consisting of questions designed to collect data from the study participants on IT organizational design and a firm's ability to innovate. The study used an existing survey instrument developed by Goktan and Miles (2011), Goodale et al. (2011), Plugge et al. (2013), Popadiuk (2012), and Zhuang (1995) to measure various IT organizational structure elements. The Goktan and Miles' (2011)

instrument which was selected to measure innovation speed and innovation level was validated by the author by conducting factor analysis. The instrument's convergent and discriminant validity was assessed, and the standard loadings were above 0.5. Similarity, both Goodale et al. (2011) and Plugge et al. (2013) conducted factor analysis of their instruments and reported support for internal validity.

Construct Validity

Construct validity focuses on the study variables and is used to determine the degree the methods used to study the variable are valid (Cohen, Manion, & Morrison, 2007). In this study, I examined different types of organizational designs and how they relate to the firm's ability to innovate. To establish the degree of construct validity associated with an instrument, definition of the variables must reflect the theoretical meaning of the variable (Cozby & Bates, 2012, p.71). The variables in this study are derived from the research questions; they focus on the design of IT organizations and innovation. The survey instrument includes questions designed to collect data from participants regarding these variables.

Ethical Procedures

The study was conducted in accordance with the policies established by Walden University's Institutional Review Board (IRB; approval number 02-13-15-0320446), which ensures the ethical protection of research participants. The principle tenet of ethical protection is to ensure participants are not harmed as a result of the study. Research design literature (e.g., Cohen et al., 2007; Cozby & Bates, 2012; Singh, 2006) described several principles of protecting participants from potential harm. Cozby and

Bates (2012) outlined a comprehensive list of principles that include: voluntary participation, informed consent, confidentiality, anonymity, and right to service (p.56). Singleton and Straits (2005) noted that it is a violation of basic human rights to "harm others, to force people to perform actions against their will, to lie to or mislead them, and to invade their privacy" (p. 518). Research studies that use online websites to collect data are held to the same ethical standards as those that collect data through face-to-face contacts or postal mail (Leedy & Ormrod, 2010).

Participation in this study was strictly on a voluntary basis. Potential participants were members of LinkedIn CIO group. An invitation explaining the purpose of the study was posted on the LinkedIn group site. The invitation explained how information provided would be used and secured. It also outlined risks to participants, estimated time it takes to complete the survey, and other requirements for participation in the study. Participants were asked to complete an online survey anonymously and were informed that individual responses were not going to be revealed to anyone or identified in the study. A consent statement was included in the survey. Prior to accessing the survey questions, potential participants were required to acknowledge that they had read and understood the risks and were instructed to click on the appropriate button to participate or not participate in the study.

Summary

The research questions for this study determined that a quantitative method was appropriate. A correlational design offers the opportunity to examine variables as they naturally occurred and to determine the degree to which they are associated (Creswell,

2009), which was the purpose of the study. The results of this correlational design may lay foundations for future experimental or quasi-experimental designs that will be more focused on the cause-effect relational links among IT organizational design variables and innovativeness of the firm.

This chapter included the rationale for using a correlational design as the best approach to answering the research questions on the relationship between IT organizational design and innovativeness of the firm. This chapter included the data collection and data analysis procedures that were used to answer the research questions. Data was collected electronically using a self-administered online survey. The quantitative data was analyzed using the SPSS software program to execute descriptive and correlation analyses. Pearson's correlation was computed to provide statistical evidence that supported retention or rejection of the null hypotheses.

The following chapter covers the following topics: a description of the pilot study and a discussion of the validity and reliability of the survey; a presentation of data collection procedure, including the population, the sample, their demographic characteristics; the results of the study.

Chapter 4: Results

The purpose of this quantitative correlational study was to examine the correlation between three IT organizational design elements and a firm's ability to innovate. I examined how IT organizational design strategies relate to a firm's innovation in terms of its ability to deliver business solutions. The central question was as follows: Is there a correlation between the design of the IT organization and a firm's innovativeness? The hypotheses presented in Chapter 1 were examined by using an online survey instrument. The survey consisted of a five-section questionnaire that covered IT organizational design elements and a firm's innovativeness. Based on the methodology presented in Chapter 3, the collected data were coded and analyzed using SPSS, version 21. The results of the analysis, as well as findings of the study, are presented in this chapter.

This chapter begins with a description of the pilot study and a discussion of the validity and reliability of the instruments used in the study. This description is followed by a presentation of data collection including population and sample used in the study, data collection procedure, and demographic characteristics. A discussion of study results follows. This discussion includes descriptive statistics and hypotheses testing. The chapter concludes with a summary of key points presented in the chapter.

Pilot Study

The instrument used in this study was a composite survey comprised of six published scales used to measure constructs similar to the ones in this study. Each of those scales was validated by their original authors as outlined in Chapter 3. The purpose

of conducting a pilot test was to make sure the composite survey instrument was valid and reliable.

Pilot Study Procedure

The pilot study was conducted after IRB approval was obtained. Participants were members of the LinkedIn CIO group. Invitations to participate in the pilot study were sent to the group as a LinkedIn message. The invitations included a link to the online survey. The survey started with the consent form that outlined its purpose, benefits, and risks as well as the requirements for participation. Each of the survey sections included instructions on how to complete the questions. No identifying information was recorded, for example, e-mail address or IP address of the device used to complete the survey.

Pilot Study Results

During the 5-day pilot period, candidates were reminded to take the survey; 17 responses were received. Four did not have complete answers and were removed from the analysis. The survey data were coded into proper numerical form for statistical analysis, including Cronbach's alpha, which was used to determine the reliability of the survey scale; correlation matrixes were used to examine internal validity. Pilot test indicated that the composite instrument was valid and reliable. Results generated Cronbach's alpha statistics of .828, .766, .759, and .742 for the knowledge creation, dynamic capabilities, communication structures, and innovativeness scales, respectively. Table 15 includes a summary of the pilot study response distribution based on the 13 valid responses obtained from pilot participants.

Table 15

Pilot Study Response Distribution

Study construct	Number of factors	Mean	Variance	Std. deviation	Cronbach's alpha
Knowledge creation	15	31.615	36.756	6.063	.828
Dynamic capabilities	16	47.461	39.603	6.293	.766
Communication structures	18	58.615	77.590	8.808	.759
Innovativeness of the firm	19	31.077	42.410	6.512	.742

Correlations between elements of each IT construct in the study showed reasonable reliability. For example, correlation between elements of innovativeness ranged from $r = -.687$, $p < .01$ to $r = .892$, $p < .05$. This example shows a broad range of correlations, both positive and negative, between elements with varying degrees of statistical significance. For knowledge creation, positive correlations between factors are confirmed with $r > .564$, $p < 0.05$ and $r > .801$, $p < 0.01$. The complete analysis of the pilot data is presented in Appendix F.

Data Collection

The population, sample, and recruitment process outlined in Chapter 3 were followed during the data collection process. Qualified participants were limited to tenured managers of US firms that use IT to deliver products or services. The sample size calculated using GPower was 111. Data collection lasted 31 days and during this time, 158 responses were received, 43 of which were incomplete.

Population and Sample

Inclusion in the study was identified based on the following criteria: (a) the participants must be employees of firms that relied on IT to deliver their product or

service, (b) the participants must be employed by their firms for at least 2 years, (c) participants must be IT professional or employees who deal directly with IT, and (d) the population will be limited to firms in the United States. Inclusion criteria was established through a combination of 3 different methods: (a) the target pool was limited to the LinkedIn CIO group, a professional network for CIOs and IT and business managers who are the target population for this study, (b) specific requirements for participation in the study were outlined in the invitation to the study and the study consent statement, and (c) demographic questions were designed to provide answers that would enable the researcher to identify qualified participants.

The simple random sampling technique was used as it allows the researcher to form a sample by choosing participants from the population at random (Cozby & Bates, 2012; Singh, 2007). This type of sampling strategy is typically representative of the population. The LinkedIn CIO group is a professional network with over 140,000 members comprised of CIOs, IT managers, and business managers. It was assumed that the members of the LinkedIn CIO group are random by the nature of the membership in the group. In addition, members of the LinkedIn CIO group who chose to participate were not directly contacted by the researchers; therefore, a random sampling strategy was assumed. A GPower analysis to determine sample size for bivariate normal correlation with alpha α error probability = .05, power = .95, and medium effect size correlation ρ = .30 indicated a minimum sample size of n = 111.

Instrumentation

The data collection instrument used for this study was a composite survey questionnaire developed based on the research questions. Four explanatory constructs were operationalized based on the review of prior studies and field experiences. These constructs are IT knowledge creation, IT dynamic capabilities, communication structures, and innovation. A Likert scale was developed to capture the respondents' level of agreement, ranging from s*trongly disagree* to *strongly agree*.

The instrument development involved building a scale and conducting a pilot test to determine the adequacy of the data-collection technique and the validity and reliability of the overall instrument. The instrument was verified to be valid and reliable, as explained in the pilot study section. This composite instrument was used to collect participants' responses for all study variables at the same time.

Data Collection Procedures

The initial contact with the potential participants was achieved via a LinkedIn message. The LinkedIn message invited members of the group to participate in the study. The invitation explained the purpose of the study, emphasized the voluntary and anonymous nature of the survey, and outlined the criteria for participation in the study. The invitation contained a link to the online survey. The introduction page of the survey presented the consent form which outlined the purpose, benefits, and risks of the study as well as the requirements for participation.

Group postings on professional networking sites such as LinkedIn groups typically exhibit significantly lower response rates than do direct e-mail invitations to the

same population (Couper & Miller, 2008). Therefore, to achieve the necessary level of participation, the invitation was posted on the LinkedIn CIO group twice a week for the duration of the study. The response rate was not important for this study as we did not target or contact a specific population. The recruitment and participation period was 31 days. During that time, 158 responses were received. Forty-three of them did not provide complete responses; therefore, their entries were removed from the analysis. After the 31-day period, the recruitment and participation period ended, and the survey was closed.

SurveyMonkey.com was used to host the online survey. SurveyMonkey.com is secure and has been used in similar research studies. Data collected on the site was directly downloaded into the researcher's computer and was password protected immediately. No personal identifying information was required to complete the survey. The IP Access feature that collects the participant's IP address was turned off. Therefore, the data cannot be matched with a person. Raw data will be kept for 5 years. After the 5 years, data will be destroyed.

Data Cleaning and Screening

As described in Chapter 3, participants' responses were exported from the online survey site as a Microsoft Excel file. The data collected was cleansed before any analysis was conducted. The cleansing process included a review of all responses for missing data. Answers to scalar questions were converted into the appropriate numerical value ranging between 0 and 5. Some questions were framed in reverse phrasing and hence the numerical values assigned to the answers were reversed. The Excel data was imported into SPSS version 21.0 for statistical analysis.

Demographic Characteristics

The survey included 12 demographic questions that were used to collect basic demographic data regarding the participants and the firms where they are employed. Participant's data included age, role at current job, and tenure while firm data included size, age, and industry. The data were used to understand how representative of the population the sample is. One hundred and fifteen valid responses were collected in this study. Participants were employees of 115 firms ranging in size from fewer than 50 employees to over 100,000 employees and representing more than 18 industries. While participants were managers within their perspective firms, their roles varied from business development and executive management to engineering and IT. The most frequent industry reported was telecommunication, technology, Internet and electronics (n = 49, 42.6%, see Table 16).

While descriptive statistics were analyzed for all demographic responses, only participant role, tenure, and industry that justify participants demographic as adequate population sample are included in this section. Furthermore, descriptive statistics of participants' level of education, role, and tenure are depicted within the correlational statistics. Additional descriptive statistics such as hierarchical levels, the number of employees in the firm, and total employees in IT department are reported in Appendix G.

The following descriptive statistics report on the population demographic of participants who responded to the survey (see Tables 16 to 17). The report allows for an assessment of the raw data as computed in frequency and percentiles. All statistics were computed using the statistical functions of SPSS.

Table 16

Distribution of Participants' Roles

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accounting	2	1.7	1.7	1.7
	Art/Creative/Design	1	.9	.9	2.6
	Business Development	10	8.7	8.7	11.3
	Consulting	4	3.5	3.5	14.8
	Engineering	13	11.3	11.3	26.1
	Finance	2	1.7	1.7	27.8
	Information Technology	58	50.4	50.4	78.3
	Executive Management	17	14.8	14.8	93.0
	Quality Assurance	3	2.6	2.6	95.7
	Sales	2	1.7	1.7	97.4
	Strategy/Planning	2	1.7	1.7	99.1
	Training	1	.9	.9	100.0
	Total	115	100.0	100.0	

Table 16 identifies participant's roles while Tables 17 and 18 outlines the distribution of firms' sizes and industries represented by participants. The descriptive tables identify the research data reported to come from business and technology management professionals who have knowledge of their firm's IT operations, governance, and strategy. For example, while the study focused on the design of the IT organization, it intended to include participants who are not part of an IT organization, but work closely with IT. The participation pool for this study consisted of 50.4% IT professional; the remaining participants are combination of business professional and executive management. The size of the firms were reported by participants and fell into five categories as outlined in Table 17. Firm sizes in the six categories ranged between

fewer than 200 and over 10,000 employees. Nineteen of the 115 firms have less than 200 employees and 10 firms employ more than 10,000 employees. The largest number of firms (*n* = 50, 43.5%) has between 1000 and 4,999 employees.

Table 17

Distribution of Firms' Sizes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-199	19	16.5	15.7	16.5
	200 - 499	14	12.2	12.2	28.7
	500 - 999	12	10.4	10.3	39.1
	1000 - 4999	50	43.5	43.5	82.6
	5000 - 10000	10	8.7	8.7	91.3
	> 10000	10	8.7	8.7	100.0
	Total	115	100.0	100.0	

The sample represented more than 18 industries (see Table 18). The most frequent industry reported was telecommunication, technology, Internet and electronics, which accounted for 42.6% of the total, or 49 participants. Other representative industries included automotive (*n* = 9, 7.8%), financial services (*n* = 8, 7%), and education and entertainment (*n* = 7, 6.1% each).

While 18 industries were represented in this study, industry was not a factor in the population as the focus was on manager of IT and managers of business units that dealt directly with IT. Inclusion criteria was established through a combination of the following: IT and busineness managers, United Stated firms that relied on IT to deliver its products or services, and minimum tenure of 2 years.

Table 18

Distribution of Industry

	Industry	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Advertising & Marketing	1	.9	.9	.9
	Airlines & Aerospace	2	1.7	1.7	2.6
	Automotive	9	7.8	7.8	10.4
	Business Support & Logistics	2	1.7	1.7	12.2
	Education	7	6.1	6.1	18.3
	Entertainment & Leisure	7	6.1	6.1	24.3
	Finance & Financial Services	8	7.0	7.0	31.3
	Food & Beverages	1	.9	.9	32.2
	Government	6	5.2	5.2	37.4
	Healthcare & Pharmaceuticals	6	5.2	5.2	42.6
	Insurance	1	.9	.9	43.5
	Manufacturing	3	2.6	2.6	46.1
	Nonprofit	1	.9	.9	47.0
	Retail & Consumer Durables	5	4.3	4.3	51.3
	Real Estate	2	1.7	1.7	53.0
	Telecommunications, Technology, Internet & Electronics	49	42.6	42.6	95.7
	Transportation & Delivery	3	2.6	2.6	98.3
	Utilities, Energy, and Extraction	2	1.7	1.7	100.0
	Total	115	100.0	100.0	

Study Results

The study data were collected and analyzed at a significance level (alpha, α) of 0.05, using the procedures outlined in Chapter 3. The results are presented in this chapter

and are organized into two sections. The first section provides a description of the sample used in the study. The second section addresses the five research questions and hypotheses concerning IT organizational design and innovativeness of the firm.

Descriptive Statistics

Descriptive statistics were used to analyze basic attributes the collected data. Those statistics presented a comprehensive view of the sample through mean, standard deviation, and score range. The mean and standard deviation measured the central tendency of the data and the variation in the distribution of the data. The score range showed how the variables were distributed by indicating the difference between the largest and smallest data values. In addition, internal consistency reliability coefficients (Cronbach's alpha) were calculated for all composite scores used in this study.

Descriptive statistics were generated for the study constructs and reported for knowledge creation, dynamic capabilities, communication structures, and innovativeness (see Tables G1 to G14 in Appendix G). The four study constructs were represented in the study instrument as 14 scalar questions (see Appendix D). Each of the scalar questions contained one or more statements to be evaluated using a 6-point Likert type scale. Each statement represented a factor that affects IT organizational design based on the literature review in Chapter 2. In total, the survey scalar questions include 68 statements. Table 19 shows the number of scalar questions associated with each construct and a summary of basic statistics of survey response. Overall, responses appear to be reasonably distributed across the 6-point Likert-type scales.

Table 19

Study Response Distribution

Study construct Variable	Number of factors	Mean	Std. Deviation	Variance	Cronbach's Alpha
Innovativeness of the firm					
Innovation speed	6	11.835	5.102	26.034	.787
Innovation level	6	12.400	6.035	36.418	.909
Risk control	4	8.887	4.588	21.049	.876
Process control	3	6.835	3.330	11.086	.839
Knowledge creation					
Socialization	5	10.400	4.448	19.786	.816
Integration	3	7.521	3.205	10.269	.827
Publishing	4	8.774	3.965	15.720	.803
Application	3	9.391	2.437	5.889	.762
Dynamic capabilities					
Sensing	5	14.870	4.833	23.360	.883
Seizing	6	19.139	5.641	31.823	.875
Reconfiguring	5	15.000	4.823	23.263	.892
Communication structures					
Complexity	4	9.078	3.958	15.669	.804
Centralization	8	15.617	7.102	50.431	.892
Formalization	6	18.017	5.323	28.333	.786

IT knowledge creation. *IT Knowledge creation* is the process of generating new ideas through purposeful activities (Mitchell & Boyle, 2010). Knowledge is created by individuals in the firm through social interactions, integration, publishing, and application (Nonaka et al., 2000; Sabherwal & Becerra-Fernandez, 2003). Therefore, to assess the degree of IT knowledge creation, participants were asked to evaluate 15 survey statements representing the four elements of knowledge creation (see Tables F5 through F8 in Appendix D). IT knowledge creation was measured with four subscales; each consisting of two or more survey statements. Each statement was measured with 6-point

Likert scales (from 0 = *never* to 5 = *always*). The scores of the 15 Items were summed up for an overall *IT Knowledge Creation* index. The lowest possible score for the scale was 0 and the highest possible score was 75, with a theoretical midpoint of 37.5. Scores below 37.5 indicated less agreement with the IT knowledge creation statements and scores above 37.5 indicated more agreement with the statements. Table 20 includes the descriptive statistics for the IT knowledge creation subscale. Tables G1 through G4 in Appendix G include the response distribution and statistics for the elements of IT knowledge creation and corresponding factors.

Table 20

Descriptive Statistics for the IT Knowledge Creation Subscale

	N	Survey Statements (factors)	Range	Mean	Std. Deviation	Variance
Knowledge Socialization	115	5	25.00	10.400	4.448	19.786
Knowledge Integration	115	3	15.00	7.521	3.205	10.269
Knowledge Publishing	115	4	20.00	8.774	3.965	15.720
Knowledge Application	115	3	13.00	9.391	2.427	5.889
Valid *N*	115					

Knowledge socialization was measured using five statements developed by Plugge et al. (2013). This subscale intended to assess the extent to which the IT organization encourages employees to engage in specific social activities that promote knowledge sharing. Items were measured using a 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*). Scores of individual items were added up to produce a total score that could range from 0 to 30; higher scores indicate greater sense of

knowledge socialization. The majority of the participants showed they do not agree or agree slightly that socialization is taking place at their organizations.

Knowledge integration subscale measured the extent to which the IT organization uses knowledge integration methods and activities. The scale consisted of three survey statements with a range between 0 and 15. Response distribution displayed wide variation with most common response of 6 (n = 17, 14.8%). The calculated mean was 7.5, indicating overall neutrality in how the sample viewed knowledge publishing at their firms.

Knowledge publishing subscale measured the degree to which the IT organization adopts specific knowledge publishing activities and tools. The scale consisted of four survey statements with a range between 0 and 20. Response distribution showed the most common response to be 8.0 (n = 23, 20%) with a calculated mean of 8.79, indicating overall disagreement with the knowledge integration statements.

The last knowledge creation subscale, *knowledge application*, measured the level of knowledge application within the IT organizations. Participants were asked to provide an opinion as to the extent to which the IT organization performs certain knowledge application activities. The data indicated that the majority of the participants agree or agree slightly that knowledge application is taking place at their organizations.

IT dynamic capabilities. *Dynamic capabilities* enable firms to achieve their objectives by applying skills and competencies that are adaptable to changing circumstances (Camisón & Villar-López, 2014; Helfat & Peteraf, 2009; Teece et al., 1997). To assess the degree IT dynamic capabilities exist, participants were asked to

respond to 16 survey statements representing the three elements of dynamic capabilities (see Tables D9 through D11 in Appendix D). Hence, IT dynamic capabilities were measured with three subscales; each consisting of three or more survey statements. Each statement was measured with 6-point Likert scales (from 0 = *strongly disagree* to 5 = *strongly agree*). The scores of the 16 Items were summed up for an overall index of dynamic capabilities. This resulted in a lowest possible score for a scale of 0, and a highest possible score was 80, with a theoretical midpoint of 40. Scores below 40 indicated less agreement with the IT dynamic capabilities statements and scores above 40 indicated more agreement with the statements. Table 21 presents the descriptive statistics for the IT dynamic capabilities scores. Tables G5 through G7 in Appendix G summarize the response distribution and statistics for the elements of IT dynamic capabilities and corresponding factors.

Table 21

Descriptive Statistics for IT Dynamic Capabilities Subscale

	N	Survey Statements (Factors)	Range	Mean	Std. Deviation	Variance
Dynamic Capabilities - Sensing	115	5	20.00	14.8696	4.83322	23.360
Dynamic Capabilities - Seizing	115	6	25.00	19.1391	5.64115	31.823
Dynamic Cap. - Reconfiguring	115	5	25.00	15.0000	4.82319	23.263
Valid *N*	115					

Sensing capability subscale measured the extent to which the IT organization is able to sense changing business circumstances. The scale consisted of five statements with a range between 0 and 25. The participants were asked to select the appropriate response that best describe their IT organization's ability to sense changing business

circumstances for each of the five statements. Response distribution displayed wide variation, however, the majority of the participants showed they agree (n = 40, 34.8%) or agree strongly (n = 24, 20.9%) that their IT organization is able to sense the change in the business environment. The calculated mean was 14.87, which indicates a positive overall agreement with the sensing capability statements.

Seizing capability subscale measured the ability of an IT organization to seize opportunities to support the business. The participants were asked to select the appropriate response that best describes the IT organization's ability to seize opportunities to support the business based on six activities. The scale has a range between 0 and 30. Response distribution displayed wide variation with most common response of 6 (n = 17, 14.8%). The calculated mean was 19.14, indicating agreement with the survey statements.

Reconfiguring capability subscale measured the ability of the IT organization to reconfigure resource, technology and processes to support the business. Participants were asked to provide an opinion as to the extent to which their IT organizations are able to perform certain activities that have been known to enable reconfiguration. The analysis indicates agreement in how the sample viewed reconfiguring capability at their firms.

IT communication structures. Studies have suggested that when a firm's communication flows become structured around a firm's current product architecture, the firm may have difficulty recognizing possibilities for innovation (Handel, 2014). Communication structures are influenced by organizational complexity, command and control, and decision-making process (Handel, 2014; Meirovich et al., 2007). Therefore,

to assess the IT communication structures, participants were asked to respond to 18 survey statements representing the three elements of communication structures (see Tables D12 through D14 in Appendix D). IT communication structures were measured with three subscales; each consisting of multiple survey statements. Each statement was measured with 6-point Likert scales (from 0 = *strongly disagree* to 5 = *strongly agree*). The scores of the 18 Items were summed up for an overall index. The lowest possible score for the scale was 0, and the highest possible score was 80, with a theoretical midpoint of 40. Scores below 40 indicated less agreement with the IT communication structures statements and scores above 40 indicated more agreement with the statements. Table 22 presents the descriptive statistics for the IT communication structures scores. Tables G8 through G10 in Appendix G summarize the response distribution and statistics for the elements of IT communication structure and corresponding factors.

Table 22

Descriptive Statistics for IT Communication Structures Subscale

	N	Survey Statements (Factors)	Range	Mean	Std. Deviation	Variance
Communication - Complexity	115	4	20.00	9.078	3.958	15.669
Communication - Centralization	115	8	40.00	15.617	7.101	50.431
Communication - Formalization	115	6	29.00	18.020	5.323	28.333
Valid *N*	115					

The survey included four statements intended to assess the *complexity* of the IT organizational structure as it relates to the way work is accomplished. The participants

were asked to select the appropriate response that best describe their IT organization for each of the four statements on a 6-point Likert scale. The complexity subscale has a range between 0 and 20, with a theoretical midpoint of 10. A majority of the participants indicated they disagree (n = 24, 20.9%) or disagree slightly (n = 56, 48.7%) that their IT organizations are complex.

Eight survey statements focused on *centralization*, often referred to as command and control, within the IT organization. The participants were asked to select the appropriate response that best describes the IT organization's decision-making process. In most cases, the participants disagreed (n = 21, 18.26%) or disagree slightly (n = 67, 58.26%) that decision-making at their firms was centralized.

The last six statements in the IT communication structures scale measured *formalization*, which refers to the policies and procedures of the IT organization. Participants were asked to provide an opinion as to the extent to which their IT organizations possess and enforce certain activities that have been known to be associated with formalization. The distribution of the responses shows some bimodality, with an even distribution of responses clustered towards the middle of the scale.

Innovativeness of the firm. While we could not ask firms if they are innovative and to what extent, we could ask participants about their current understanding of factors that affect innovation. Therefore, to assess the innovativeness of the firm, participants were asked to indicate the degree of agreement with 19 statements associated with four elements of innovation (see Tables D1 through D4 in Appendix D). The four elements of innovation considered in this study are innovation speed, innovation level, risk control,

and process control. Each element was treated as a subscale and consisted of multiple statements that were used to measure participants views on 6-point Likert scale (from 0 = *strongly disagree* to 5 = *strongly agree*).

The scores of the 19 items were summed up to create an index reflecting the overall innovation capability of an organization. The lowest possible score for the scale was 0 and the highest possible score was 95, with a theoretical midpoint of 47.5. Scores below 47.5 indicated less agreement with the innovation statements and scores above 47.5 indicated more agreement with the statements. Table 23 includes the descriptive statistics for the innovation scores. Tables G11 through G14 in Appendix G summarize the response distribution and statistics for the elements of innovation and corresponding factors.

Table 23

Descriptive Statistics for Innovativeness of the Firm Subscale

	N	Survey Statements (Factors)	Range	Mean	Std. Deviation	Variance
Innovativeness - Speed	115	6	22.00	11.83	5.102	26.034
Innovativeness - Level	115	6	29.00	12.40	6.035	36.418
Innovativeness - Risk Control	115	4	20.00	8.89	4.588	21.049
Innovativeness - Process Control	115	3	15.00	6.83	3.330	11.086
Valid *N*	115					

Innovation speed was measured using a 6-item scale developed by Goktan & Miles (2011) who reported an internal consistency of .87. Items were measured using a 6-point Likert. Score of individual items were summed to produce an overall score that could range from 0 to 30; higher scores indicate a greater innovation speed. Innovation

speed contained two reverse phrasing items and hence, their scores were reversed. The majority of the participants showed they do not agree that innovation speed was appropriate at their organizations. Response distribution displayed wide variation with most common response of 9 (n = 17, 14.8%).

Level of innovation was measured using a 6-item scale developed by Goktan & Miles (2011). Internal consistency for this instrument was reported at .97. Items were measured using a 6-point Likert scale with responses ranging from (from 0 = *strongly disagree* to 5 = *strongly agree*). Score of individual items were summed to produce an overall score that could range from 0 to 30; higher scores indicate greater innovation level. The majority of the participants showed they do not agree or agree slightly that the level of innovation at their firms was considered radical. The results show that the most common responses are 10 (n = 20, 17.39%) and 8 (n = 15, 13.04%).

Risk control was measured using a 4-item scale developed by Goodate et al. (2011). Convergent and discriminant validity of this instrument was assessed by Goodate et al. (2011); they reported a minimum loadings factor of .65. Items were measured using a 6-point Likert scale with responses ranging from *strongly disagree* to *strongly agree*, with value of 0 to 5, respectively. Scores of individual items were summed to produce an overall score that could range from 0 to 20; higher scores indicate greater risk tolerance and more Entrepreneurship. Responses displayed wide variation; however, the most common response was 4 (n = 16, 13.91%).

Process control scale measures flexibility by using a 3-item questionnaire developed by Goktan & Miles (2011). Convergent and discriminant validity of this

instrument was assessed by Goktan & Miles (2011); they reported a minimum loadings factor of .65. Items were measured using a 6-point Likert scale with responses ranging from *strongly disagree* to *strongly agree*. Individual items scores were added up to produce an overall score that could range from 0 to 15; higher scores indicate greater flexibility.

Hypothesis Testing

Hypothesis tests involve both the null hypothesis and the alternative hypothesis, denoted by H_0 and H_1, respectively. It was assumed that the null hypothesis is true but tested for possible rejection while the alternative hypothesis is assumed to be false but could be established as a result of the test (Pollard, 2014). The null hypothesis probability value (*p*-value) obtained from the statistical test was used to draw inferences regarding the status of the null hypothesis (Masson, 2011). If the *p*-value is very low, it is an indication that the null hypothesis is unlikely to be true; and hence the null hypothesis can be rejected and the alternative hypothesis can be supported. By contrast, if the *p*-value is greater than the α-level, the null hypothesis cannot be rejected and no support will be claimed for the alternative hypothesis.

Pearson's correlation coefficients were calculated to test the statistical hypotheses. This method appeared to be the most appropriate statistical method to use because the purpose of this study was to identify correlations rather than to determine causation (Leedy & Ormrod, 2010; Naoum, 2013). Along with Pearson's correlation coefficients, Kendall's *taub* and Spearman's *rho* nonparametric correlations were analyzed to determine the relationships between the study variables. This correlation statistics method

was used in similar studies, which gave additional credibility to the selection of the data analysis methodology (e.g., Carnabuci & Operti, 2013; Qian, Cao, & Takeuchi, 2013). Since the nature of the relationships between variables was unknown, two-tailed tests were conducted. Table 24 includes means, standard deviations, and correlations for all study constructs.

Table 24

Correlations for Study Constructs

	Construct	Mean	S.D.	1	2	3	4
1	Innovation	39.957	12.836	1			
2	Knowledge Creation	36.087	11.138	.360**	1		
3	Dynamic Capabilities	49.009	13.963	.312**	.646**	1	
4	Communication Structures	53.322	14.470	.352**	.586**	.826**	1

** Correlation is significant at the 0.01 level (2-tailed).

Research Question 1. To what extent, if any, is knowledge creation in IT organizations related to a firm's innovativeness? This question inquired whether and how IT knowledge creation facilitates a firm's innovativeness. The literature treats knowledge as both a resource and a capability (Mishra et al., 2013). Thus the question deals with two hypotheses; the first relates knowledge creation to dynamic capabilities and the second relates knowledge creation to innovation.

Hypothesis 1a. To understand the correlation between knowledge creation and dynamic capabilities, we tested the following hypothesis:

$H1a_0$: IT–business knowledge creation is not correlated with IT dynamic capabilities.

$H1a_1$: IT–business knowledge creation is correlated with IT dynamic capabilities.

Hypothesis 1a predicted that knowledge creation facilitates dynamic capabilities. The related null hypothesis predicted that, for the entire sample, knowledge creation has no correlation to dynamic capabilities. Results of testing the null hypothesis using Pearson's correlation coefficient showed a positive correlation, $r = .646$, $p < .01$ (see Table 24). The results indicated that there was a statistically significant positive correlation between knowledge creation and dynamic capabilities, which meant that the two variables change in the same direction. The correlation coefficient of .646 resulted in a coefficient of determination of $R^2 = .42$, suggesting that 42% of the variance in dynamic capabilities was attributed to the relationship between knowledge creation and dynamic capabilities. Nonparametric rank order correlation was also confirmed with Kendall's tau$_b$ $\tau = .46$, $p < .01$ and Spearman's rho $r_s = .623$, $p < .01$ (see Table H1 in Appendix H). Therefore, the null hypothesis was rejected and the alternate hypothesis was supported.

Hypothesis 1b. To understand the correlation between knowledge creation and a firm's innovativeness, I tested the following hypothesis:

$H1b_0$: IT–business knowledge creation is not correlated with a firm's innovativeness.

$H1b_1$: IT–business knowledge creation is correlated with a firm's innovativeness.

Hypothesis 1b predicted that knowledge creation facilitates innovativeness of the firm. The related null hypothesis predicted that, for the entire sample, knowledge creation has no correlation to how innovative the firm is. Results of testing the null hypothesis using Pearson's correlation coefficient showed a positive correlation, $r = .36$, $p < .01$ (see Table 24). The results indicated that there was a statistically significant positive

correlation between knowledge creation and a firm's innovativeness, which meant that the two variables change in the same direction. The correlation coefficient of 0.36 resulted in a coefficient of determination of $R^2 = .13$, suggesting that 13% of the variance in innovation capability was explained by the relationship between knowledge creation and innovation capability. Nonparametric rank order correlation was also confirmed with Kendall's tau$_b$ $\tau = .255$, $p < .01$ and Spearman's rho $r_s = .377$, $p < .01$ (see Table H1 in Appendix H). The null hypothesis was rejected and the alternate hypothesis was supported.

Research Question 2. To what extent, if any, are dynamic capabilities in IT organizations related to a firm's innovativeness? This question inquired whether and how IT dynamic capabilities facilitate a firm's innovativeness. Only one hypothesis was formulated to address this question.

Hypothesis 2. To understand the correlation between dynamic capabilities of IT and a firm's innovativeness, I tested the following hypothesis:

$H2_0$: IT dynamic capabilities are not correlated with a firm's innovativeness.

$H2a$: IT dynamic capabilities are correlated with a firm's innovativeness.

Hypothesis 2 predicted that dynamic capabilities facilitate a firm's innovativeness of the firm. The related null hypothesis predicted that, for the entire sample, dynamic capabilities have no correlation to how innovative the firm is. Results of testing the null hypothesis using Pearson's correlation coefficient showed a positive correlation, $r = .312$, $p < .01$ (see Table 24). The result indicated there was a statistically significant positive correlation between dynamic capabilities and a firm's innovativeness, which meant that

the two variables change in the same direction. The correlation coefficient of .312 resulted in a coefficient of determination of R^2 =.1, suggesting that dynamic capabilities account for 10% of the variation in a firm's innovativeness. Nonparametric rank order correlation was also confirmed with Kendall's tau$_b$ τ = .258, p < .01 and Spearman's rho r_s = .369, p < .01 (see Table H1 in Appendix H). The null hypothesis was rejected and the alternate hypothesis was supported.

Research Question 3. To what extent, if any, are communication structures within IT related to a firm's innovativeness? This question inquired whether a relationship exists between communication structures and a firm's innovativeness. The literature review revealed that communication structures may affect innovation indirectly through dynamic capabilities and knowledge creation (MacCormack et al., 2012). Therefore, to address the question, six hypotheses were formulated to test the relationships between IT communication structures, namely, complexity, centralization, and formalization and both knowledge creation and dynamic capabilities.

Table 25

Correlations Between Communication Structures Factors

		Mean	S.D.	1	2	3	4	5
1	Complexity	9.079	3.958	1				
2	Centralization	15.617	7.102	.732**	1			
3	Formalization	18.017	5.323	-.643**	-.618**	1		
4	Knowledge Creation	36.087	11.138	-.605**	-.512**	.458**	1	
5	Dynamic Capabilities	49.009	13.963	-.751**	-.732**	.711**	.646**	1

** Correlation is significant at the 0.01 level (2-tailed).

Hypothesis 3a. To understand the correlation between organizational complexity and knowledge creation, we tested the following hypothesis:

$H3a_0$: IT organizational complexity is not correlated with IT knowledge creation.

$H3a_1$: IT organizational complexity is correlated with IT knowledge creation.

Hypothesis 3a predicted that the level of complexity of the IT communication structures affects IT's knowledge creation. The related null hypothesis predicted that, for the entire sample, knowledge creation has no correlation to how complex the IT organization is. Results of testing the null hypothesis using Pearson's correlation coefficient showed there was a significant relationship between organizational complexity and knowledge creation, $r = -.605$, $p < .01$ (see Table 25). Nonparametric correlations showed similar results, $\tau = -.435$, $p < .01$ and $r_s = -.574$, $p < .01$ (see Table H2 in Appendix H). The result indicated there was a statistically significant negative correlation between knowledge creation and complexity of IT organizational communication, which meant that the two variables change in the opposite direction. The correlation coefficient of $R^2 = -.605$ resulted in a coefficient of determination of .37, suggesting that over a third of the variance in knowledge creation was explained by the relationship between organizational complexity and knowledge creation. The null hypothesis was rejected and the alternate hypothesis was supported.

Hypothesis 3b. To understand the correlation between organizational complexity and dynamic capabilities, we tested the following hypothesis:

$H3b_0$: IT organizational complexity is not correlated with IT dynamic capability.

$H3b_1$: IT organizational complexity is correlated with IT dynamic capability.

Hypothesis 3b predicted that the level of complexity of the IT communication structures affects the dynamic capabilities of the IT organization. The related null hypothesis predicted that, for the entire sample, dynamic capabilities have no correlation to how complex the IT organization is. Results of testing the null hypothesis using Pearson's correlation coefficient showed there was a significant relationship between organizational complexity and dynamic capabilities, $r = -.751$, $p < .01$ (see Table 25). Nonparametric correlations showed similar results, $\tau = -.538$, $p < .01$ and $r_s = -.709$, $p < .01$ (see Table H2 in Appendix H). The result indicated there was a statistically significant negative correlation between knowledge creation and complexity of IT organizational communication, which meant that the two variables change in the opposite direction. The correlation coefficient of $R^2 = -.751$ resulted in a coefficient of determination of .56, suggesting that more than half of the variance in dynamic capabilities was accounted for by organizational complexity. The null hypothesis was rejected and the alternate hypothesis was supported.

Hypothesis 3c. To understand the correlation between centralization and knowledge creation, I tested the following hypothesis:

$H3c_0$: IT centralization is not correlated with IT knowledge creation.

$H3c_1$: IT centralization is correlated with IT knowledge creation.

Hypothesis 3c predicted that the level of IT centralization affects IT knowledge creation. The related null hypothesis predicted that, for the entire sample, knowledge creation has no correlation to how centralized decision-making in the IT organization is. Results of testing the null hypothesis using Pearson's correlation coefficient showed there

was a significant relationship between centralization of an IT organization and its ability to create knowledge, $r = -.512$, $p < .01$ (see Table 25). Nonparametric correlations showed similar results, $\tau = -.367$, $p < .01$ and $r_s = -.501$, $p < .01$ (see Table H2 in Appendix H). The result indicated there was a statistically significant negative correlation between knowledge creation and centralization of IT organizational communication, which meant that the two variables change in the opposite direction. The correlation coefficient of $R^2 = -.521$ resulted in a coefficient of determination of .27, suggesting that over a quarter of the variance in knowledge creation was explained by the relationship between centralization and knowledge creation. The null hypothesis was rejected and the alternate hypothesis was supported.

Hypothesis 3d. To understand the correlation between centralization and dynamic capabilities, we tested the following hypothesis:

$H3d_0$: IT centralization is not correlated with IT dynamic capabilities.

$H3d_1$: IT centralization is correlated with IT dynamic capabilities.

Hypothesis 3d predicted that the level of centralization of the IT communication affects the dynamic capabilities of the IT organization. The related null hypothesis predicted that, for the entire sample, dynamic capabilities have no correlation to how centralized IT communication is. Results of testing the null hypothesis using Pearson's correlation coefficient showed there was a significant relationship between centralization and dynamic capabilities, $r = -.732$, $p < .01$ (see Table 25). Nonparametric correlations showed similar results, $\tau = -.543$, $p < .01$ and $r_s = -.705$, $p < .01$ (see Table H2 in Appendix H). The result indicated there was a statistically significant negative correlation

between knowledge creation and centralization of IT organization, which meant that the two variables change in the opposite direction. The correlation coefficient of -.732 resulted in a coefficient of determination of R^2 =.54, suggesting that over half of the variance in dynamic capabilities was explained by the relationship between centralization and dynamic capabilities. The null hypothesis was rejected and the alternate hypothesis was supported.

Hypothesis 3e. To understand the correlation between formalization and knowledge creation, I tested the following hypothesis:

$H3e_0$: IT formalization is not correlated with IT knowledge creation.

$H3e_1$: IT formalization is correlated with IT knowledge creation.

Hypothesis 3e predicted that the level of IT formalization affects IT knowledge creation. The related null hypothesis predicted that, for the entire sample, knowledge creation have no correlation to how formalized the IT processes are. Results of testing the null hypothesis using Pearson's correlation coefficient showed there was a significant relationship between formalization of an IT organization and its ability to create knowledge, $r = .458$, $p < .01$ (see Table 25). Nonparametric correlations showed similar results, $\tau = .319$, $p < .01$ and $r_s = .453$, $p < .01$ (see Table H2 in Appendix H). The result indicated there was a statistically significant positive correlation between knowledge creation and formalization of IT organizational communication, which meant that the two variables change in the same direction. The correlation coefficient of .458 resulted in a coefficient of determination of $R^2 = .21$, suggesting that 21% of the variance in

knowledge creation was accounted for by process formalization. The null hypothesis was rejected and the alternate hypothesis was supported.

Hypothesis 3f. To understand the correlation between formalization and dynamic capabilities, I tested the following hypothesis:

$H3f_0$: IT formalization is not correlated with IT dynamic capability.

$H3f_1$: IT formalization is correlated with IT dynamic capability.

Hypothesis 3f predicted that the level of IT formalization affects the dynamic capabilities of the IT organization. The related null hypothesis predicted that, for the entire sample, dynamic capabilities have no correlation to how formalized the IT processes are. Results of testing the null hypothesis using Pearson's correlation coefficient showed there was a significant relationship between centralization and dynamic capabilities, $r = .711$, $p < .01$ (see Table 25). Nonparametric correlations showed similar results, $\tau = .550$, $p < .01$ and $r_s = .714$, $p < .01$ (see Table H2 in Appendix H). The results indicated that there was a statistically significant positive correlation between dynamic capabilities and formalization of IT processes, which meant that the two variables change in the same direction. The correlation coefficient of .711 resulted in a coefficient of determination of $R^2 = .51$, suggesting that over half of the variance in dynamic capabilities was explained by the relationship between process formalization and dynamic capabilities. The null hypothesis was rejected and the alternate hypothesis was supported.

Research Question 4. To what extent, if any, are IT communication structures more strongly related to a firm's innovativeness than is IT knowledge creation? The

question inquired the degree knowledge creation and communication structures have on a firm's innovativeness. One hypothesis was formulated to address this question.

Hypothesis 4. To understand the effect of knowledge creation and communication structure on innovation, we tested the following hypothesis:

$H4_0$: IT knowledge creation has an equal or greater correlation with a firm's innovativeness than IT communication structure.

$H4_1$: IT communication structure has a greater correlation with a firm's innovativeness than IT knowledge creation.

Hypothesis 4 predicted that IT communication structures have a greater effect than knowledge creation on innovation. The related null hypothesis predicted that, for the entire sample, communication structures have an equal or greater scale scores than knowledge creation. Pearson's correlation coefficient for knowledge creation and a firm's innovativeness, $r = .360$, $p < .01$ had a greater positive value than did Pearson's correlation coefficient for IT communication structures and innovativeness, $r = .352$, $p < .01$ (see Table 25 and Table H3 in Appendix H). However, the difference between the two correlation coefficients was negligible (.008); therefore, the null hypothesis was accepted, indicating that knowledge creation and communication structure have a similar effect on innovation.

Research Question 5. To what extent, if any, is IT knowledge creation more strongly related to innovation than is IT dynamic capability? The question inquired to what extend is knowledge creation scale scores are rated higher than dynamic capabilities. One hypothesis was formulated to address this question.

Hypothesis 5. To understand the effect of knowledge creation and dynamic capabilities on innovation, I tested the following hypothesis:

$H5_0$: IT dynamic capabilities have an equal or greater correlation with a firm's innovativeness than IT knowledge creation.

$H5_1$: IT knowledge creation has a greater correlation with a firm's innovativeness than IT dynamic capabilities.

Hypothesis 5 predicted that IT knowledge creation scores are rated higher than dynamic capabilities. The related null hypothesis predicted that, for the entire sample, dynamic capabilities have an equal or greater scale scores than knowledge creation. Pearson's correlation coefficient for knowledge creation and innovation, $r = .360$, $p < .01$ had a greater positive value than did Pearson's correlation coefficient for IT dynamic capabilities and innovativeness, $r = .312$, $p < .01$ (see Table 25 and Table H3 in Appendix H). While the difference in correlation coefficients was not significant, knowledge creation value was higher than dynamic capabilities; therefore, the null hypothesis was rejected, indicating that knowledge creation has a greater effect than dynamic capabilities on innovation.

Summary

This study started with a pilot test, which involved 13 participants. Cronbach's alpha analysis was conducted to determine the reliability of the survey scale and correlation matrixes were used to examine their internal validity. The results confirmed the validity and reliability of the survey instrument. A total of 158 participants answered the survey during the study; 43 of them did not provide complete responses and therefore

their entries were not included in the analysis. Demographic data was used to test for external validity. The results showed that the sample was representative of the population of interest. Finally, Pearson's correlation was used in the hypothesis tests to decide whether a null hypothesis was rejected or not.

Table 26

Summary of Hypotheses Testing

Research Question	H_0	Pearson's Coefficient	p-value	Accept/Reject
To what extent, if any, is knowledge creation in IT organizations related to a firm's innovativeness?	$H1a_0$	.646	<.01	Rejected
	$H1b_0$	.360	<.01	Rejected
To what extent, if any, are dynamic capabilities in IT organizations related to a firm's innovativeness?	$H2_0$	.312	<.01	Rejected
To what extent, if any, are communication structures within IT related to a firm's innovativeness?	$H3a_0$	.605	<.01	Rejected
	$H3b_0$	.751	<.01	Rejected
	$H3c_0$	.512	<.01	Rejected
	$H3d_0$	.732	<.01	Rejected
	$H3e_0$	.458	<.01	Rejected
	$H3f_0$	.711	<.01	Rejected
To what extent, if any, are IT communication structures more strongly related to a firm's innovativeness than is IT knowledge creation?	$H4_0$			Accepted
To what extent, if any, is IT knowledge creation more strongly related to a firm's innovativeness than is IT dynamic capability?	$H5_0$			Rejected

Note. All p-values were < .01.

Construct distribution analysis, histograms, and Cronbach's alpha analysis indicated the four-study construct were normally distributed. Pearson's correlation analysis indicated statistically significant correlations between all construct and construct transform pairs (see Table 25). Spearman's rho and Kendall's taub rank-order

correlations were also significant for all construct and construct-transform pairs (see Table H3 in Appendix H). Results for each research question are summarized in Table 26.

The following chapter covers the following topics: a discussion of the results, conclusions, recommendations for action and further study; and finally, the implications for social change, for the literature, and for managers.

Chapter 5: Discussion, Conclusions, and Recommendations

Business success is heavily dependent on its ability to innovate (Camisón & Villar-López, 2011; Hausman & Johnston, 2014; Jiménez-Jiménez & Sanz-Valle, 2011; Noruzy et al., 2013). Studies have demonstrated that product innovation may be dependent on organizational innovation (Camisón & Villar-López, 2011). This study sought to link organizational innovation to traditional technological innovation. Thus, the purpose of this study was to examine the relationships between IT organizational design and firm's innovativeness. I developed and tested hypotheses that empirically link the design of the IT organization to a firm's ability to innovate.

In this study, a survey instrument was used to examine whether and to what extent individual elements of an organizational design relate to certain aspects of innovation. IT and business managers were invited to participate in the study. Details of the design method, survey instrument, data collection procedures, and statistical analysis were presented in Chapter 4. This chapter presents the interpretations of the results outlined in Chapter 4. I begin this chapter with an interpretation of the findings, followed by a discussion of the limitations associated with the study. Next, recommendations and implications are presented. These recommendations take into account both practitioners and researchers, while the implications focus on practitioners.

Interpretation of Findings

Innovation is considered a vital source of performance and economic growth. It plays an important role in improving the quality of life. The literature review in Chapter 2 suggested that several organizational characteristics may have an impact on innovation

(Gopalakrishnan et al., 2014; Meroño-Cerdan & López-Nicolas, 2013). The review also revealed that most studies on innovation control for industry (e.g., Aarstad et al., 2015; Kindström et al., 2013; Ravishankar & Pan, 2013), organizational size (e.g., Ošenieks & Babauska, 2014), and the age of the firm (e.g., Laforet, 2013). While these measures were included in the questionnaire, this study focused on factors related to the IT function within the firm. Specifically, the study was bounded by three specific IT organizational design elements, namely, knowledge creation, dynamic capabilities, and communication structures.

The central question addressed in this study was as follows: Is there a correlation between the design of the IT organization and a firm's innovativeness? Five research questions guided the study as described in Chapter 3. Three of them focused on the direct relationship between the design elements of an IT organization and a firm's ability to innovate. The other two questions focused on the significance of the relationships between the elements. Eleven sets of hypotheses consisting of null and alternate hypotheses were advanced in this study. These hypotheses were tested as outlined in Chapter 4 and a summary of the results is presented in Table 26. One of the 11 hypotheses was accepted.

Research Question 1

Research Question 1 inquired whether and to what extent knowledge creation in IT organizations relates to a firm's innovativeness. Two hypotheses were formulated to examine this correlation. Results suggested that knowledge creation has statistically significant positive correlation ($r = .360$, $p<.01$) with the innovativeness of the firm. This

finding confirmed Hacklin and Wallin's (2013) arguments that knowledge is a critical challenge to innovation management. While the positive correlation between knowledge creation and innovativeness was expected, the weak level of correlation was not. This weak correlation implies that only a small percentage ($R^2 = .13$) of innovativeness may be explained by variation in knowledge creation. Analysis of data collected on each of the four knowledge creation factors revealed that all four factors are statistically significant, and one, namely, knowledge publishing, explained up to 72% of the variance in knowledge creation. This result has a major effect on managerial decision-making as investments in tools and procedures that enable employees to publish knowledge are important.

The relationship between knowledge creation and dynamic capabilities were tested. The null hypothesis was rejected as positive correlation was found between the two constructs. The results showed that knowledge creation advances dynamic capabilities. Further analysis of the knowledge creation construct indicated that knowledge publishing, one of four knowledge creation factors, has stronger ($r = .607$, $p < .01$) contribution to dynamic capabilities than the other factors. This analysis supported research by Sheng et al. (2013) that found Knowledge stickiness as the major reason for knowledge transfer failures. The correlations between knowledge publishing and the factors of dynamic capabilities are important.

Research Question 2

Research Question 2 inquired whether and to what extent dynamic capabilities in IT organizations relate to a firm's innovativeness. One hypothesis was formulated to

examine this correlation. Results suggested that dynamic capabilities have a statistically significant positive correlation ($r = .312$, $p < .01$) with innovativeness of the firm. This result supported Camisón & Villar-López's (2014) arguments that firms should continue to reconfigure and renew these resources in order to sustain competitiveness and foster innovation. The correlation between dynamic capabilities and innovativeness was weak. This implies that only a small percentage ($R^2 = .097$) of innovativeness may be explained by dynamic capabilities; therefore, dynamic capabilities are weak predictors of innovativeness.

Dynamic capabilities comprise three factors: sensing, seizing, and reconfiguring. Analysis conducted on these factors indicated reconfiguration has a stronger correlation to innovativeness than does the other two factors. This finding is consistent with Carnabuci and Operti's (2013) arguments that "most technological innovations are derived either from combining technologies in a novel manner or from reconfiguring existing technological combinations so that they can be put to new uses and applications" (p. 1592). Further, reconfiguration was found to have strong correlation to the speed of innovation ($r = .498$, $p <. 01$) and level of innovation ($r = .391$, $p < .01$) and virtually no correlation to entrepreneurship ($r = .005$) or process flexibility ($r = -.105$).

Research Question 3

Research Question 3 inquired whether and to what extent communication structures in IT organizations relate to a firm's innovativeness. Six hypotheses were formulated to test the correlations between IT communication structures, namely, complexity, centralization, and formalization and both knowledge creation and dynamic

capabilities. Results suggested that communication structures have statistically significant positive correlation ($r = .353$, $p < .01$) with the innovativeness of the firm. This result confirmed Conway's (1968) arguments that "organizations are constrained to produce designs, which are copies of the communication structure of these organizations" (p. 29).

Communication structures comprise three factors: complexity, centralization, and formalization. Analysis conducted on these factors demonstrated strong correlations, both positive and negative, between the three factors and knowledge creation and dynamic capabilities. For example, complexity, which measures how lean an organization is, showed statistically significant negative correlation with knowledge creation ($r = -.605$, $p < .01$) and with dynamic capabilities ($r = -.751$, $p < .01$). This result supports Dunford et al.'s (2013) argument that organizational flexibility drives the capacity to respond to changing business environment. Similar results were found when centralization data was analyzed. As the IT organization becomes less centralized, both knowledge creation and dynamic capabilities were enhanced. This finding supported Schmitt et al.'s (2015) arguments that decentralized structures promote communication and elevate employee motivation.

Research Question 4

Research Question 4 inquired whether and to what extent IT communication structures have a stronger influence than knowledge creation on a firm's innovativeness. One hypothesis was formulated to examine this correlation. Results suggested that both communication structures and knowledge creation have the same effect on the innovativeness of the firm. These results do not seem to support a trade-off between

communication structures and knowledge creation, whereby one was sacrificed for the other. Consequently, organizations must able to create knowledge and develop simple communication structures simultaneously in order to promote and achieve innovation.

Research Question 5

Research Question 5 inquired whether and to what extent IT knowledge creation has a stronger influence than dynamic capabilities on a firm's innovativeness. One hypothesis was formulated to examine this correlation. Results suggested that knowledge creation has a greater effect than dynamic capabilities on innovation.

Level and Speed of Innovation

The four factors of innovation included in this study are speed of innovation, level of innovation, risk control, and process control. Speed and level of innovation are highly correlated with one another. Our findings revealed a significant positive relationship between the level of innovations and the speed of innovation (r =.501, p < .01). This result was consistent with Goktan and Miles's (2011) findings, which revealed a significant correlation between radical product innovation and speed of innovation. It was expected that level of innovation and speed of innovation were negatively related. A possible explanation for the positive relationship between level and speed of innovation is that firms that constantly produce innovative products may have found ways to deliver innovative products and shorten product development time at the same time in order to stay in business.

Complexity and the Speed of Innovation

Communication complexity measures how easy information flows across the organization and through the various layers of the organization. Complexity was one of three factors that comprised the communication structures construct. Results suggested that complexity has statistically significant negative correlation ($r = -.550$, $p < .01$) with innovation speed. While this finding was expected, it does not explain how large complex firms are able to produce radical innovations quickly. Additionally, while process control flexibility was positively correlated to innovation speed ($r = .479$, $p < .01$), it may not produce radical innovation as the correlation between level of innovation and process control flexibility was not significant ($r = .185$, $p < .01$).

The tension between flexibility and formalization was a classical problem in organizing innovation (Mattes, 2014). Formalization defines process and policy, which govern the stakeholders' relationship while flexibility implies moving away from predefined procedures towards the autonomy of organizational units and individuals. These two factors have been viewed as competing concepts. While the results of this study confirm these views, the correlation between the two was weak as evident in highly formal large firms that have been able to create flexibility through modularity. For decades, the merits of bureaucracy were promoted in organizational theory literature, but today, there is broad agreement across different perspectives that a bureaucratic organization is inefficient and does not support current enterprise complexities. Findings in this study revealed that organizations with relatively flat hierarchies (less complexities) and low management overhead (less centralization) are better adapted to create

knowledge and develop dynamic capabilities. Therefore, the most prominent change is usually associated with management practices, which include a shift from a hierarchical, centralized bureaucracy to simple and limited routines and regulations.

Limitations of the Study

The results of this study were based on a low number of responses. However, the low number of responses was not surprising as it is known that group postings on professional networking sites such as LinkedIn groups typically exhibit significantly lower response rates than do direct e-mail invitations to the same population (Couper & Miller, 2008). Nevertheless, the sample met the requirement of having a minimum of 111 responses. Another limitation of this study may be its design. Limitation of correlational design is that it does not allow a test of strong causal inference. Consequently, results must be interpreted carefully as we cannot say definitively that only the organizational factors under study are responsible for a firm's ability to innovate.

The population included firms that use IT to deliver their product or service; therefore, the results from this study may not be generalized to firms that may use IT as a utility. While the study did not exclude firms that operated globally, it limited participants to those who reside in U.S. This limitation may manifest itself in the participants' definition of innovation as innovation could mean different things in different regions of the world. Further, this limitation may manifest itself in cultural differences, even within a single global firm, where certain organizational practices, such as decision-making, may be limited to top management. Therefore, results of this research may not be generalizable to other geographies.

Recommendations

This study empirically examined a potentially important link between the design of an IT organization and innovation capabilities. The study was based on a number of assumptions that included population and sample, design approach, and interpretation of findings. For example, inclusion in the study was identified based on the following criteria: (a) the participants must be employees of firms that relied on IT to deliver their product or service, (b) the participants must be employed by the firms for at least two years, (c) participants must be IT professional or employees who deal directly with IT, and (d) the population will be limited to firms in the United States. Second, the design approach for this study was correlational. The primary limitation of correlation approach is the problem of interpreting causal relationships. Lastly, 11 hypotheses were tested and results were outlined; however, the results of each individual hypothesis may not be useful unless it is viewed in the context of the study along with other hypotheses.

Narrow Set of Variables

The study addressed four broad constructs, namely, knowledge creation, dynamic capabilities, communication structures, and innovativeness. While I examined each of the four constructs in detail, future research could benefit from focusing on one dimension of organizational design and how it may relate to innovation. For example, IT communication structures were examined in the context of complexity, centralization, and formalization. Each of the three factors addressed multiple attributes within the organization. In total, the study examined 18 different attributes, and the results show the relative effect of each of the 18 attributes of innovation. Future research may benefit from

focusing on a small number of attributes and provide deeper understanding of the interdependencies of the attributes of innovation.

Linking Organizational Attribute to Innovation Type

A future research may also benefit from linking a particular organizational design to a type of innovation. I defined four types of innovation, which include imitation, reconfiguration, creation, and transformation. Each of these innovations requires specific organizational factors and antecedents. This study investigated 49 attributes across three organizational design attributes. Understanding the combination of organizational design attributes that may facilitate one type of innovation over another is important to practitioners.

Knowledge Creation

The findings of this study show that the overall knowledge creation of IT has a relatively small effect on innovation compared to the other IT organizational design elements. The study pointed out that knowledge publishing was by far the most influential on innovation. Further analysis should consider other knowledge creation factors. For example, the inability or unwillingness of individuals to transfer knowledge may be a factor.

Sample and Population

The findings are based on a sample consisting of IT and IT managers who work for U.S. firms. Responses to the study survey are based on the perceptions of the participants. Future research may investigate global firms that have operations in multiple regions in the world. Additionally, future analysis should include both managers and

other types of employees who may have different perceptions of innovation and organizational design factors and antecedents. Lastly, while organizational design factors and attributes are well established within the organizational design discipline, elements of the design do not have equal effects on all organizations. Thus, future analysis may focus on a particular industry in order to understand which design factors influence the specific industry.

Flexibility and Formalization

As described earlier, the tension between flexibility and formalization is a classical problem in organizing innovation (Mattes, 2014). The structure of an organization defines the relationship between various stakeholders within the organization and outside of its boundaries. Formalization defines process and policy, which govern the stakeholders' relationship while flexibility implies moving away from predefined and rigid procedures toward the autonomy of organizational units and individuals (Mattes, 2014). The results of this study confirmed the tension between the two organizational attributes. However, some firms have been able to balance the two attributes. Additional research may be necessary to understand how some firms are able to balance flexibility and formalization of the innovation process.

Implications

This study focused on a significant challenge facing firms today: how to create an innovative environment through IT organizations. An innovative environment enables firms to create new products or services by various means including combining existing technologies or reconfiguring existing combinations of technologies. Therefore, the

significance of this study to the field of management was its focus on measuring various IT organizational design elements and analyzing their effect on a firm's ability to innovate. Further, the study synthesizes theories from a broad range of disciplines to develop quantitative evidence of the link between organizational design and innovation.

Implications for Positive Social Change

Investments in IT represent a significant percentage of a firm's expenditure. The problem is that a firm's investments in IT may not enable innovation if specific IT elements are not designed to support the innovation expected by firms. Studies on the business value of IT reported mixed findings on the effect of expenditures on the performance of firms (Camisón & Villar-López, 2014). The results of this study draw attention to the relationship between the IT organization and innovation and by highlighting the importance of knowledge creation, dynamic capabilities, and communication structures. The findings provide organizations with information that could be used in the development of strategies and practices that increase the effectiveness of IT. Therefore, the implications on social change are twofold. First, the study established a link between investment in IT and performance through the design of the IT organization. Second, managerial decisions as a result of the study may shift or redistribute resources to enable certain types of innovation.

Theoretical Implications

This study makes several contributions to innovation research and management literature by investigating the influence of organizational design on the speed and level of innovation. The study improves our understanding of the influence of IT and design of

the IT organization on a firm's innovation. Our analysis confirms that designs of the IT organization have a significant effect on innovation. The implications of this study might improve the understanding of relationships between various IT organizational design factors and a firm's ability to innovate.

Innovation is a key driver to business performance and sustainable strategic advantage. Our findings provide empirical evidence to identify organizational designs that enable innovation. Views regarding optimal organizational structure have changed dramatically in the past thirty years. While many early researchers argued the benefits of bureaucracy, today bureaucracy, specifically hierarchy and centralization, has few defenders as organizational structures are believed to be associated with firm profitability (Handel, 2014).

Managerial Implications

Managers in firms that rely on IT to deliver their products or service may benefit from this study in two ways. First, the results suggest that managers should focus on establishing tools and processes that enable specific organizational factors to enhance innovation speed and deliver new products and services at the same time. Second, the results support previous research, which suggested that product and process innovations are linked.

There does not seem to be a difference between dynamic capabilities and knowledge creation; and thus, one could not be replaced by the other. Successful firms are able to create knowledge and develop dynamic capabilities simultaneously. This result indicates that achieving both is possible and does relate positively to a firm's

ability to innovate. One obvious managerial implication is the need for managers to manage the tension between formalization and flexibility on a continuous basis. Managers must also support and encourage employees to make their own choices in order to promote lean management. At the same time, management is accountable to stakeholders. Therefore, the balance of control and flexibility is essential to management practice. Lastly, results revealed a significant relationship between the level of innovation and the speed of innovation. These results suggest that managers should develop and implement significant or even disruptive innovations with no fear of being late to market.

Conclusions

Innovation is a broad and multidisciplinary concept. It can mean scientific inventions, technological breakthroughs, or even a simple new way to do things. The main function of innovation is to create value for the firm and its stakeholders. Therefore, innovation is directly tied to value creation. In a dynamic and uncertain market conditions, it is vital that firms innovate in order to survive. Firms use information to gain competitive advantage. As a result, IT has become a key component of modern firms as it translates business objectives into solutions.

This study attempted to examine the correlation between the design of the IT organization and the firm's innovativeness. The findings of the study showed significant correlations between the designs of an IT organization and its effect on a firm's innovativeness. Eleven sets of hypotheses consisting of null and alternate hypotheses were advanced in this study. These hypotheses were tested, but only one of the eleven hypotheses was accepted.

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Appendix A: Invitation to Participate in Pilot Study

Dear Linkedin CIO Network members,

I am a student at the Walden University's Management program. I am working on a Ph.D. in Management degree with a focus on Information Systems. I am conducting a research study titled *the role of IT organizational design in firms' ability to innovate*. The purpose of the research study is to investigate the possible correlations between three dimensions of IT, namely, knowledge creation, dynamic capability, and communication structure, and innovativeness of the firm.

You are invited to participate in the pilot study. Your participation will involve filling out an online survey questionnaire, which will take less than 25 minutes to complete. The results of the pilot study may be published, however, no identifying information will be used in the survey and your answers will be maintained in confidence. In this pilot, there are no foreseeable risks to you except that you are asked to give your opinions about your organization, which you may want to keep private. Although there may be no direct benefit to you, the possible benefit of your participation is that the pilot may help us validate the clarity of the survey questions.

The link below will redirect you to the online survey, which will begin with the informed consent. The informed consent process allows you to understand the study before deciding whether to participate.

The following link will redirect you to the online survey: (**Pilot Survey URL**)

Sincerely,

Hassan S. Halimi
XXX-XXX-XXXX

Appendix B: Invitation to Participate in Study

Dear LinkedIn CIO Network members,

I am a student at the Walden University's Management program. I am working on a Ph.D. in Management degree with a focus on Information Systems. I am conducting a research study titled *the role of IT organizational design in firms' ability to innovate*. The purpose of the research study is to investigate the possible correlations between three dimensions of IT, namely, knowledge creation, dynamic capability, and communication structure, and innovativeness of the firm.

You are invited to participate in the study. Your participation will involve filling out an online survey questionnaire, which will take less than 25 minutes to complete. The results of the research study may be published, however, no identifying information will be used in the survey, and your answers will be maintained in confidence. In this research, there are no foreseeable risks to you except that you are asked to give your opinions about your organization, which you may want to keep private. Although there may be no direct benefit to you, the possible benefit of your participation is that the study may help you gain insight into your organizational innovation strategy and management.

The link below will redirect you to the online survey, which will begin with the informed consent. The informed consent process allows you to understand the study before deciding whether to participate.

The following link will redirect you to the online survey: (**Survey URL**)

Sincerely,

Hassan S. Halimi
XXX-XXX-XXXX

Appendix C: Demographic Survey Questions

The first six questions are about your general background

1. What is your gender?
    a. Male
    b. Female
2. What is your age? _____
3. What is the highest level of education you have completed?
    a. High school
    b. Associate degree
    c. Bachelor degree
    d. MSc or MA
    e. Decorate
4. How long have you worked for the current company? ____
5. Which of the following best describe your job function
    a. Accounting
    b. Advertising
    c. Design
    d. Business Development
    e. Consulting
    f. Engineering
    g. Finance
    h. Human Resources

i. Information Technology

j. Legal

k. Executive Management

l. Public Relations

m. Purchasing

n. Quality Assurance

o. Research

p. Sales

q. Strategy / Planning

r. Supply-chain

6. How long have you been in the present position? ____

The next six questions are about your company's general background

7. What category is your company

   a. Public

   b. Private

   c. NGO

   d. NPO

8. Approximately, how many employees work at your company?

   a. 1 - 199

   b. 200 - 499

   c. 500 – 999

   d. 1,000 – 4,999

e. 5,000 – 9,999

f. > 10,000

9. Approximately, how many employees work in the IT organization?

a. 1 - 199

b. 200 - 499

c. 500 – 999

d. 1,000 – 1,999

e. > 2,000

10. How long has your company been in business under its present form? ____

11. How many levels of management are there in your company? ____

12. Which of the following describes the principle industry of your company?

a. Advertising and Marketing

b. Agriculture

c. Automotive

d. Business Support and Logistics

e. Construction

f. Education

g. Entertainment

h. Finance and Financial Services

i. Food and Beverage

j. Government

k. Healthcare and pharmaceutical

l. Insurance

m. Manufacturing

n. Retail and Consumer Durables

o. Real Estate

p. Telecom, Technology and Internet

q. Transportation and delivery

r. Utility and Energy

Appendix D: Survey Instrument

Speed of Innovation was measure on a 6-point Likert scale as shown in Table D1. Participants were asked to select the appropriate response for each of the six statements outlined in Table D1.

Table D1

Survey - Innovation Speed of the Firm

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	The duration of our innovation process gets shorter each time	o	o	o	o	o	o
2	We are satisfied with the speediness of our innovation process	o	o	o	o	o	o
3	We think our innovation process is short and efficient	o	o	o	o	o	o
4	Our innovation process could be much faster than it is today	o	o	o	o	o	o
5	Our project completion speed is faster than other firms in our industry	o	o	o	o	o	o
6	Our innovation projects are usually behind schedule	o	o	o	o	o	o

Note. Source: Goktan & Miles (2011) with permission (see Appendix E)

Level of Innovation was measure on a 6-point Likert scale as shown in Table D2. Participants were asked about the level of innovation (level of innovation is determined by the degree of newness of the innovation) at their company by selecting the appropriate response for each of the six statements in Table D2.

Table D2

Survey - Innovation Level of the Firm

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	Our products (or services) are radically innovative	o	o	o	o	o	o
2	Technologies we develop are radically innovative	o	o	o	o	o	o
3	Our methods of production are radically innovative	o	o	o	o	o	o
4	We find radically new sources of supply	o	o	o	o	o	o
5	We find radically new ways of reducing our labor costs	o	o	o	o	o	o
6	We find radically new ways of improving our production flexibility	o	o	o	o	o	o

Note. Source: Goktan & Miles (2011) with permission (see Appendix E)

Risk Control was measured on a 6-point Likert scale as shown in Table D3. Participants were asked to assess the risk tolerance of their organization based on the four statements in Table D3. Level of risk a firm is willing to take measure its entrepreneurial orientation.

Table D3

Survey - Firm's Risk Control

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	In general, top management of my company have a strong inclination for high risk projects that have chances for very high returns	o	o	o	o	o	o
2	In general, top managers of my company believe that owing to the nature of the environment, bold and wide ranging acts are necessary to achieve the firm's objectives	o	o	o	o	o	o
3	When confronted with decision making situations involving uncertainty, my company adopts a bold and aggressive posture in order to maximize the probability of exploiting potential opportunities	o	o	o	o	o	o
4	In general, top managers of my company favor a strong emphasis on R&D, technological leadership, and innovations	o	o	o	o	o	o

Note. Source: Goodale et al. (2011) with permission (see Appendix E)

Process Control was measured on a 6-point Likert scale as shown in Table D4. Participants were asked to assess the operating management philosophy based regarding adherence to process on the three statements in Table D4. Process control is an indicator of level of formalization within the firm.

Table D4

Survey - Firm's Process Control

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	A strong emphasis on getting things done even if it means disregarding formal procedures	o	o	o	o	o	o
2	Loose, informal control; heavy dependence on information relationships and the norm of cooperation for getting work done	o	o	o	o	o	o
3	A strong tendency to let the requirements of the situation and the individual's personality define proper on-the-job behavior	o	o	o	o	o	o

Note. Source: Goodale et al. (2011) with permission (see Appendix E)

Knowledge creation through *socialization* was measured on a 6-point Likert scale as shown in Table D5. Participants were asked to assess the extent to which their IT organizations encourage employees to engage in the social activities outlined in Table D5.

Table D5

Survey - IT Knowledge Creation (Knowledge Socialization)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	Become a member in professional organization	o	o	o	o	o	o
2	Adopt mentor / mentee to transfer knowledge	o	o	o	o	o	o
3	Adopt brainstorming workshops	o	o	o	o	o	o
4	Adopt employee rotation across areas	o	o	o	o	o	o
5	Attend professional meetings	o	o	o	o	o	o

Note. Source: Popadiuk (2012) with permission (see Appendix E)

Knowledge creation through *integration* was measured on a 6-point Likert scale as shown in Table D6. Participants were asked to assess the extent to which their IT organizations adopt the three integration activities outlined in Table D6.

Table D6

Survey - IT Knowledge Creation (Knowledge Integration)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	Data access via technology-based systems	o	o	o	o	o	o
2	Repositories of information, best practices, and lessons learned	o	o	o	o	o	o
3	Business training for the IT organization	o	o	o	o	o	o

Note. Source: Popadiuk (2012) with permission (see Appendix E)

Knowledge creation through *publishing* was measured on a 6-point Likert scale as shown in Table D7. Participants were asked to assess the extent to which their IT organizations adopt the three publishing activities outlined in Table D7.

Table D7

Survey - IT Knowledge Creation (Knowledge Publishing)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	Technology-based knowledge system for problem-solving	o	o	o	o	o	o
2	Case-based reasoning	o	o	o	o	o	o
3	Collaboration tools	o	o	o	o	o	o
4	Modeling based on analogies and metaphors	o	o	o	o	o	o

Note. Source: Popadiuk (2012) with permission (see Appendix E)

Knowledge creation through *application* was measured on a 6-point Likert scale as shown in Table D8. Participants were asked to assess the extent to which their IT organizations adopt the three knowledge application activities outlined in Table D8.

Table D8

Survey - IT Knowledge Creation (Knowledge Application)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	On-the-job training	o	o	o	o	o	o
2	Learning by doing	o	o	o	o	o	o
3	Learning by observation	o	o	o	o	o	o

Note. Source: Popadiuk (2012) with permission (see Appendix E)

Sensing capability was measured on a 6-point Likert scale as shown in Table D9. Participants were asked to assess their IT organization's ability to sense changing business circumstances. They were asked select the appropriate response that best describes their IT organization's capability for each of the six statements outlined below.

Table D9

Survey - IT Capabilities (Sensing)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	IT monitor changes in business circumstances regularly	o	o	o	o	o	o
2	IT identifies changes in business circumstances regularly	o	o	o	o	o	o
3	Important changing business circumstances are regularly discussed with the business	o	o	o	o	o	o
5	IT capabilities are regularly assessed in order to match the needs of the business	o	o	o	o	o	o
6	IT management stimulates employees to deal with business requirements	o	o	o	o	o	o

Note. Source: Plugge et al. (2013) with permission (see Appendix E)

Seizing capability was measured on a 6-point Likert scale as shown in Table D10. Participants were asked to assess their IT organization's ability to seize opportunities to support the business. They were asked select the appropriate response that best describes their IT organization's capability for each of the six statements outlined below.

Table D10

Survey - IT Capabilities (Seizing)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	IT's capabilities are regularly discussed with the business	o	o	o	o	o	o
2	Changing business circumstances are regularly assessed on their effect on IT	o	o	o	o	o	o
3	IT encourages internal cooperation between working groups	o	o	o	o	o	o
4	IT strategy is based on business strategy	o	o	o	o	o	o
5	IT encourages employees to take a proactive attitude	o	o	o	o	o	o
6	IT is effectively organized to cater to flexibility	o	o	o	o	o	o

Note. Source: Plugge et al. (2013) with permission (see Appendix E)

Reconfiguring capability was measured on a 6-point Likert scale as shown in Table D11. Participants were asked to assess their IT organization's ability to reconfigure resources, technology and processes to support the business. They were asked select the appropriate response that best describes their IT organization's capability for each of the six statements outlined below.

Table D11

Survey - IT Capabilities (Reconfiguring)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	IT improve its capabilities continuously	o	o	o	o	o	o
2	IT continuously adapt its capabilities to shifting needs	o	o	o	o	o	o
4	Changing business circumstances have an impact on the courses and training that are provided to IT employees	o	o	o	o	o	o
5	IT accumulates relevant knowledge to effectively adapt to clients changing circumstances and needs	o	o	o	o	o	o
6	IT management has expertise in coordinating capabilities required to offer services that fit the business needs	o	o	o	o	o	o

Note. Source: Plugge et al. (2013) with permission (see Appendix E)

Complexity was measured on a 6-point Likert scale as shown in Table D12. Participants were asked to assess their IT organization's structure and communication by selecting the appropriate response that best describes their IT organization's attributes for each of the five statements outlined below.

Table D12

Survey - The IT Communication Structure (Complexity)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	IT is a lean organization	o	o	o	o	o	o
2	IT can quickly adapt the numbers of hierarchical layers	o	o	o	o	o	o
3	IT management has expertise in reorganizing the IT organization to adapt to business circumstances and needs	o	o	o	o	o	o
4	IT facilitates employees with training to work in cross-functional teams	o	o	o	o	o	o
5	Our employees can easily meet and communicate with top IT management.	o	o	o	o	o	o

Note. Source: Plugge et al. (2013) with permission (see Appendix E)

Centralization was measured on a 6-point Likert scale as shown in Table D13. Participants were asked to assess their IT organization's command and control by selecting the appropriate response that best describes their IT organization's attitude towards each of the seven statements outlined below.

Table D13

Survey - The IT Communication Structure (Centralization)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	Decision-making is highly decentralized in the IT organization	o	o	o	o	o	o
2	Strategic decisions are quickly passed onto relevant employees	o	o	o	o	o	o
3	Employees are authorized to correct problems when they occur	o	o	o	o	o	o
4	IT organization stimulates employees to work in cross-functional teams	o	o	o	o	o	o
5	IT managers are supportive of the decisions made by work teams	o	o	o	o	o	o
6	Important tasks and activities are carried out by cross-functional teams	o	o	o	o	o	o
7	IT management has expertise to lead various cross-functional teams	o	o	o	o	o	o
8	IT managers encourages handling job-related problems by ourselves	o	o	o	o	o	o

Note. Source: Plugge et al. (2013) with permission (see Appendix E)

Formalization was measured on a 6-point Likert scale as shown in Table D14. Participants were asked to assess policies and procedures used by your IT organization by selecting the appropriate response that best describes their IT organization's attitude towards each of the seven statements outlined below.

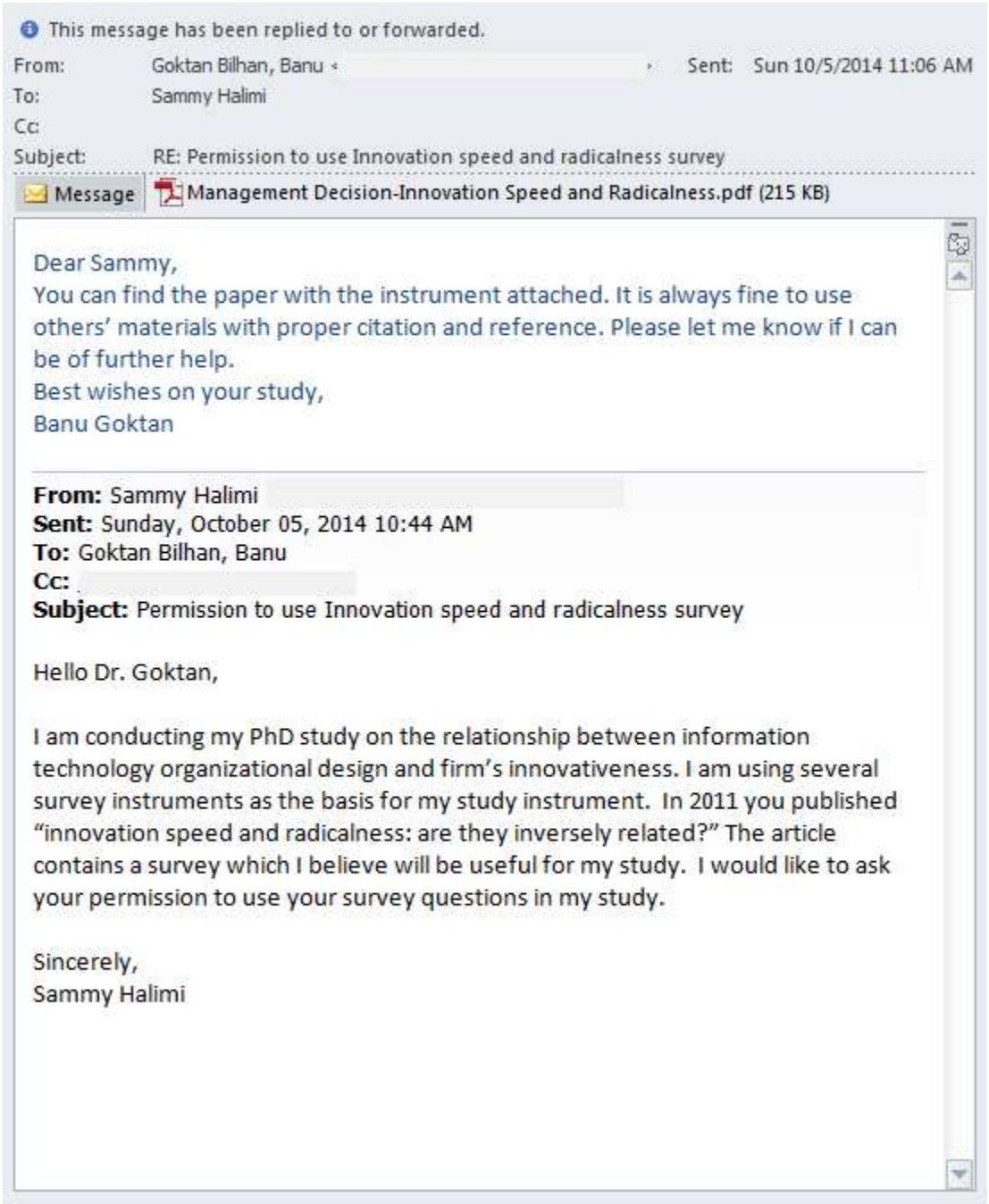
Table D14

Survey - The IT Communication Structure (Formalization)

N	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	Written rules and procedures improve the quality of IT services	o	o	o	o	o	o
2	IT has written rules and procedures guide	o	o	o	o	o	o
3	Written rules and procedures enable employees to make suggestions for changes	o	o	o	o	o	o
4	Written rules and procedures are strictly observed in IT	o	o	o	o	o	o
5	Communication between different levels in the IT organization is easy	o	o	o	o	o	o
6	There are few hierarchical layers in our IT organization	o	o	o	o	o	o
7	Communication among IT managers is collaborative	o	o	o	o	o	o

Note. Source: Plugge et al. (2013) with permission (see Appendix E)

Appendix E: Permission to Use Instrument



This message has been replied to or forwarded.

From: Goktan Bilhan, Banu Sent: Sun 10/5/2014 11:06 AM
To: Sammy Halimi
Cc:
Subject: RE: Permission to use Innovation speed and radicalness survey
Message Management Decision-Innovation Speed and Radicalness.pdf (215 KB)

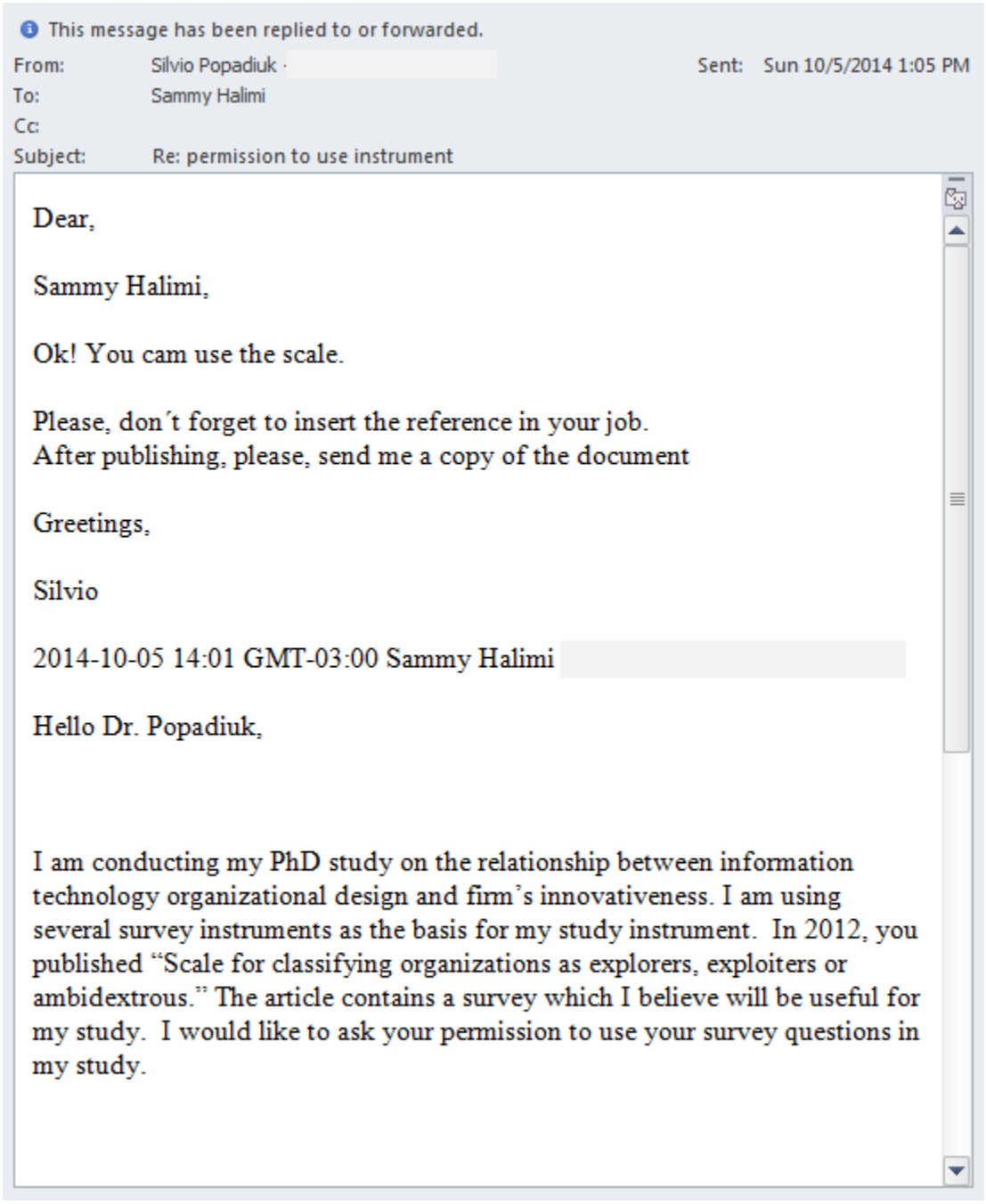
Dear Sammy,
You can find the paper with the instrument attached. It is always fine to use others' materials with proper citation and reference. Please let me know if I can be of further help.
Best wishes on your study,
Banu Goktan

From: Sammy Halimi
Sent: Sunday, October 05, 2014 10:44 AM
To: Goktan Bilhan, Banu
Cc:
Subject: Permission to use Innovation speed and radicalness survey

Hello Dr. Goktan,

I am conducting my PhD study on the relationship between information technology organizational design and firm's innovativeness. I am using several survey instruments as the basis for my study instrument. In 2011 you published "innovation speed and radicalness: are they inversely related?" The article contains a survey which I believe will be useful for my study. I would like to ask your permission to use your survey questions in my study.

Sincerely,
Sammy Halimi



This message has been replied to or forwarded.

From: Silvio Popadiuk · Sent: Sun 10/5/2014 1:05 PM
To: Sammy Halimi
Cc:
Subject: Re: permission to use instrument

Dear,

Sammy Halimi,

Ok! You cam use the scale.

Please, don´t forget to insert the reference in your job.
After publishing, please, send me a copy of the document

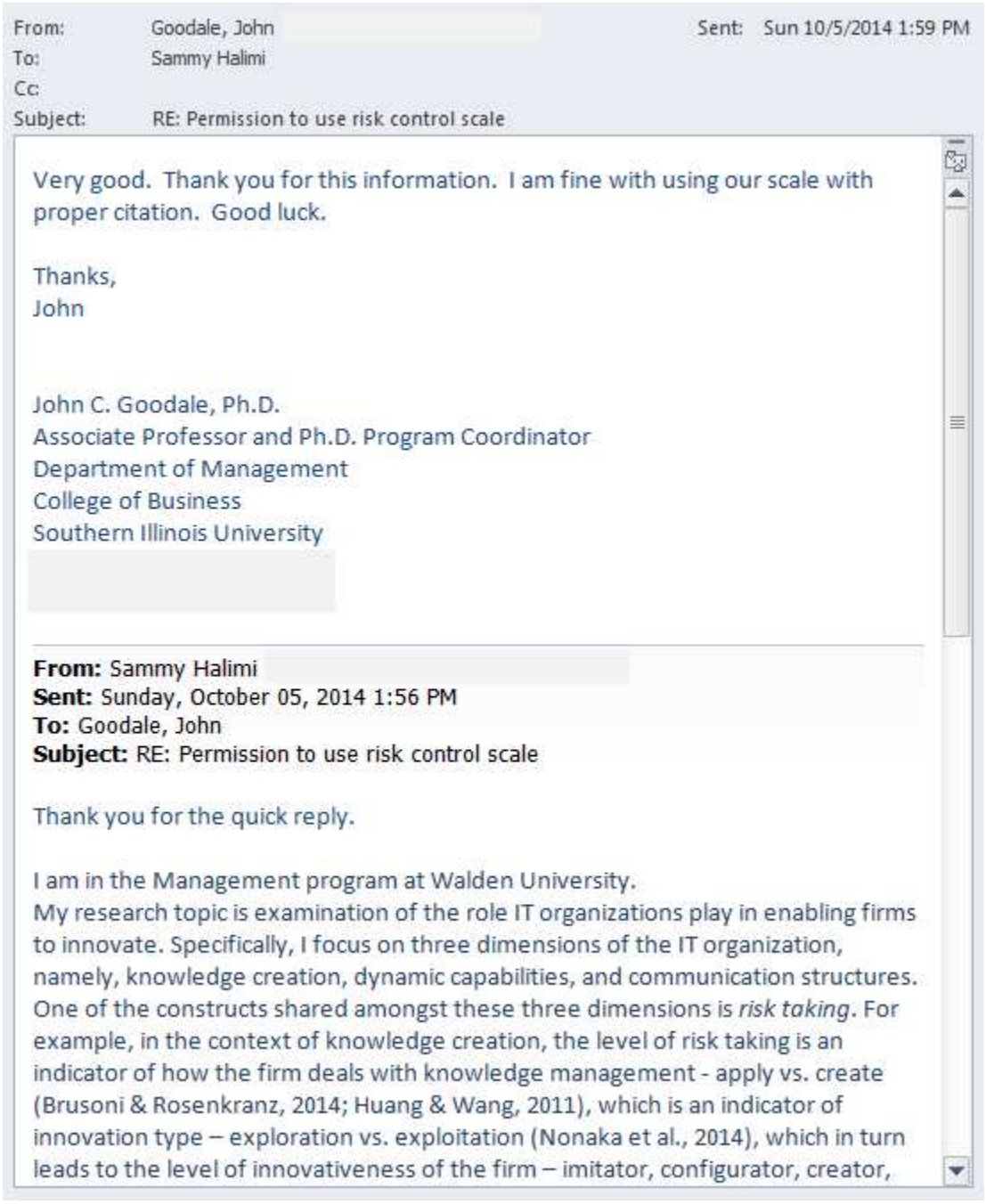
Greetings,

Silvio

2014-10-05 14:01 GMT-03:00 Sammy Halimi

Hello Dr. Popadiuk,

I am conducting my PhD study on the relationship between information technology organizational design and firm's innovativeness. I am using several survey instruments as the basis for my study instrument. In 2012, you published "Scale for classifying organizations as explorers, exploiters or ambidextrous." The article contains a survey which I believe will be useful for my study. I would like to ask your permission to use your survey questions in my study.



From: Goodale, John Sent: Sun 10/5/2014 1:59 PM
To: Sammy Halimi
Cc:
Subject: RE: Permission to use risk control scale

Very good. Thank you for this information. I am fine with using our scale with proper citation. Good luck.

Thanks,
John

John C. Goodale, Ph.D.
Associate Professor and Ph.D. Program Coordinator
Department of Management
College of Business
Southern Illinois University

From: Sammy Halimi
Sent: Sunday, October 05, 2014 1:56 PM
To: Goodale, John
Subject: RE: Permission to use risk control scale

Thank you for the quick reply.

I am in the Management program at Walden University.
My research topic is examination of the role IT organizations play in enabling firms to innovate. Specifically, I focus on three dimensions of the IT organization, namely, knowledge creation, dynamic capabilities, and communication structures. One of the constructs shared amongst these three dimensions is *risk taking*. For example, in the context of knowledge creation, the level of risk taking is an indicator of how the firm deals with knowledge management - apply vs. create (Brusoni & Rosenkranz, 2014; Huang & Wang, 2011), which is an indicator of innovation type – exploration vs. exploitation (Nonaka et al., 2014), which in turn leads to the level of innovativeness of the firm – imitator, configurator, creator,

This message has been replied to or forwarded.

From: ZHUANG Lee Sent: Sun 10/5/2014 2:18 PM
To: Sammy Halimi
Cc:
Subject: RE: Permission to use attitude and activity survey

Hello Sammy Halimi,

Thank you for your email.

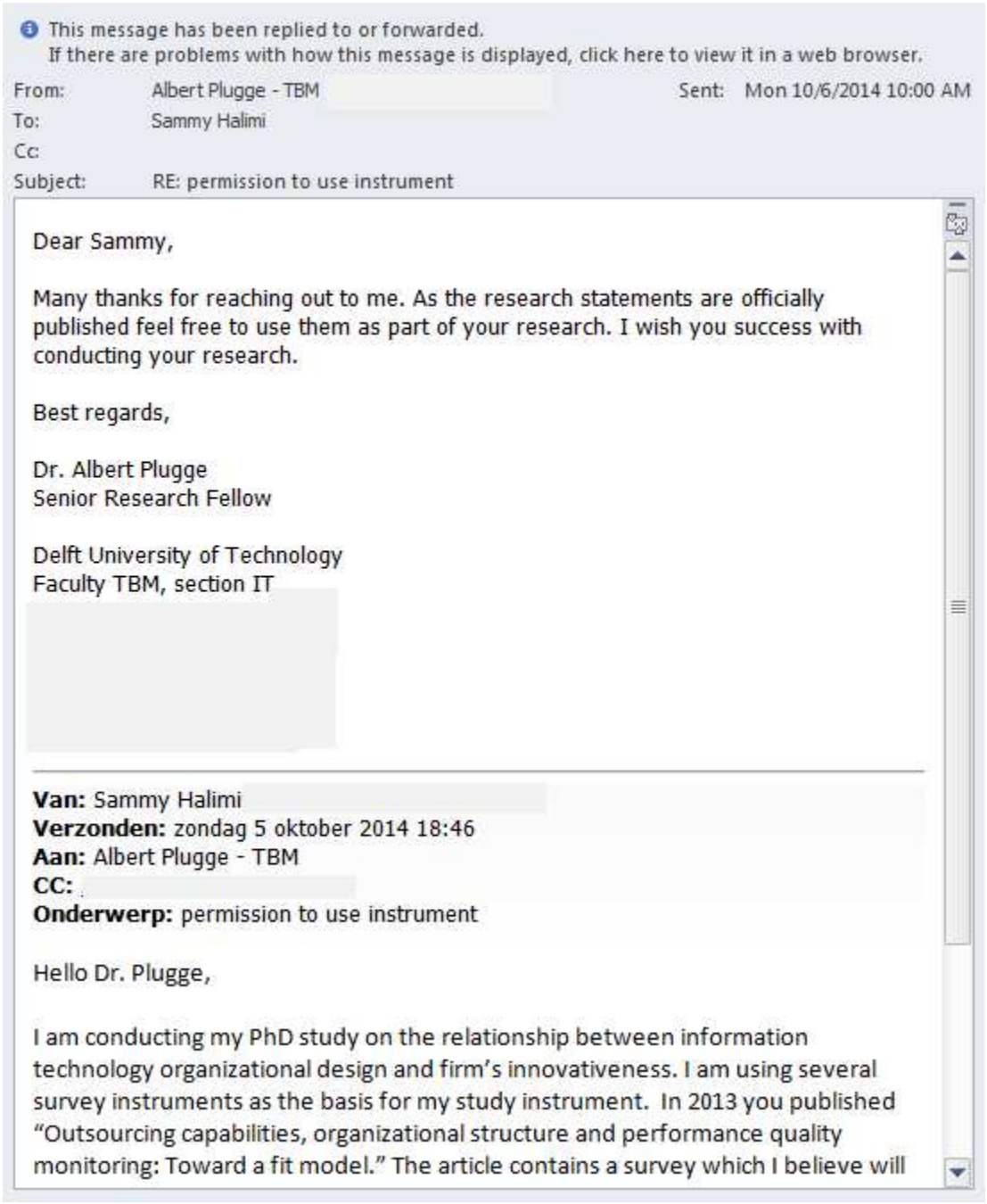
I have not revised my research instrument since 1995 when I first published it. I would be happy for you to use that version. Good luck with your PhD research.

Best wishes,

Lee

Dr Lee Zhuang (BSc, MBA, PhD, FHEA)
Head of International Partnerships
Staffordshire University
E200 Blackstone Building
College Road
Stoke-on-Trent
ST4 2DE

From: Sammy Halimi



This message has been replied to or forwarded.
If there are problems with how this message is displayed, click here to view it in a web browser.

From: Albert Plugge - TBM Sent: Mon 10/6/2014 10:00 AM
To: Sammy Halimi
Cc:
Subject: RE: permission to use instrument

Dear Sammy,

Many thanks for reaching out to me. As the research statements are officially published feel free to use them as part of your research. I wish you success with conducting your research.

Best regards,

Dr. Albert Plugge
Senior Research Fellow

Delft University of Technology
Faculty TBM, section IT

Van: Sammy Halimi
Verzonden: zondag 5 oktober 2014 18:46
Aan: Albert Plugge - TBM
CC:
Onderwerp: permission to use instrument

Hello Dr. Plugge,

I am conducting my PhD study on the relationship between information technology organizational design and firm's innovativeness. I am using several survey instruments as the basis for my study instrument. In 2013 you published "Outsourcing capabilities, organizational structure and performance quality monitoring: Toward a fit model." The article contains a survey which I believe will

Appendix F: Pilot Study Results

A pilot study was conducted to determine the validity and reliability of the study instrument. A total of 17 responses were received, four of which did not have complete answers and were removed from the analysis. Cronbach's alpha analysis was conducted to determine the reliability of the survey scale and correlation matrixes were used to examine their internal validity. Table H1 is a summary of the response distribution for the pilot study including Cronbach's Alpha results.

Table F1

Pilot Study Response Distribution

Study construct Variable	Number of factors	Mean	Variance	Std. Deviation	Cronbach's Alpha
Innovativeness of the firm					
Innovation speed	6	8.923	11.577	3.402	.739
Innovation level	6	8.682	9.064	3.010	.839
Risk control	4	6.846	9.141	3.023	.827
Process control	3	6.615	5.256	2.292	.674
Knowledge creation					
Socialization	5	9.000	6.167	2.482	.630
Publishing	3	6.231	2.859	1.691	.650
Integration	4	7.000	4.167	2.041	.757
Application	3	9.385	3.256	1.805	.644
Dynamic capabilities					
Sensing	5	14.154	6.141	2.478	.682
Seizing	6	18.538	9.769	3.126	.527
Reconfiguring	5	14.769	5.026	2.242	.575
Communication structures					
Complexity	4	10.000	6.333	2.516	.600
Centralization	8	25.769	21.192	4.604	.653
Formalization	6	19.692	15.231	3.903	.478

In the literature review, four elements of innovation were identified: innovation speed, level of innovation, risk control, and process control (see Chapter 2 for more details). Nineteen factors contributed to the four elements of innovation scale (see tables D1 through D4 in Appendix D). For example, *Level of Innovation* consists of six factors, each represented by a survey question. To ensure all six items are measuring the same construct, these items must be highly correlated with one another. The closer the values are to 1 the more highly correlated the items are.

Table H3 represents the outputs of the subscale *Level of Innovation*. The reliability statistic output shows a Cronbach's Alpha value of 0.839 for the six factors included in this subscale. The values in the column titled "Corrected Item-Total Correlation" are all above 0.3, which indicates a reliable scale. The value in the column titled "Cronbach's alpha if item deleted" indicate that with the except for item 14Q1, all values are less than the overall reliability of 0.839. Item 14Q1 is .84, which is 0.001 higher than the Cronbach's Alpha and consequently, none of the items in this subscale would increase the reliability if the item is deleted. The correlation matrix of *Level of Innovation* shows that all factors are highly correlated with one another with most values higher than 0.5, suggesting positive internal validity of the innovation drivers' constructs.

The remainder of this appendix contains a statistical summary for the three IT organizational design constructs: knowledge creation, dynamic capability, and communication structure.

Table F2

Correlation Matrix for Innovation— Speed

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.703	.739	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
8.9231	11.577	3.40249	6

Item-Total Statistics

innovation speed	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
13#1	7.0000	8.000	.323	.592	.721
13#2	7.7692	7.692	.730	.729	.575
13#3	7.6923	8.397	.432	.484	.664
13#4	8.2308	9.859	.493	.760	.671
13#5	6.3077	9.231	.301	.348	.703
13#6	7.6154	7.923	.517	.648	.635

Pearson Correlation

Innovation Speed	13#1	13#1	13#1	13#1	13#1	13#1
13#1	1					
13#2	.539	1				
13#3	.169	.622*	1			
13#4	-.045	.567*	.547	1		
13#5	.130	.212	.119	.092	1	
13#6	.245	.372	.197	.592*	.459	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F3

Correlation Matrix for Innovation—Level

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.818	.839	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
8.6923	9.064	3.01066	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
14#1	6.7692	6.026	.454	.925	.840
14#2	6.9231	5.244	.821	.930	.727
14#3	7.5385	6.769	.688	.863	.774
14#4	7.3077	6.564	.623	.705	.781
14#5	7.4615	7.769	.451	.722	.817
14#6	7.4615	6.769	.621	.962	.784

Pearson Correlation

Innovation Speed	14#1	14#2	14#1	14#1	14#1	14#1
14#1	1					
14#2	.711**	1				
14#3	.182	.625*	1			
14#4	.589*	.486	.515	1		
14#5	.046	.387	.527	.247	1	
14#6	.034	.617*	.887**	.395	.732**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F4

Correlation Matrix for Innovation—Risk Control

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.815	.827	4

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.846	9.141	3.02341	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
15#1	5.0769	5.410	.666	.458	.754
15#2	5.0769	4.577	.722	.529	.727
15#3	5.4615	6.603	.633	.436	.789
15#4	4.9231	5.244	.593	.365	.792

Pearson Correlations

	15#1	15#2	15#3	15#4
15#1	1			
15#2	.602*	1		
15#3	.574*	.605*	1	
15#4	.500	.571*	.418	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F5

Correlation Matrix for Innovation—Process Control

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.666	.674	3

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.6154	5.256	2.29269	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
16#1	4.5385	3.269	.243	.253	.871
16#2	4.5385	2.769	.497	.647	.546
16#3	4.1538	2.141	.770	.695	.144

Pearson Correlations

	16#1	16#2	16#3
16#1	1		
16#2	.078	1	
16#3	.377	.771**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F6

Correlation Matrix for Knowledge Creation—Socialization

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.678	.630	5

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
9.0000	6.167	2.48328	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
17#1	7.4615	5.436	.096	.166	.748
17#2	7.5385	5.603	.120	.084	.726
17#3	7.1538	3.474	.687	.631	.497
17#4	7.0000	3.833	.521	.453	.584
17#5	6.8462	2.974	.769	.629	.431

Pearson Correlations

	17#1	17#2	17#3	17#4	17#5
17#1	1				
17#2	-.056	1			
17#3	.012	.185	1		
17#4	.000	.000	.637*	1	
17#5	.270	.192	.731**	.568*	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F7

Correlation Matrix for Knowledge Creation—Publishing

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.659	.650	3

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.2308	2.859	1.69085	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
18#1	3.6923	1.397	.468	.421	.569
18#2	4.1538	1.141	.703	.508	.202
18#3	4.6154	1.923	.284	.194	.773

Pearson Correlations

	18#1	18#2	18#3
18#1	1		
18#2	.631*	1	
18#3	.114	.402	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F8

Correlation Matrix for Knowledge Creation—Integration

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.726	.757	4

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
7.0000	4.167	2.04124	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
19#1	5.2308	2.026	.783	.856	.484
19#2	5.0769	3.244	.127	.183	.889
19#3	5.2308	2.359	.576	.739	.628
19#4	5.4615	2.603	.773	.711	.562

Pearson Correlations

	19#1	19#2	19#3	19#4
19#1	1			
19#2	.116	1		
19#3	.841**	-.035	1	
19#4	.801**	.325	.579*	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F9

Correlation Matrix for Knowledge Creation—Application

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.638	.744	3

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
9.3846	3.256	1.80455	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
20#1	6.3077	1.397	.547	.711	.385
20#2	5.8462	2.308	.147	.121	.900
20#3	6.6154	1.423	.756	.727	.108

Pearson Correlations

	20#1	20#2	20#3
20#1	1		
20#2	.057	1	
20#3	.831**	.239	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F10

Correlation Matrix for Dynamic Capability—Sensing

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.621	.6284	5

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
14.1538	6.141	2.47811	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
21#1	11.0000	3.500	.668	.825	.400
21#2	11.1538	3.474	.657	.857	.403
21#3	11.6154	4.423	.462	.433	.533
21#4	11.6154	4.756	.161	.093	.683
21#5	11.2308	5.359	.058	.022	.708

Pearson Correlations

	21#1	21#2	21#3	21#4	21#5
21#1	1				
21#2	.892**	1			
21#3	.461	.618*	1		
21#4	.228	.116	.033	1	
21#5	.021	.000	.089	.067	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F11

Correlation Matrix for Dynamic Capability—Seizing

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.526	.527	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
18.5385	9.769	3.12558	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
22#1	15.6154	7.256	.381	.626	.433
22#2	15.6154	5.423	.531	.671	.310
22#3	15.1538	7.141	.403	.463	.422
22#4	15.1538	7.474	.324	.467	.459
22#5	15.2308	9.192	-.078	.353	.649
22#6	15.9231	8.077	.189	.377	.518

Pearson Correlations

	22#1	22#2	22#3	22#4	22#5	22#6
22#1	1					
22#2	.645*	1				
22#3	.043	.515	1			
22#4	.598*	.515	.229	1		
22#5	-.252	-.251	.043	-.236	1	
22#6	-.043	.050	.212	-.229	.514	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F12

Correlation Matrix for Dynamic Capability—Reconfiguring

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.561	.575	5

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
14.7692	5.026	2.24179	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
23#1	11.9231	3.744	.207	.226	.575
23#2	11.8462	3.641	.399	.293	.469
23#3	12.3846	3.256	.323	.188	.509
23#4	11.4615	3.769	.351	.716	.494
23#5	11.4615	3.436	.368	.723	.478

Pearson Correlations

	23#1	23#2	23#3	23#4	23#5
23#1	1	.463	.212	-.064	-.053
23#2	.463	1	.357	.064	.053
23#3	.212	.357	1	.070	.186
23#4	-.064	.064	.070	1	.839**
23#5	-.053	.053	.186	.839**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F13

Correlation Matrix for Communication Structure—Complexity

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.580	.600	4

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
10.0000	6.333	2.5166	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
24#1	6.8462	3.974	.231	.397	.644
24#2	7.8462	2.974	.823	.700	.103
24#3	7.5385	4.769	.284	.359	.565
24#4	7.7692	4.526	.241	.496	.599

Pearson Correlations

	24#1	24#2	24#3	24#4
24#1	1			
24#2	.462	1		
24#3	.101	.487	1	
24#4	-.036	.554*	.071	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F14

Correlation Matrix for Communication Structure—Centralization

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.677	.653	8

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
25.7692	21.192	4.60351	8

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
25#1	23.0000	15.667	.311	.493	.674
25#2	22.9231	13.577	.748	.714	.537
25#3	22.3077	15.731	.469	.603	.620
25#4	23.0000	16.833	.401	.647	.639
25#5	22.0000	20.667	.084	.356	.690
25#6	22.3846	18.256	.207	.277	.684
25#7	22.6154	15.590	.476	.531	.618
25#8	22.1538	19.474	.226	.318	.674

Pearson Correlations

	25#1	25#2	25#3	25#4	25#5	25#6	25#7	25#8
25#1	1							
25#2	.437	1						
25#3	.540	.642*	1					
25#4	.018	.542	.101	1				
25#5	.308	-.077	.065	-.318	1			
25#6	.065	.263	-.022	.091	.210	1		
25#7	.024	.402	.134	.609*	.077	.295	1	
25#8	-.194	.250	.149	.360	-.045	-.009	.422	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table F15

Correlation Matrix for Communication Structure—Formalization

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.638	.649	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
16.9231	16.077	4.00960	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
26#1	14.1538	11.308	.435	.900	.568
26#2	14.4615	10.436	.494	.506	.541
26#3	14.1538	11.141	.374	.911	.596
26#5	13.7692	12.526	.369	.868	.596
26#6	14.3077	13.231	.195	.768	.658
26#7	13.7692	13.192	.386	.912	.598

Pearson Correlations

	26#1	26#2	26#3	26#5	26#6	26#7
26#1	1					
26#2	.361	1				
26#3	.841**	.525	1			
26#5	.106	.139	-.035	1		
26#6	-.074	.194	-.237	.359	1	
26#7	-.137	.171	-.123	.811**	.629*	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix G: Descriptive Statistics

Table G1

Descriptive Statistics for IT Knowledge Socialization

Descriptive Statistics for Knowledge Socialization Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
17#1	115	.00	5.00	2.1304	1.21049	1.465
17#2	115	.00	5.00	2.2000	1.17876	1.389
17#3	115	.00	5.00	2.2522	1.13047	1.278
17#4	115	.00	5.00	1.6957	1.17110	1.371
17#5	115	.00	5.00	2.1217	1.17090	1.371
Valid N (listwise)	115					

Descriptive Statistics for Knowledge Socialization Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
17#Knowledge Socialization	115	.00	25.00	10.4000	4.44814	19.786
Valid N (listwise)	115					

Table G2

Descriptive Statistics for IT Knowledge Integration

Descriptive Statistics for Knowledge Integration Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
18#1	115	.00	5.00	2.7913	1.26696	1.605
18#2	115	.00	5.00	2.6174	1.21093	1.466
18#3	115	.00	5.00	2.1130	1.24086	1.540
Valid N (listwise)	115					

Descriptive Statistics for Knowledge Publishing Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
18#Knowledge Publishing	115	.00	15.00	7.5217	3.20457	10.269
Valid N (listwise)	115					

Table G3

Descriptive Statistics for IT Knowledge Publishing

Descriptive Statistics for Knowledge Publishing Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
19#1	115	.00	5.00	2.3739	1.25279	1.569
19#2	115	.00	5.00	1.9391	1.17941	1.391
19#3	115	.00	5.00	2.6870	1.37882	1.901
19#4	115	.00	5.00	1.7739	1.19253	1.422
Valid N (listwise)	115					

Descriptive Statistics for Knowledge Publishing Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
19#Knowledge Integration	115	.00	20.00	8.7739	3.96489	15.720
Valid N (listwise)	115					

Table G4

Descriptive Statistics for IT Knowledge Application

Descriptive Statistics for Knowledge Application Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
20#1	115	.00	5.00	3.1130	.98020	.961
20#2	115	1.00	5.00	3.4870	.90190	.813
20#3	115	.00	5.00	2.7913	1.07194	1.149
Valid N (listwise)	115					

Descriptive Statistics for Knowledge Application Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
20#Knowledge Application	115	2.00	15.00	9.3913	2.42681	5.889
Valid N (listwise)	115					

Table G5

Descriptive Statistics for IT Dynamic Capabilities - Sensing

Descriptive Statistics for Dynamic Capabilities (Sensing) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
21#1	115	.00	5.00	3.0348	1.21345	1.472
21#2	115	.00	5.00	2.8957	1.16509	1.357
21#3	115	.00	5.00	2.9304	1.21194	1.469
21#4	115	1.00	5.00	2.9304	1.13726	1.293
21#5	115	1.00	5.00	3.0783	1.12506	1.266
Valid N (listwise)	115					

Descriptive Statistics for Dynamic Capabilities (Sensing) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
21#Capability - Sensing	115	5.00	25.00	14.8696	4.83322	23.360
Valid N (listwise)	115					

Table G6

Descriptive Statistics for IT Dynamic Capabilities - Seizing

Descriptive Statistics for Dynamic Capabilities (Seizing) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
22#1	115	.00	5.00	3.1913	1.19865	1.437
22#2	115	.00	5.00	3.0609	1.25856	1.584
22#3	115	.00	5.00	3.3043	1.20069	1.442
22#4	115	.00	5.00	3.3391	1.22035	1.489
22#5	115	1.00	5.00	3.4261	1.10072	1.212
22#6	115	.00	5.00	2.8174	1.20367	1.449
Valid N (listwise)	115					

Descriptive Statistics for Dynamic Capabilities (Seizing) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
22#Capability - Seizing	115	5.00	30.00	19.1391	5.64115	31.823
Valid N (listwise)	115					

Table G7

Descriptive Statistics for IT Dynamic Capabilities - Reconfiguring

Descriptive Statistics for Dynamic Capabilities (Reconfiguring) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
23#1	115	.00	5.00	3.0435	1.05457	1.112
23#2	115	.00	5.00	3.1043	1.11901	1.252
23#3	115	.00	5.00	2.7652	1.30673	1.708
23#4	115	.00	5.00	2.9739	1.15060	1.324
23#5	115	.00	5.00	3.1130	1.14528	1.312
Valid N (listwise)	115					

Descriptive Statistics for Dynamic Capabilities (Reconfiguring) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
23#Capability - Reconfiguring	115	.00	25.00	15.0000	4.82319	23.263
Valid N (listwise)	115					

Table G8

Descriptive Statistics for IT Communication Structures - Complexity

Descriptive Statistics for Communication Structures (Complexity) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
24#1	115	.00	5.00	2.0609	1.31314	1.724
24#2	115	.00	5.00	2.5391	1.19419	1.426
24#3	115	.00	5.00	2.1739	1.20132	1.443
24#4	115	.00	5.00	2.3043	1.29218	1.670
Valid N (listwise)	115					

Descriptive Statistics for Communication Structures (Complexity) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
24#Communication - Complexity	115	.00	20.00	9.08	3.95844	15.669
Valid N (listwise)	115					

Table G9

Descriptive Statistics for IT Communication Structures - Centralization

Descriptive Statistics for Communication Structures (Centralization) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
22#1	115	.00	5.00	2.4696	1.32666	1.760
25#2	115	.00	5.00	2.9565	1.23111	1.516
25#3	115	.00	5.00	3.4696	1.09482	1.199
25#4	115	.00	5.00	2.9478	1.14588	1.313
25#5	115	.00	5.00	3.2261	1.08467	1.177
25#6	115	.00	5.00	3.0957	1.13920	1.298
25#7	115	.00	5.00	3.2348	1.20183	1.444
25#8	115	.00	5.00	2.9826	1.23532	1.526
Valid N (listwise)	115					

Descriptive Statistics for Communication Structures (Centralization) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
25#Communication - Centralization	115	.00	40.00	15.617	7.10150	50.431
Valid N (listwise)	115					

Table G10

Descriptive Statistics for IT Communication Structures - Formalization

Descriptive Statistics for Communication Structures (Formalization) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
26#1	115	.00	5.00	3.1304	1.21772	1.483
26#2	115	.00	5.00	2.8783	1.29200	1.669
26#3	115	.00	5.00	2.9913	1.21753	1.482
26#5	115	.00	5.00	3.0348	1.31743	1.736
26#6	115	.00	5.00	2.8957	1.35319	1.831
26#7	115	.00	5.00	3.0870	1.26050	1.589
Valid N (listwise)	115					

Descriptive Statistics for Communication Structures (Formalization) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
26#Communication - Formalization	115	1.00	30.00	18.0174	5.32288	28.333
Valid N (listwise)	115					

Table G11

Descriptive Statistics for Innovation Speed

Descriptive Statistics for Innovation (Speed) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
13#1	115	.00	5.00	2.3565	1.35848	1.845
13#2	115	.00	5.00	1.8000	1.27183	1.618
13#3	115	.00	4.00	1.7130	1.16050	1.347
13#4	115	.00	5.00	1.1565	1.00517	1.010
13#5	115	.00	5.00	2.6000	1.11450	1.242
13#6	115	.00	5.00	2.2087	1.32781	1.763
Valid N (listwise)	115					

Descriptive Statistics for Innovation (Speed) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
13#innovation speed	115	2.00	24.00	11.8348	5.10234	26.034
Valid N (listwise)	115					

Table G12

Descriptive Statistics for Innovation Level

Descriptive Statistics for Innovation (Level) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
14#1	115	.00	5.00	2.3043	1.40284	1.968
14#2	115	.00	5.00	2.3565	1.30580	1.705
14#3	115	.00	5.00	1.8609	1.15384	1.331
14#4	115	.00	5.00	1.9304	1.10598	1.223
14#5	115	.00	5.00	1.9130	1.15899	1.343
14#6	115	.00	5.00	2.0348	1.16175	1.350
Valid N (listwise)	115					

Descriptive Statistics for Innovation (Level) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
14#level of innovation	115	.00	29.00	12.4000	6.03470	36.418
Valid N (listwise)	115					

Table G13

Descriptive Statistics for Innovation – Risk Control

Descriptive Statistics for Innovation (Risk Control) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
15#1	115	.00	5.00	2.1826	1.33497	1.782
15#2	115	.00	5.00	2.3391	1.34352	1.805
15#3	115	.00	5.00	2.3391	1.35651	1.840
15#4	115	.00	5.00	2.0261	1.34073	1.798
Valid N (listwise)	115					

Descriptive Statistics for Innovation (Risk Control) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
15#Entrepreneurship	115	.00	20.00	8.8870	4.58787	21.049
Valid N (listwise)	115					

Table G14

Descriptive Statistics for Innovation – Process Control

Descriptive Statistics for Innovation (Process Control) Factors

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
16#1	115	.00	5.00	2.0609	1.24455	1.549
16#2	115	.00	5.00	2.2957	1.27715	1.631
16#3	115	.00	5.00	2.4783	1.30685	1.708
Valid N (listwise)	115					

Descriptive Statistics for Innovation (Process Control) Scale

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
16#Flexibility	115	.00	15.00	6.8348	3.32964	11.086
Valid N (listwise)	115					

Appendix H: Hypothesis Test Results

Table H1

Nonparametric Correlations—Study Constructs

		Innovativeness	Knowledge Creation	Dynamic Capabilities	Communication Structures
Kendall's tau$_b$ τ	Innovativeness	1.000			
	Knowledge Creation	.255**	1.000		
	Dynamic Capabilities	.258**	.460**	1.000	
	Communication Structures	.276**	.408**	.612**	1.000
Spearman's rho	Innovativeness	1.000			
	Knowledge Creation	.377**	1.000		
	Dynamic Capabilities	.369**	.623**	1.000	
	Communication Structures	.389**	.562**	.788**	1.000

** Correlation is significant at the 0.01 level (2-tailed).

Table H2

Nonparametric Correlations—Communication Structures Factors

		Complexity	Centralization	Formalization	KC	DC
Kendall's tau_b τ	Complexity	1.000				
	Centralization	.517**	1.000			
	Formalization	-.491**	-.460**	1.000		
	Knowledge Creation (KC)	-.435**	-.367**	.319**	1.000	
	Dynamic Capabilities (DC)	-.538**	-.543**	.550**	.460**	1.00
Spearman's rho	Complexity	1.000				
	Centralization	.675**	1.000			
	Formalization	-.662**	-.594**	1.000		
	Knowledge Creation (KC)	-.574 **	-.501 **	.453**	1.000	
	Dynamic Capabilities (DC)	-.709**	-.705**	.714**	.623**	1.00

** Correlation is significant at the 0.01 level (2-tailed).

Table H3

Nonparametric Correlations—Study Constructs

	Construct Element	Mean	S.D.	A	13	14	15	16	B	17	18	19	20	C	21	22	23	D	24	25	26
A	**Innovation**	39.9565	12.836	1																	
13	Speed	11.8348	5.1023	.696**	1																
14	Level	12.4	6.0347	.764**	.501**	1															
15	Entrepreneurship	8.88696	4.5879	.659**	.151	.217*	1														
16	Flexibility	6.83478	3.3296	.495**	.033	.065	.538**	1													
B	**Knowledge Creation**	36.087	11.138	.360**	.359**	.416**	.105	-0.061	1												
17	Socialization	10.4	4.4481	.246**	.288**	.258**	.049	-0.027	0.831**	1											
18	Integration	7.52174	3.2046	.341**	.275**	.360**	.197*	-0.031	0.769**	0.484**	1										
19	Publishing	8.77391	3.9649	.365**	.384**	.428**	.098	-0.097	0.85**	.568**	.576**	1									
20	Application	9.3913	2.4268	0.153	.126	.259**	-0.031	-0.03	0.660**	.416**	.382**	.468**	1								
C	**Dynamic Capabilities**	49.0087	13.963	.312**	.467**	.334**	-0.018	-0.096	.646**	.551**	.421**	.607**	.410**	1							
21	Sensing	14.8696	4.8332	.247**	.395**	.325**	-0.082	-0.13	0.601**	.502**	.351**	.590**	.410**	.900**	1						
22	Seizing	19.1391	5.6412	.255**	.392**	.214**	0.022	-0.036	0.561**	.538**	.338**	.510**	.309**	.935**	.769**	1					
23	Reconfiguring	15	4.8232	.356**	.498**	.391**	0.005	-0.105	.613**	.462**	.472**	.569**	.416**	.899**	.705**	.767**	1				
D	**Communication**	53.3217	14.47	.353**	.536**	.324**	-0.004	-0.041	.586**	.500**	.396**	.565**	.325**	.826**	.687**	.771**	.801**	1			
24	Complexity	9.078	3.9584	.422**	-.550**	.382**	-.054	-.016	-.605**	-.522**	-.527**	-.495**	-.318**	-.751**	-.625**	-.680**	-.752**	-.869**	1		
25	Centralization	15.617	7.1015	.324**	-.427**	-.308**	-.038	.017	-.512**	-.398**	-.325**	-.537**	-.316**	-.732**	-.595**	-.667**	-.742**	-.918**	.732**	1	
26	Formalization	18.0174	5.3229	0.214*	.479**	.185*	-0.102	-.101	.458**	.438**	.252**	.453**	.225*	.711**	.609**	.700**	.628**	.847**	-.643**	-.618**	1

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).