TOWARDS A SYSTEMIC VIEW OF ORGANIZATIONAL DYNAMIC IT CAPABILITY: AN EMPIRICAL ASSESSMENT

by

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ABSTRACT

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In an increasingly complex world characterized by hyper-competition and turbulence, an organization's ability to sustain its competitive advantages depends not only on how it acquires its capabilities, but also on how it orchestrates the relationships among them. While the resource based view of the firm and the literature on dynamic capabilities have provided strategic insights to the successful deployment and expeditious management of scarce resources, there is very little research on dynamic capabilities from an IT perspective. In particular, there is no common understanding of what the phrase "dynamic IT capability" means or how it can be achieved. This study draws on the rich body of knowledge in the strategic management and IT fields and bases its assertions on the intellectual foundations in general systems theory, organizational

cybernetics and the information processing theory of organizations, to: define the construct of organizational dynamic IT capability; offer greater clarity on the relationship among the various constructs; offer a clarity between what constitutes 'resources' and what constitutes 'capabilities' and their relationship (i.e.How do they all fit?); and answer practitioner questions such as, "How do I know I have dynamic capability?" To address these pertinent questions, an instrument was developed. Data were collected from senior IT manager, including CIOs across several industries. The results provide excellent support for the reliability of the instrument and the validity for the model of Dynamic IT capability. All the hypothesis were supported, except the relationship between Dynamic IT outsourcing management with Dynamic IT human resource management, and Dynamic IT human resource management with Dynamic IT strategy planning. Thereafter, discussion on the results and implications for research and practitioner are presented.

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CHAPTER 1

INTRODUCTION AND STUDY OUTLINE

1.1 Introduction

The authors of the book, 'The Only Sustainable Edge: Why Business Strategy Depends on Productive Friction and Dynamic Specialization' John Hagel, a former McKinsey consultant and John Brown, a former chief scientist at Xerox, propose that executives need to think about strategic advantage flowing from dynamism rather that static capabilities. Further, they note that a rapidly changing world requires a set of capabilities that can project the required dynamism (Hagel and Brown, 2005).

The practicing world has rightly echoed what the recent research literature has been proposing as the '*Dynamic capability view'* (Collis, 1994, Teece et al, 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002). Popular definition of the dynamic capability view is, "*the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments*" (Teece et al., 1997). Essentially, the abilities to be dynamic are manifest as routines in an organization (Winter, 2003). Close at heels with strategy research, IS/IT scholars have signaled the excitement and importance of research in dynamic capability (ICIS, 2003; 2004).

This brings us to the question of the relationship between Information Technology (IT) and the organizations from the dynamic capability view. Sambamurthy et al., (2003) ask, "*What business and IT capabilities, structures, and processes are associated with continued success in leveraging information technologies for superior performance through innovation, globalization, speed-to-market, operational excellence, cost leadership, and customer intimacy?"* Similarly, the significance of IT as a strategic asset was confirmed through a recent research by Computer Science Corporation (CSC, 2004), which indicated that the majority of businesses as well as IT executives, considered IT as a strategic asset.

1.2 Problem Statement

An organization's dynamic Information Technology capability has been understood as an important phenomenon. However, conceptually, dynamic capability has been defined from multiple view points and new definitions are still being formulated. For instance, organizational theorists such as Teece et al. (1997) define it as, "a *firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments"*. Zollo and Winter (2002) define dynamic capability as, "*a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness*". Similarly in IT research, several converging view points are offered to shed light on the construct of dynamic capability with its relationship to IT (Wheeler, 2002; Sambamurthy et al., 2003; Pavlou, 2005).

In light of this progressing cumulative tradition, this thesis seeks to offer greater clarity on the construct of dynamic capability. In particular, it addresses the question of what the components of an organizational dynamic IT capability are and how they interact to make an organization viable in a turbulent and hypercompetitive environment.

Although in literature there is evidence of enthusiasm for the conceptual contribution of dynamic capability (Teece et al., 1997; Teece and Pisano 1998; Eisenhardt and Martin, 2000; Nelson and Winter 2002), there has been little previous empirical work done to expand the understanding of the construct (Priem and Butler, 2000). Evidence of conceptual attempts to explain the construct of dynamic capability is present IT literature (Bharadwaj and Sambamurthy, 1999; Sambamurthy and Zmud, 2000; Wheeler, 2002; Sambamurhty et al., 2003). The objective of this thesis is not only to theoretically establish the construct of organizational dynamic IT capability and explain its components, but also to empirically validate it at an organizational level.

The lack of empirical foundations for dynamic capability research has been voiced in literature (Priem and Butler, 2000). It is only recently that Pavlou (2005) offers an empirical validation for the dynamic capability construct by describing the 'mechanisms' that make up dynamic capability. Similarly, this thesis endeavors to offer greater clarity to the organizational dynamic IT capability construct by arguing for the enabling factors that collectively make up the construct. Secondly and more importantly, this thesis explains that the constructs are organized at different levels and that these capabilities can be observed in an organizational setting. Further, the

sequence in which the sets of capabilities are invoked will have greater effect on an organizations' desired outcome.

It is mostly in the recent literature that we find suggestions to what may be the constructs within the 'Black Box' of dynamic capability, in the context of the Internet (Wheeler, 2002) and new product development (Pavlou, 2005). Yet, there is little evidence of studies on the dynamic capabilities of Information Technology at an organizational level. What is missing from research so far, is an over-arching perspective of what IT dynamic capability is and a scrutiny from an overall organizational perspective (i.e., Organizational Dynamic IT Capabilities- ODITC). Moreover, there is no unifying framework that outlines the specific capabilities and their arrangement with accordance to one another in order to fully realize the benefits of possessing these capabilities.

The contributions of this thesis are summarized below.

1. Define the construct of organizational dynamic IT capability
2. Offer greater clarity of the relationship among the various constructs
3. Present an arrangement of the various constructs that comprise 'organizational dynamic IT capabilities' that are informed by trans-disciplinary theories such as the General Systems Theory
4. Offer clarity between what constitutes 'resources' and what constitutes 'capabilities' and their relationship. How do they all fit?
5. Offer a validated instrument that can be used in future dynamic capability research.

6. Answer practitioner questions such as, “How do I know I have dynamic capability?”

In order to achieve these objectives, we define organizational dynamic IT capability at a macro level construct. This will promote the generalizability of the construct. We not only define ODITC, we theoretically establish the various capabilities that make up the construct. Further, the thesis, in order to offer greater clarity to the construct, distinguishes between ‘*resource*’ and ‘*capabilities’*. The base level capabilities are what we call, ‘*Resources and Capabilities’*, while the other level is what we call, ‘*IT enabled ambidextrous innovative capabilities*’. These base capabilities consists of, Dynamic IT Strategy Planning, Dynamic IT Change Management, Dynamic IT Technology Resource Management, Dynamic IT Human Resource Management, Dynamic IT Knowledge Resource Management, and Dynamic IT Outsourcing Management. While, IT enabled ambidextrous innovative capabilities consist of ‘IT Enabled Explorative Innovative Capability’ and ‘IT Enabled Exploitative Innovation Capability’.

For the scope of this thesis, our research questions are:

1. What are Organizational Dynamic IT Capability (ODITC)? What are the specific component capabilities that create ODTIC?
2. How are these capabilities related? Is there an order to them?
3. What are the antecedents to these capabilities?

The intent of this thesis is to achieve the objectives outlined earlier and to address the research question discussed above. This will be achieved through an empirical analysis using structural modeling technique, which will help us in validating the research model. In an editorial note, Benbasat (2001) suggests that IS research needs a bigger focus on developing its own theories. In light of this sentiment, this thesis is one small step in that direction.

1.3 Outline of the Dissertation

In line with the intent of this study, the chapters of this study are organized as follows. Chapter Two: is a review the literature in organization theories, organizational research, and management research. We discuss the theoretical foundation of the dynamic capability view, as well contrast and compare the various notions of it. We then trace the research root that have led to the discussion of dynamic capability in IT/ IS literature to the present time. Chapter Three: discusses the organizational dynamic IT capability model, the theories and views that inform the model, the relationships of the constructs that inform the model, and the hypotheses that we wish to empirically test. In Chapter Four, we discuss each of the specific constructs that underlies the ODITC model, the theories and views that inform them, and outline the measurement items that we wish to use to test the relationships hypothesized in Chapter Three. In Chapter Five, we discuss the methodological approach for testing of our hypotheses, the development of our research instrument, the choice of sample, the identification of the sample and the method of tapping the sample population. In Chapter Six we follow the normative

approach in establishing the reliability of the ‘organizational dynamic IT capability’ instrument and validity of our constructs. The data is analyzed using partial least squares (PLS) approach and test of the hypotheses is presented. Finally, in Chapter Seven, we present the results and the implications from this research.

CHAPTER 2

LITERATURE REVIEW

In strategic use of the IT literature we see the pioneering work of viewing IT at an organizational level. This forms the basic movement towards understanding the impact of IT on the entire organization and the ability to use IT in a strategic form. Such movement of augmenting the capabilities of traditional Information Technology systems has been showcased by now classical examples of American Hospital Supply, Electronic Funds Transfer (EFTS) besides others (Barrett, 1986). Informed by the concept of competitive advantage (Porter, 1980; 1985), along with the strategic use of IT, (Keen, 1981; Ives and Learmonth, 1984; Benjamin et al., 1984; Cash and Konsyski, 1985; Bakos and Treacy 1986; Benjamin and Morton 1988), research in Information Systems was able to point to the dynamism that could be injected into organizations through development of capabilities (Johnston and Carrico, 1988). These humble beginnings have culminated in IT capability research in the recent past, which is now recognized as Dynamic Capability research. There are few notable works in the area of dynamic capability in IS (e.g., Sambamurthy et al., 2003; Wheeler, 2002; Zahra and George, 2002).

Research endeavors in dynamic capability in Information Technology have been informed by a rich cumulative tradition in strategic management along with research in organization theory (Teece et al., 1997; Winter, 2003; Eisenhardt and Martin, 2000,

Collis, 1994; Grant, 2005; Amit and Shoemarker, 1993). In addition, the conditions of turbulent and hyper-market conditions (Bogner and Barr, 2000; Zohar and Morgan, 1996; Volberda, 1996) render it as a compelling area to study.

This chapter will first discuss the contributions of the reference literature such as organizational theory, strategy and management, which address the phenomenon of dynamic capability. This will be followed by an assessment of the Information Systems literature. Together, these reviews will provide the theoretical backdrop for 'Organizational Dynamic IT Capability' (ODITC).

2.1 Reference Literature

Dynamic Capabilities is a relatively new area of scientific inquiry in IS research and its roots can be traced back to the studies in competitive advantage and an increasing interest in explaning the importance of dynamism in strategy (Porter, 1994, Rockart et al., 1996) and firm performance. Research on 'dynamic capability' developed in strategy literature beginning initially with 'organizational capabilities'. This initial literature was motivated by Resource Based view (RBV) (Selznick, 1957; Penrose, 1959; Grant, 1991; Barney, 199l) and additionally, inspired by the works of the economist, Joseph Schumpeter (1942). The RBV provided a different approach to competitive advantage, as opposed to earlier economic theories of cost. The RBV in effect has formed the backbone for the development of studies in dynamic capability (Teece et al., 1997, Eisenhardt and Martin, 2000).

Dynamic Capabilities has been a growing area of study in management strategy literature (Teece et al., 1992; Teece et al., 1997; Teece and Pisano 1998; Teece et al., 2002; Zollo and Winter 2002; Eisenhardt and Martin, 2000). The increasing contributions to RBV suggests that not only is exploitation of existing resources and competencies the only means to sustained competitive advantage (Sheun, 1994) but also intangible assets, acquiring skills and organization learning that leads to knowledge stocks, are newer ways to stay competitive (Teece et al., 1997). Collis (1994) argues that capabilities are directly related to efficiency as well as the ability to invoke new ways to create value, i.e., effectiveness. Building on this understanding, the construct of dynamic capability emerges with a strong appeal in the quest to add more explanatory power to the drivers for sustained competitive advantage. In the dynamic capability view, organizations demonstrate the ability to respond to market changes, achieve dexterity in product development and innovation, coordinate as well as reconfigure their competencies (external and internal) on a continuous basis. It is this collective ability to stay competitive that is referred to as, dynamic capability (Teece et al., 1997).

The contributing literature on dynamic capability view espouses several differing opinions on what is constitutes and what its antecedents are. Ostensibly, this is an expected feature of any phenomenon that is under much scrutiny and refinement. Subsequently, there are as many definitions of dynamic capability as there are studies. What follows is a quick review of the variety of definitions that are proposed in the contributing literature.

1. "DC is the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece et al., 1997).

2. Similar and close-at-heels to Teece et al. (1997) definition of dynamic capability. Dosi et al. (2002) have proposed that competitive advantage is derived from excellence that resides in identifiable and limited bundles of capabilities (competencies), where a leadership position can be maintained for extended period of time. This characterization of dynamic capability is based on the core competency view (Prahalad and Hamel, 1990) and limited to large organizations.

3. Dynamic capabilities are in the form of routines in stable market, while they are in the form of adaptive routines in high velocity markets (Eisenhardt and Martin 2000). Here dynamic capability acquires multiple levels- one type of DC operates in predictable markets; the other type of dynamic capability is where the markets are in a state of flux. Dynamic capability is defined as, 'Firm processes that used resources, specifically the processes to integrate, reconfigure, gain and release resources- to match and even create market changes' (Eisenhardt and Martin, 2000). In this definition, an organization integrates and recombines resources to both react and enact on market stimulus for sustained competitive advantage.

4. In contrast to the definition of DC by Teece et al. (1997), Zollo and Winter (2002) offer an alternative definition. This understanding is based on the

notion that organizations also integrate, build and reconfigure in less dynamic market conditions. Their definition captures this view, “A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness”. Capabilities (competencies) and resource as characterized as routines, based on this definition. Moreover, an organization's dynamic capability is derived from a set of stable behaviors that are committed to improving its operational processes.

5. Taking an opposing stance from Eisenhardt and Martin (2000), and building on the logic of 'patterned activities' (Zollo and Winter, 2002), in an alternate view of DC states that capabilities can be classified as base level and higher level that involve those activities which are basic for the existence of the organization. In addition to the afore mentioned, there are those activities which are involved in, for instance, new product development (Winter, 2003). The author, further states that, “it is equally beyond question that they (DC) are highly patterned and routine in many respects'. Consequently, Winter (2003), make a clarification of what DC constitutes based of the activities of an organization. The author makes a further distinction between DC and 'ad-hoc problem solving. "Ad-hoc problems solving is not routine; in particular, not highly patterned, and non-repetitious". Therefore, simply novel responses to the challenge from market conditions cannot be classified DC.

These multiple viewpoints and interpretations represent a mosaic of definitions on DC, which stem from various understandings. Such a landscape makes it a challenging task when we are striving to account for a cogent understanding of what constitutes DC. Essentially, what remains to be answered is the question on what makes up the construct of dynamic capability. Further, research in capabilities is complicated with multiple positions on the concept of Capabilities and Competencies. For instance Deeds et al., (1999); Zhu and Kraemer (2002), do not distinguish between capabilities and competencies and use them interchangeably. Butler and Murphy (2005) building on earlier research (Nanda, 1996), argue towards the confusion existing in literature on the definitions between what constitutes ‘resources’ and what constitutes ‘capabilities’. Given all this, in the very debate on fine tuning and micro-analyzing the definitions, it seems that the constructs of 'Competency' and 'Capability appear to be synonyms. As captured by Dosi et al. (2002), "The concepts of core competency and capability point in the same direction". In addition, as articulated by (Peppard and Ward, 2004), "*capability refers to the strategic application of competencies, and competence refers to a firm's ability to deploy resources*". Therefore, capability alludes to the ‘latent’ or ‘potential’ ability to organize/reorganize/reconfigure resources. On the other hand, competencies are formed with the application of the ability, i.e., the ‘kinetic’ ability. From this perspective, it seems evident that the conceptual distance is infinitesimally small between capabilities and competencies and that they are indeed analogous to each other.

2.2 IS Literature

Research in dynamic capability in IS is at an early stage. Recent studies on the capabilities of Information Technology have been built on several research streams. The first link in the chain leading to research in dynamic capability is in the area of the 'strategic use of IT' (e.g. Benjamin, et al., 1984; Ives and Learmonth, 1984; Cash and Konsynki 1985; Bakos and Treacy, 1986). The other link in this capability chain can be traced back to the research in 'IS systems capabilities' or 'system success' (e.g. DeLone and McLean 1992; Seddon, 1997). The final link leading to research in IT dynamic capability is 'IT capability', which has benefited from organizational theories such as the Resourced Based View (e.g. Bharadwaj, 2000; Sambamutrhy and Zmud, 2000). These three historical landmarks leading up to the IT dynamic capability view are reviewed in the sections that follow.

2.2.1 Strategic Use of Information Systems

The ability to use Information Technology is a strategic manner is reflected through the numerous works, which build on Michael Porter's 'value chain' and the 'five forces model' (Porter, 1980; 1985). For instance, Parsons (1983) building on Porter's work, proposes the strategic significance of Information Technology and discusses a three level framework. At the industry level, IT changes an industry's product and services, markets and production economy; at level two: IT affects Competitive forces; level three: IT affects a firm's strategy. Later, Benjamin et al., (1984) build on Parson's (1983) work by suggesting how to take the strategic

significance factor forward by exploring Information Technology strategic opportunities- 'applying the learning'. Towing a similar line, exemplary work in the capabilities of Information Technology as a strategic tool has been argued in literature (e.g., Benjamin, et al., 1984; Ives Learmonth, 1984; Cash and Konsysnki, 1985; Bakos and Treacy, 1986; Benjamin and Morton, 1988). Finally, the richness of contribution culminated into the seminal work of Swanson (1994), who proposed a tri-core theory of information technology capabilities, which was empirically validated by (Grover et al., 1997). Through the theory, he purported that the benefits of new advances (innovations) in information systems have an impact not only on effective coupling of technology with organizational design but also the processes within the organization, its strategy, and external relationships. This set of interfaces, produced superior ability to stay competitive. This stream of research demonstrated the significance and ability to use Information Technology in a strategic way. In essence, this was the first indication of a basic form of 'dynamic IT capability'.

2.2.2 Information System Capabilities

The next wave of another basic form of the dynamic capability research was in the 1990's, with the emphasis on the capabilities of an information system, with alternating model of IS success (DeLone and McLean 1992, 2003 and Seddon, 1997). These models form the backbone of literature on IS success. According to the DM model of IS success (DeLone and McLean, 1992; 2003), the capabilities of an Information System were among the principle antecedents for its success and the

benefits that a user could derive. These capabilities were manifest in the form of technical competencies (DeLone and McLean, 1992). In time, the DeLone and McLean IS success model was criticized in literature for several reason, such as lacking theoretical underpinning (Goodhue and Thompson, 1995), combing process and variance models in a single framework (Seddon, 1997). As an alternate model, the Task-technology fit model was proposed (Goodhue, 1995, Goodhue and Thompson, 1995). The model addressed the impact of the capabilities of a particular Information System on the effectiveness of an individual end user. Essentially, both the touted models and their variants had two features: the capability of a single information system and the consequences for an individual user.

2.2.3 Information Technology Capabilities

The early directions for Information Technology dynamic capability was reflected in research on change management, which stressed on the agility of Information Technology to deliver solution with hastily changing market conditions (Clark et al., 1997). Similarly, earlier work in IS governance looked at IS capabilities as a pre-condition for changes to governance structures of the IS function (Brown, 1997) However, the direct contributing literature in dynamic capability in information systems is informed by a large cluster of extant literature which builds on the emerging view of the resource management, i.e., the Resource Based View (RBV). RBV asserts that internal resources of individual firms are the key determinants of competitive advantage (Amit and Schoemaker, 1993; Teece et al. 1997). In this view, competitive advantage is

a derivative of owned inimitable, rare, valuable, and non substitutable resources. Organizations achieve sustainable competitive advantage through configuration of their resources, which translate into value-creating strategies (Lippman and Rumelt, 1982; Wernerfelt, 1995; Barney 1991; Peteraf 1993). The first instances of the application of the resource based view in IS literature can be traced back to the early 1990s, when capabilities have been regarded as 'traits' that can be analyzed (Clemons and Row, 1991). Other noteworthy work using the RBV is reflected in the assertions of Bharadwaj and Sambamurthy (1999), who based on the arguments of (Amit and Schoemarker, 1993; Grant, 1991), offer a distinction between resources and capabilities. Information Technology capability not only includes technology but also organizational attributes. The construct of Information Technology capability is conceptualized as an organization wide construct, reflected in six concepts. These are: IT business Partnerships, Eternal IT linkages, Business IT, Strategic Thinking, IT Business Process Integration, IT management, and IT infrastructure (Bharadwaj, 2000). Organization IT capabilities is defined by Bharadwaj (2000) as: "*its ability to mobilize and deploy IT-based resources in combination or copresent with other resources and capabilities*". However there is ambiguity in differentiating which concept is to be considered a resource or a capability. This ambiguity is also seen in knowledge management literature. For instance, Gold et al. (2001) propose certain preconditions to knowledge management that are interchangeably addressed as 'capabilities' and 'resources'.

Building on the cumulative tradition of research on Information Technology capabilities (e.g. Mata et al., 1995; Ross et al., 1996; Bharadwaj and Sambamurthy, 1999), Dehning and Stratopoulos (2003), offer empirical validation to the assertions of Mata, et al., while Sambamurthy and Zmud (2000) attempt to offer greater clarity to the construct of Information Technology capabilities. They (Sambamurthy and Zmud, 2000) conceptualize Information Technology capabilities as: '*value-added contributions of IT-assets and routine to the enterprise*', '*IT capabilities are both understood and operationalized as comprised of highly interdependent core assets and routines that take on distinctive profiles in their situational execution*', '*IT capabilities apply skills and routines that evolve very rapidly and are typically acquired and retired in a discontinuous fashion*'. These various notions of IT capabilities are part of the pioneering effort to offer a richer understanding of Information Technology dynamic capability.

Moving ahead towards a better understanding of the concept of IS capabilities, literature attempts to offer empirical proof of sorts, along with professing the multi dimensional nature of the capability construct (Bharadwaj, 2000; Santhanam and Hartono, 2003) in order to validate the positive impact of Information Technology capabilities on an organization's performance. Bharadwaj (2000), states that the essence of capabilities is in the exploitation of resources in conjunction with other resources and capabilities. Continuing in the spirit of literature in Information Technology capabilities, Santhanam and Hartono (2003), offers some empirically validation to support that superior Information Technology capabilities results in sustained

competitive advantage for the organization. Although, empirically the IS literature establishes that Information Technology capability do exist and are indeed an important function in sustained competitive position of an organization, the treatment given to capabilities is analogous to a ‘black-box’. What constructs constitute the capability appears to be allusive at this time.

In an attempt to better explain and understand the position of IT capabilities, Javenpaa and Leidner (1998), propose the usefulness of ‘dynamic capabilities’ to an organization that operates in an unstable environment. The dynamic capability construct is contrived from the concepts of flexibility and strategic foresight together with a core competency of trustworthiness. In a similar vein, Sambamurthy et al. (2003) suggest that dynamic capabilities are organizational mechanisms that facilitate flexible combinations of organizational resources. These dynamic capabilities are: digital options (prior learning in the form of digitized knowledge repositories and systems of interaction among organizational members); agility (detection of opportunity and assembling the appropriate asset, knowledge, and relationships with alacrity); entrepreneurial alertness (ability to anticipate and explore opportunities along with the ability to visualize the meshing together of organizational learning and agility).

In an attempt to further refine and clarify the concept of Information Technology capabilities, Wade and Hulland (2004) argue that resources comprise capabilities and assets. They define capabilities as ‘repeatable patterns of actions’ that employ differing assets to generate products. Further, based on an comprehensive review of the IS literature that incorporates the RBV, the author’s suggest that over time

the capabilities and assets together form dynamic capabilities, which posses the attributes of rarity and idiosyncrasy (Teece et al., 1997; Eisenhardt and Martin, 2000). This characterization of dynamic capability, suggest it to be an organizational resource. In an alternate view, IS literature approaches dynamic capability from the over arching perspective of IT value (Melville et al., 2004). Here, based on a review of IT value related literature, observations drawn were that, there are two components to IT value: efficiency and effectiveness (Melville et al., 2004). That is, the ability to function in a changing as well as stable market condition. This is essentially what a dynamic capability facilitates an organization to do. However, the 'processes' that bring about the dynamics is still treated as a 'Black box'.

In the ongoing tradition to understand dynamic capability, IS literature has attempted to make a distinction among several capabilities. Under the umbrella of 'capabilities' are: Information Technology infrastructure; Information Technology management capabilities that include the business experience of IT managers (Boynton and Zmud, 1994) and relationship assets (Ross et al., 1996); dynamic capability, which is an organizational level phenomenon dependent on the potency of learning (Bhatt and Grover, 2005; Piccoli and Ives, 2005) as well as asset stock accumulation (Piccoli and Ives, 2005) in the organization. In essence, dynamic capability is an organizational level phenomenon and can be framed as: *Organizational Dynamic IT Capability (ODITC)*.

2.3 Dynamic Capability Definitions within Information Systems

The significance of Information Technology dynamic capability has been validated through the recent annals of IS research (Table of contributing IS literature on capabilities is in Appendix A). This increasing conformation is evidenced by the variety in the definitions of dynamic capability. For instance, in the recent ICIS (2004) panel discussion, multiple perspectives on dynamic capabilities were offered such as '*alignment as a dynamic synchronization between IT and business capabilities*'; '*dynamic capability is the missing link between IT-competitive advantage relationship in a turbulent environment*'; *'viewing the synchronization of IT and dynamic capability through a punctuated equilibrium model'*. All these varying notions point the salience of the dynamic capability, especially with reference to Information Technology. However, any progress towards understanding a significant yet complex phenomenon will necessarily be mired by diversity of definitional attempts. In the following paragraphs, these varying definitions are discussed.

1. Conceptualization of IT capabilities as the ability to mobilize and deploy IT based resources, that comprise IT infrastructure; IT resources of technical and managerial skills; intangibles such as knowledge assets, customer orientation and synergy (Bharadwaj, 2000)
2. The key to understanding Knowledge Management success and failure in organization is determined by 'pre-conditions' which are defined as capabilities or resource, (Gold et al. 2001), thereby offering little differentiation between the two.

3. '*IT capabilities are combinations of IT based assets and routines that support business conduct in value added way*s', (Sambamurthy and Zmud, 2000). Dynamic capability is that which enables firms to flexibly coalesce diverse IT and business resources resulting in innovations that encourage competitive actions. (Sambamurthy et al. 2003)

4. Wade and Hulland (2004) define resources as repeatable patterned actions (capabilities) that work with assets for reacting to market conditions.

5. Dynamic capability is a staged process that begins with first choosing the appropriate IT; matching that IT with opportunities for economic rents; executing of the innovation that is borne out of the earlier two activities; finally, assessing the value derived from the innovation by customers. This sequence leads to organizational learning, which in turn feeds back into the four processes (Wheeler 2002)

6. Building upon the definition purported by Teece et al. (1997), Zhu and Kraemer (2002) are of the opinion that e-commerce is a dynamic capability, since Internet dependent organizations need to reconfigure their resources on a continuous basis.

7. Zahra and George (2002) extend Wheeler's (2002) definition of dynamic capability by suggesting that entrepreneurial inclination is essential to the process of identification and exploitation of innovations. They couple strategy with entrepreneurship. This brings in an argument of the more

encompassing nature of DC that embodies the notion of stability as well as change..

8. '*Dynamic capability is a broad concept that encompasses the ability to search, explore, acquire, assimilate, and apply knowledge about resources, opportunities, and how resources can be configured to exploit opportunities.*' (Bhatt and Grover, 2005). They frame this understanding under the construct of '*intensity of organization learning*'.

9. Directly building on Teece et al.(1997) conceptualization on dynamic capability, Pavlou (2005) defines dynamic capability as, '*the ability to deploy superior new configuration of functional competencies by sensing the environment, generating new knowledge, coordinating activities, and integrating resources.*'

10. Dynamic capabilities comprise of organization learning and asset stock accumulation (Piccoli and Ives, 2005). The role that dynamic capabilities in an organization is, "*It explains the process by which erosion of competitive advantage can be prevented, delayed, limited, or even reversed by the reinvestment in, and rejuvenation of, barriers to erosion*" (Piccoli and Ives, 2005)

2.4 Conclusion

Peppard and Ward (2004) argue that until recently there is little evidence in IS literature on defining Dynamic Information Technology capability, outside an idiom of

its central nature; '*enabling an organization to continuously derive and leverage business value through IS/IT*'.

Beyond this idiomatic expression of dynamic capability, research has asked and outlined the importance of presenting evidence on how organization can develop capabilities (Nonaka and Takeuchi, 1995). What gives me these dynamic capabilities? (Eisenhardt and Martin, 2000), and what are the underlying indicators for dynamism in the capabilities? Or as Peppard and Ward (2004) have stated, '*…Nor has it described the fundamental components or characteristics of organizational IS capability*'. In other words, what is dynamic capability and what are its essential constructs? It is only recently that research has shed some light to unravel, the so called 'black box' of dynamic capability. Two notable recent and direct contributions in this stream of research has been made by Wheeler (2002) and Pavlov (2005). Wheeler (2002) outlines four constructs that make up a capability chain starting with choosing an enabling technology, then matching it with a promising profit making opportunity, followed by executing of innovation in business that will lead to growth and finally assessing the value to a customer in an Internet environment. Collectively this chain promotes organization learning that in turn feeds back into the specific activities. Pavlov (2005), on the other hand, using reconfigurability as a proxy for dynamic capability, outlines four constructs that contribute to reconfigurability- market orientation, absorptive capacity, coordination capability, and collective mind. Dynamic capability is explained in the reference to a new product development process. Motivated by these contributions, we attempt to enhance our understanding of Dynamic IT Capability

beyond a specific perspective, to a more encompassing macro-level view. In this view, we attempt to delineate an over-arching operationalization of the organizational dynamic information technology capability (ODITC), without the boundaries of a specific processes, products or industry.

With these multitude understandings of dynamic capability which is conceptualized at an organizational level (Bhatt and Grover, 2005), we are encouraged to build a larger and more encompassing view of *Organizational Dynamic Information technology Capability (ODITC).* Astute conceptualization of dynamic capability is amply evidenced by the writings in current literature. As part of continuing research, we will develop this systemic view on dynamic capability. For instance, the varied notions on the types of capabilities strongly suggest the existence of multiple capabilities levels (Collis, 1994; Grant, 1996; Zollo and Winter, 2002). Further, learning (Argyris and Schön 1978; Senge, 1990), information processing (Galbraith, 1974), knowledge creation (Polanyi, 1967; Nonaka, 1994) theories can be synthesized and capabilities can be understood more richly by the ideas embedded in General Systems theory, the science of Cybernetics, and the Gestalt theory (Weiner, 1948; Ashby, 1956; Bertalanffy, 1968; Beer, 1959; Katz and Kahn, 1978; Churchman et al., 1957). GST has been professed as a rich contributor to understanding a phenomenon, which is manifest at an organizational level (Ashmos and Huber, 1987).

CHAPTER 3

ODITC MODEL AND RESEARCH HYPOTHESES

In this chapter we discuss the Organizational Dynamic Information Technology Capability (ODITC) model. In particular we discuss the salience of the structure of Dynamic capability. We first briefly discuss the phenomenon that necessitates dynamism in organizations today. That is, why does an organization need to be dynamic? What views and theories in literature that underscore the dynamic mechanism? How are the parts of the ODTIC related? A second scope of this chapter is to discuss the research hypotheses.

3.1 Need for ODITC

For an organization today, the business environment is characterized by the need to stay nimble, constantly manage change, and innovate (D'aveni, 1994; Tushman and O'Riely, 1996; Fine, 1998; Nadler and Tushman, 1999; Volberdra, 1996; Mendelson, 2000; Sambamurthy and Zmud, 2000; He and Wong, 2004; Jansen et al., 2005). Having internalized this for agility, research has suggested that organizations need to develop capability that can sustain competitive advantage (Barney, 1991; Dierickx andCool, 1989; Mata et al., 1995). Research in such capabilities evolved from the RBV to the contemporary thinking of '*dynamic capability'*. Several formulations of

dynamic capability underpin its significance to sustained competitive advantage (Teece et al., 1997; Zollo and Winter, 2000; Eisendardt and Martin, 2000; Amit and Shoemarker, 1993).

As a corollary to the Dynamic capability research, the role of dynamism in IT capabilities has also been suggested (Haeckel and Nolan, 1993) and thereafter, the onerous task of delineating the construct of dynamic capability has been carried out in literature (e.g. Pavlou, 2005, Wheeler, 2002, Sambamurthy and Zmud 2000, Bharadwaj and Sambamurthy 1999). This thesis is motivated by the enthusiasm emanating from the dynamic capability research. It further attempts to offer greater clarity to the construct of dynamic Information Technology capability. Research has established that IT is an organizational level phenomenon. For instance, the impact IT has on organization forms has been confirmed in the literature (Daft and Lewin, 1993; Zenger and Hesterly, 1997; Nault, 1997, 1998). In line with this view point, we study dynamic capability as an organizational level construct and therefore, understand it from the perspective of an organization's Information Technology capability.

3.2 Theoretical Perspective

3.2.1 Contingency Perspective and Organizational Information Processing Theory

The organizing logic of organizations is considered important in hyper-competitiveness and turbulent markets (Nadler and Tushman, 1999; Sambamurthy and Zmud, 2000). Dynamic capability view is one such overarching logic that can enable organizations to stay competitively afloat in a dynamic environment. Put differently,

organizations need to be able to sense and respond (Haeckel, 1999) to contingencies that emanate from the environment (Lawrence and Losch, 1967). Support for the dynamic capability comes from several theoretical lenses, apart from its progenitor-RBV. Galbraith (1974), through the organization information processing theory explains that organizations in light of the demands of the environment, can pursue a basket of strategies. These are: a) Reduce the need for information processing by creating slack resource creation of slack resources, b) Reduce the need for information by creation of self contained tasks, c) Increase the capacity to process information by greater investment in enterprise wise IS, d) Increase the capacity to process information by creating lateral relationships in the organization. These theoretical perspectives and views come together to better inform the dynamic capability view and suggest that organization must continually adapt itself. ODITC is a meta-level organizational adaptation process that is informed by the afore mentioned rich theoretical perspectives.

3.2.2 General Systems Theory (GST)

General systems theory debates that there is heterogeneity in organizations. However, any organization can be described by principles which are independent from the specific domain. Therefore, if we would discover those general laws, then we may be able to analyze and solve problems in a domain, pertaining to any type of system. The GST differentiates it approach from the 'analytical approach', by emphasizing the interactions and connectedness of the different components of a system. The systems that are considers more appropriate for scrutiny under the purview of GST are those that

are characterized by complexity and are considered self- regulatory, with a purpose, much like today's business organizations.

The pioneering work on General Systems theory (GST) or also called the 'open systems theory' has been popularly credited to the contributions of Ludvig Von Bertlanffy (1968) and Kenneth Boulding (1956). Both proposed the same idea but from different schools; Bertlanffy from organismic biology and Boulding from Social Sciences. GST was proposed as an alternative to the Cartesian principle; of understanding the whole rather than its parts. A system therefore, is a combination of related elements organized into a complex whole.

Today's complex business organizations, are representative of such a complexity of organizing and thereby can be explained or be understood in extremely limited way from the Cartesian lens (Van Gigch, 1974; Katz and Khan, 1978). The methodology of the GST is organized around three principles. 1) Every subsystems must affect the behavior of the whole; 2) Subsystems are interrelated; 3) If a subsystem is treated a system, then it has the first two characteristic. This understanding of GST has been referred to as 'holism' (Checkland, 1981; Jackson, 2000). Organizational literature has suggested that the '*open systems'* view of an organization offers a superior way to manage dynamics of change (Sanchez and Henee, 1997). Feeney and Wilcocks (1998) suggest that a systemic thinking is essential to forming core IT capabilities. Similarly, it is incumbent on research to understand organizational dynamic IT capability as meta-construct, that it's a 'whole' comprising of several interrelated parts (i.e. sub dynamic capabilities). Literature has long voiced this sentiment under the

banner of opening the ‘black-box’ of dynamic capability. Subsequently, commendable studies have also offered the first insights into the complexity of the dynamic capability ‘parts’ and glimpses into their relationships (e.g. Wheeler, 2002; Pavlou, 2005).

As a macro model, organizational dynamic IT capability adheres to the characteristic of an open system. Katz and Kahn (1978) through their seminal work on organizations, describe a set of ten common characteristics that dynamic organizations possess. They are discussed in the following sub sections along with their fit with the capabilities.

3.2.2.1 The importation of energy

Any organization is rarely self contained. That is they must constantly rely on external sources to continually replenish and sustain themselves. In our ODITC model for instance, an organization in order to maintain the various dynamic IT capabilities, needs a never failing feeding mechanism for scanning new Information Technology. This new knowledge is the needed renewable energy that is constantly transformed. In addition, the indirect energy comes from the ‘resources’ that an organization creates to sustain the capabilities. For instance, compromising on the ‘quality of IT personnel’ will have ramifications in the capability of those personnel to be trained on new IT or absorb business knowledge.

3.2.2.2 Throughput

An organization must be capable to put to use the energy (knowledge created) captured. In the ODITC model, this transformation is done at two stages. At stage one the members of the organization form a collective understanding of the new as well as

emerging IT. At stage two what we refer to as ‘IT enabled Ambidextrous Innovative Capability’, the organization is able to deploy the IT synergistically with other processes. Depending on the possibility, the deployment could result in innovation that is explorative in nature or exploitative.

3.2.2.3 The Output

An organization is able to export some product back into the environment. This is the organizational outcome of the process of ambidextrous capability. The organization may introduce a new product / service and/or it may be change some if its structural properties, such as spin off a division, or create cross functional teams.

3.2.2.4 System as a cycle of events

The patterned activities of the energy exchange have a cyclical character. Organizations constantly scan for new and enabling IT, these new ITs, once identified are understood by the entire organization; synchronized with other business functions and implemented with an outcome in mind. Lessons learned from the implementation form a feedback, to serve as guidance for future activities. Thus, the dynamic capability is a system of cyclic events.

3.2.2.5 Negative Entropy

The loop of input, transformation, and output is considered a negative entropic process. This process is considered a universal law i.e. in line with the second law of thermodynamics. To sustain themselves, organizations must always be putting effort to mitigate the effects of slowing down and eventually coming to a stop (i.e. entropy). Based our macro dynamic organizational IT capability model, if the organization is

unable to constantly scan the environment, evaluate the potentiality of new Information Technology. In the event this is not possible, the organization will have a knowledge base that will be outdated and lacking. With this lack of knowledge the organizations will have to overcome greater challenges for innovation in a market that is marked by hypercompetition.

3.2.2.6 Information input and negative feedback

Apart from energizing inputs, as discussed earlier, organizations also have information inputs that are in the form of negative feedbacks. Negative feedback allows a system to take corrective action in the next cycle, and make correction for the deviation from the goals. This is important for an organization's dynamic IT capability. Unless, the organization is cognizant of the mistakes it has made, there is a high degree of probability that it might make the same error repeatedly. For instance, an organization has reasoned and implemented a new IT system (e.g. a data mining systems that it will use for '*undirected*' data mining) that purports to augments its explorative innovative ability However, the feedback after the implementation of the technology is not positive. The organization, then uses this feedback, makes corrective actions and pursues only extension to its existing product line. In this case, using '*directed*' data mining which has proved more benificial.

3.2.2.7 Steady State

There is continuous inflow and outflow of energy and the ratio of energy exchange and the relationship between parts is maintained. This state is called, '*Homeostasis*'- a dynamic balance (Walter Cannon, 1932). Similarly, in an organization

that has properties of dynamic IT capability, the ‘resources’ i.e. Learning Dexterity; Dynamic IT Infrastructure Management; Dynamic IT Personnel Management, and ‘capabilities’ i.e. Change Management; Dynamic IT-Strategy Planning; Dynamic Systems Development capabilities should be invoked before the ambidextrous capabilities. If this is not the case, then this pattern is becomes ‘*unsteady*’ and there is a strong chance that the outcome may be less beneficial. For instance, the deployment of new IT without formulating a clear organization wide understanding of it and IT personnel lacking skills for it, may result in project cost escalation, wasted resources, and operationalization of a incorrect strategy.

3.2.2.8 Differentiation

Organizations have a tendency to progress towards a system of differentiation and elaboration. The organization evolves and has routines that enable it to move from a primitive system to a more evolved system. For instance in an organizational dynamic IT capability model there are specific actions that facilitate the various dynamic capabilities of IT-strategy integration, organizational IT deployment, managing the flexibility of the IT infrastructure, managing the intellectual growth of IT personnel, and leveraging the relationship with IT vendors.

3.2.2.9 Integration and Coordination

In social systems such as organizations, integration and coordination allow for orderly and systematic articulation. For instance, in the organizational dynamic IT capability model, Dynamic IT strategy planning and change management facilitate orderly and systematic articulation of an identified Information Technology, its

understanding, its assimilation in the organization, that culminates is its implementation.

3.2.2.10 Equifinality

Open systems are characterized by the principle of equifinality (Bertalanffy, 1968). The principal states that a system can reach its final states through a variety of paths. This is similar to the notion of ambidexterity in innovation capability. The organization has the ability to either pursue explorative innovation or exploitative innovation based on its strategic objectives. It is not restricted to either one or the other.

In the previous section we mapped the ten principles articulated by (Katz and Khan, 1978) about the properties of an open, onto our organizational dynamic IT capability model.

3.2.3 Viable Systems Model (VSM)

Allied to GST and grounded in organization cybernetics is the 'Viable Systems Model (VSM)' (Beer, 1972). The VSM is collection of general systems that are applicable to all forms of organizations irrespective of their size, based on interdisciplinary laws. It comprises of interrelation of a set of subsystems that need to be performed to ensure the 'viability' of a systems i.e. a business organization (Beer, 1985). In light of today's complex environment and turbulence, a view of the organizational dynamic capabilities appears appropriate for scrutiny from the lens of systems theory (Jackson, 2000; Stacey, 1993). Table 3.1 illustrates the mapping of

Organizational dynamic IT capability construct to the elements that are prescribed for the viability of an organization.

Table 3.1: Comparing the elements of a Viable systems with the ODITC constructs

Viable systems Elements	**Organizational dynamic IT capabilities**
Policy: *Formulation of strategy on the basis of information received*	Dynamic IT-Strategy Planning
Development: *The assimilation of new information and internal experiences*	Dynamic IT Knowledge Resource management
Coordination: *To ensure cohesion and attainment of 'implementation'*	Dynamic IT-Strategy Planning; Dynamic IT Change management
Operational Control: *Management of assets*	Dynamic IT Technology management; Dynamic IT human resource management; Dynamic IT outsourcing management
Implementation: *Tasks that are necessary to support the* purpose of the organization	IT-enabled Ambidexterity

3.3 Towards a Synthesis and Definition

3.3.1 Towards a synthesis

The organizational dynamic IT capability is also consistent with the seminal work of evolutionary economist, Nelson and Winter (1982). They purported that organizational routines are in the center of analysis of and organization. Routine have been characterized as patterns in organizational literature (Nelson and Winter, 1982; Teece and Pisano 1998; Cohen and Levinthal, 1994; Grant, 1996; Teece et al., 1997).

Winter (1964) defines routine as, *"pattern of behavior that is followed repeatedly, but is subject to change if conditions change*". Later, Winter (2003) refines his definition to,"*behavior that is learned, highly patterned, repetitious, or quasi- repetitious, founded in part in tacit knowledge*". This line of understanding of dynamic capability in strategy literature as '*routines*' is along the same lines of following a '*cycle of events'*, as voiced in GST literature (Katz and Khan, 1978) That is, the cyclical process of importing energy (input), throughput (processing), and output (Burke, 2002) (Figure 3.1).

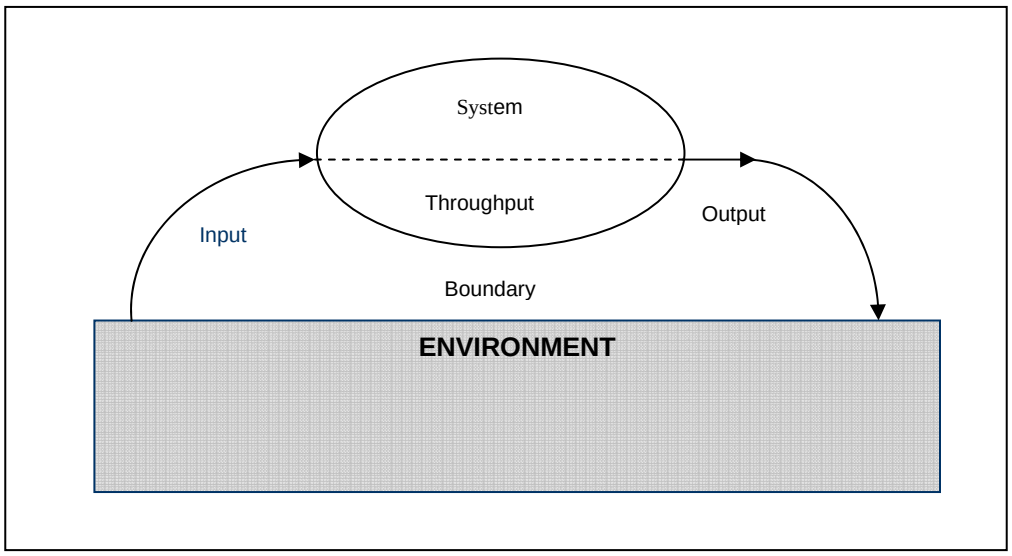

Figure 3.1: A General System in interaction with the environment

3.3.2 Towards a definition

An organization can be said to possess 'Organizational Dynamic IT Capabilities', when it is able to demonstrate ambidextrous innovative abilities that are

facilitated by invocation of capabilities (IT strategy planning and dynamic IT systems development capabilities together with effective change management practices), that are enhanced as a corollary to dynamic IT knowledge management resource, coupled with dynamism in IT technology resource and IT human resource management.

To explain, an ambidextrous capability (exploration and exploitation) allows an organization to act and transform inputs into desired outputs. For instance, viewing a business opportunity, the need of the hour may be to simply upgrade to a new version of an software application, while on the other hand the need may be to change the entire IT system and substitute is with an alternate one. In order to do these, organizations on an on-going basis internalize the lessons (both positive as well as negative) from previous outcomes and couple this experiential based knowledge with new external knowledge. These lesson in association with the capabilities of IT personnel (the ability to understand business, trying new technology, communicate with the entire organization), and the dynamism in the IT infrastructure (the ability to scale, evolve, integrate) come together to boost the dynamic IT strategy planning process (IT with Strategy), efficient change management, and developing IT systems that contribute the organization's ambidextrous innovate ability. We therefore, define ODITC as: ***"An organization's capabilities to enable and sustain exploitative and explorative business innovations through dynamic management its IT resources and deployment of information systems solutions"***.

3.3.3 *The constructs*

In the following sub section, we briefly describe each of the constructs that are related to the Organizational Dynamic IT Capability Model.

3.3.3.1 Dynamic IT Knowledge Resource Management

In literature, knowledge has been considered as one of the most significant resources (Nonaka and Takeuchi, 1995; Grant, 1996, 2005). Learning has been alluded to as 'new knowledge' (Kogut and Zander, 1992) and exemplifies the enhancement in the status of an organization's knowledge resource (Holsapple and Joshi, 2003). To be dynamic, organization need to continuously scan the environment, making sense of the new knowledge along with the prior understanding and applying it for an outcome (Weick, 1995). Therefore, knowledge management resource espouses the concept of absorptive capacity (Cohen and Levinthal, 1990) and high order learning. Absorptive capacity is the ability of an organization to take in new IT knowledge that is primarily external to the organization. Coupled with this, learning is comprised of past knowledge and knowledge from mistakes make during previous IT implementations. Learning reflects the experience of IT deployment that are considered important for future IT deployment.

3.3.3.2 Dynamic IT Technology Resource Management

IT infrastructure is considered important for promoting competitiveness of an organization (Venkatraman, 1991; Weil et al., 2002). The ability to act in response and anticipate changes in the environment requires responsive and flexible information technology infrastructure (Quinn, 1992). In order to keep up with the demands of

rapidly changing and evolving market conditions, IT technology infrastructure needs to be flexible and accommodating (Brown and Sambamurthy 2002; El Sawy, 1999; Sambamurthy and Zmud, 2000). Dynamic IT technology resource management espouses ability to keep the IT infrastructure flexible and responsive in light of changing business requirements.

3.3.3.3 Dynamic IT Human Resource Management

Dynamic IT personnel resource management facilitates an organization to keep their IT personnel motivated, knowledgeable about the business functions and can work is different job settings. For organization to be on top of the competitive curve, IT personnel need to have the ability to understand the organization's business and develop a certain degree of proactiveness (Reich and Benbasat, 2000; Roepke et al., 2000). Dynamic IT technology resource management supports the IS personnel's ability to rise to emerging organizational challenges.

3.3.3.4 Dynamic IT Change Management

The importance of managing change is considered an important ability (Grover et al., 1995; Kettinger et al., 1997). Change management involves overcoming resistance to change involved with new IT systems, especially when integrating IT within the organization. Communication and planning for minimizing the resistance to change is crucial for effective change management (Brown, 2006) In addition, change management is facilitated by the involvement of a project champion (Beath, 1991; Gratton & Goshal, 2005). Dynamic IT change management is the ability to integrate IT with the framework of the business.

3.3.3.5 Dynamic IT Systems Development

Systems development related to the ability to develop new IT systems speedily. The systems development process involves meeting the challenges of constant IT requirement of the business, which is operating in a hyper-competitive environment (Rockart et al., 1996). An organization's application of its IT in order to sharpen its competitive edge can be accomplished faster with its capability to develop systems with speed (Ross et al., 1996). Dynamic IT systems development is the ability of an organization to swiftly develop IT systems in requirement of changing organizational requirements.

3.3.4.6 Dynamic IT Strategy Planning

Coordinating of complex activities is considered a significant capability that an organization can develop (Malone and Rockart, 1991). In the context of IS, this coordination is reflected by integrated of IT strategy with the strategic objectives of the organization (King and Teo, 2000, Teo and King, 1997, Henderson and Venkatraman, 1994). Planning research has since long argued for a planning system that is reflective of an adaptable planning process (Pyburn, 1983; Earl, 1993). In addition, integrating emerging IT in the strategy of the business to make it more dynamic (Boynton and Zmud, 1987; Henderson and Venkatraman, 1993) has been argued. Dynamic IT strategy planning is the ability to incorporate IT with business planning.

3.3.4.7 Dynamic IT enabled Ambidextrous Innovative Capability

Two basic approached to innovation have been prescribed- exploration and exploitation (March, 1991). These approaches when collectively practiced have been referred to as 'Ambidexterity' (Duncan 1976; Tushman and O'Reilly, 1996). This is an ability of an organization to act in response to the incremental market changes, as well as to anticipate major market shifts and respond according. This capability includes both explorative innovation, i.e. experimentation and risk taking, as well as exploitative innovation, i.e. efficiency and production, (March, 1991). Similarly, achieving both efficiency and effectiveness are two essential components to IT value (Melville et al., 2004). Dynamic IT enabled ambidextrous innovative is the capability to leverage IT for fundamentally creating new, as well as improving existing products/ processes/ structures.

The organizational dynamic IT capability model along with its constructs is illustrated in Figure 3.2. and discussed in the following section.

3.4 ODITC Model

These various organizational resources can be grouped in three major labels of: Resources, Capabilities and IT Enabled Ambidextrous Innovative Capability. Resources comprise Knowledge Resource Management, the IT Technology Management, and the IT Human Resource Management. Capabilities comprise of dynamic IT strategy planning, dynamic IT change management, and dynamic IT systems development. IT enabled Ambidextrous Innovative Capability is reflected by a combination of

exploitation and exploration. Resources are integral to the dynamic capability view. Resources can be combined and integrated into unique clusters that enable distinctive abilities within a firm (Teece et al. 1997). These resources have also been referred to as 'firm specific dynamic capabilities', which are inimitable and difficult to replicate (Teece and Pisano, 1998). This is also consistent with the RBV in general, which calls for resources to be valuable, rare, inimitable, and non substitutable (i.e., the VRIN attributes) (Lippman and Rumelt 1982, Wernerfelt 1984, Barney 1991, Peteraf 1993). In addition to this characterization, these dynamic resources are more of 'routines' in nature (Nelson and Winter, 1982). On the other hand, resources that are less tacit and more observable are what we call as 'capabilities'. For instance literature has stressed that there is a distinction between 'learning' (a resource) and 'behavior' (Hult, 2003). Similarly, Zollo and Winter (2002) stress the distinction between learning (resource) and capabilities.Collis (1994) suggests that there are higher order capabilities such as deutro-learning. In a conceptual development of dynamic capability literature, Helfat and Peteraf (2003) through a discussion on the maturity stage of a dynamic capability lifecycle imply that resources can be considered as higher order capabilities. *"Routines may become more habitual….may become more tacit in nature"* (Helfat and Peteraf, 2003). Never the less, resources and capabilities are not isolated but are part of a process, i.e. the overall of dynamic capability process. In the context of information systems, Jarvenpaa and Leidner (1998) suggest that resources can also be understood as dynamic (capabilities). This close association between resources and capabilities has been stressed in literature as 'resource complementarity', where one resource affects

another (Teece, 1986). Thus, resources are essential to the deriving the full potential from capabilities (Zollo and Winter, 2002). Literature has also referred to this as, 'enhancing relationships' (Black and Boal, 1994). Appropriately, a distinction has also been called upon to what constitutes resources and capabilities, suggesting that resources are IT infrastructure, human IT resources (Bharadwaj, 2000) and IT-enabled intangibles (Grant, 2005). In addition, research in strategic management literature suggests that 'resources' are not static but in dynamic is nature (Helfat and Petaraf, 2003).

The organizational resources provide the framework that continually facilitates the invocation of the organizational dynamic IT capability. Amit and Shoemarker (1993), define resources as "*stocks of available factors that are owned or controlled by the firm*". Extending this simple definition, we expand the scope of resources to also include outsourcing that extend beyond organization boundary. These resources are considered essential facilitating structure that fuels the organizational dynamic IT capabilities.

Literature has argued that in light of increased need to respond to the shifts in the marketplace, organizations need to stay dynamic in such scenarios, in order to consistently rise to the challenges that are emerging (Teece et al., 1997). However, organizations that lack a base of 'resources' that dynamic capability can function on, will face tremendous challenges meeting the capricious demands of the marketplace (Nelson and Winter, 1982; Henderson and Clark, 1990; Tripsas, 1997). Resources can be considered as more in lines of routines, that are built over time as are less observable

(Nelson and Winter, 2002) and in nature have a notion of " semi-automation" (Grant, 1991). Therefore, overall, capabilities are those that are more observable and those that are less observable (Collis, 1994) i.e. resources and capabilities.

Based on the organizational information processing theory (Lawrence and Lorsch, 1967; Galbraith, 1974; Tushman and Nadler, 1978), literature has established several 'resource' and suggests the significance of a flexible IT structure as one of them (Brown and Magill, 1994; Brown, 1997; Sambamurthy and Zmud, 2000; Mendelson, 2000; Weill, 2004). These structures as literature suggests, includes the quality of IT infrastructure and IT human resource as important organizational resources that contribute of capabilities of an organization (Ross et al., 1996; Broadbent and Weill, 1997; Byrd and Turner, 2000; Weill and Vitale, 2002; Williams and Will, 2004; Ross and Weill, 2004). Similarly, knowledge which is inextricably linked with learning processes is considered as a significant resource antecedent to capabilities (Collis, 1994; Grant, 1996; Zollo and Winter, 2002; Hult, et al., 2003). These clusters of resource are considered internal to an organization. However, there is also increasing interdependencies among organizations and their business partners (Walter, 1990). Literature has suggests that alternative organizational forms are essential to achieve dynamic capability (Nault, 1998; Zajac and Bazerman, 1991; Damanpour, 1991; Sambamurthy and Zmud, 2000; Child and McGarth, 2001). These alternative forms can be in the form of strategic alliances and partnerships (Eisenhardt and Schoonhoven, 1996; Simonin, 1997) and manifest in the form of outsourcing (Lacity and Hirschhiem, 1993; Lacity and Wilcocks 2001). Such resources allow an organization to increase the

permeability of its boundaries, to facilitate ‘exchange’. With outsourcing, we look at facilitating more ‘*openness*’ (GST view) and also from a viewpoint of ‘*problem solving space’* (DiRonualdo and Gurbaxani, 1998; Straub, 2004).

Consistent with the interdisciplinary theory of General Systems (GST), the lesser open organizations tend to find ways and solutions (mainly operational activities) to their strategies, competitiveness and advancements relatively within themselves. However, with outsourcing, the problems space now includes the outside. The arena of problem solving now traverses beyond the finite boundaries of the organization. That is, a third party can now takes care of some of the activities for that organization and allows it to focus on: core competencies (DiRonualdo and Gurbaxani, 1998), innovations, and learning.

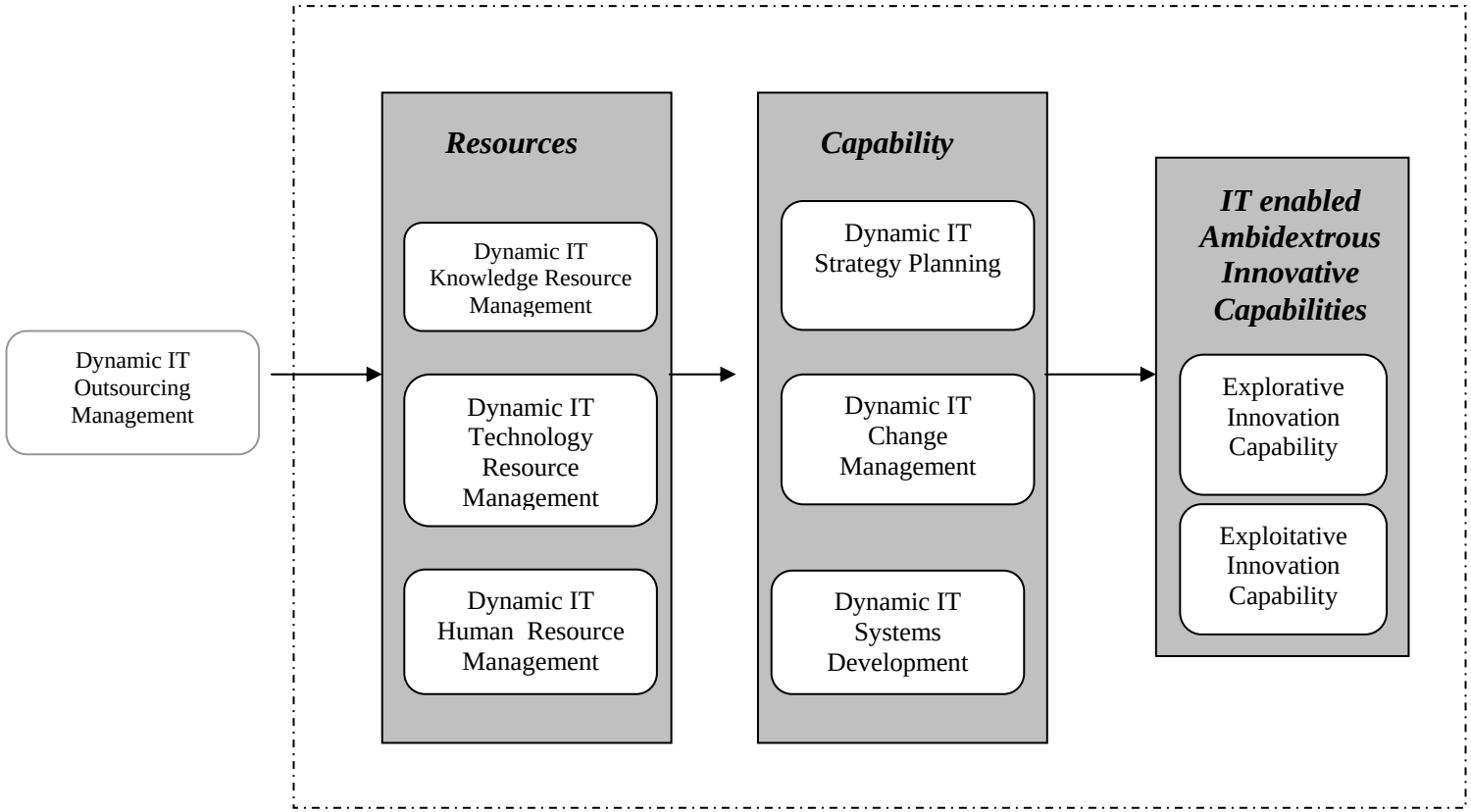

Figure 3.2: Organizational Dynamic IT Capability

3.5 Research Hypothesis

In this section, we discuss the hypotheses that are relevant for our research endeavor.

3.5.1 Dynamic IT Outsourcing Management and Resources (Dynamic IT Knowledge Resource Management, Dynamic IT Technology Resource Management, and Dynamic IT Human Resource Management)

A relationship has been stated to be one of the fundamental assets that an IT organization should have (Ross et al, 1996). One of the more significant relationships considered in a business setting is between an organization and its IT partners. Such a relationship has the tendency to augment innovation (Agarwal and Sambamurthy, 2002b), through freed organizational resources (Venkatesan, 1992).

Traditional benefits of IT outsourcing have been associated with cost savings (Lacity and Wilcocks, 1998; Gilley and Rasheed, 2000). However, outsourcing has a bigger role to play towards the realization of an organization strategic objective (DiRomualdo and Gurbaxani, 1998; Feeney and Wilcocks, 1998). Apart from the obvious availability of slack in terms of monies, the organization through outsourcing is able to reengineer and retool itself i.e. focus on its core capabilities (Quinn, and Hilmer, 1994; DiRomualdo and Gurbaxani, 1998) such as its knowledge stocks, IT technology quality, and quality of IT human resourced. In addition, outsourcing has been proposed as a means for speeding up the process of innovation through augmented learning and availability of knowledge stocks (Quinn, 2000). External relation development, such as through outsourcing, is considered an integral ingredient to knowledge creation (Eisenhardt and Martin, 2000) and learning (Ye and Agarwal, 2003). Structure of

outsourcing partnerships can be considered a type of new organizational form. Research has argued that organizational forms can enhance the extent and efficiency of knowledge absorption (Van Den Bosch et al., 1999). Another benefit associated with outsourcing is the contribution it can make in ensuring that the IT technology infrastructure of the organization stays nimble, yet flexible. Outsourcing can be an enabler in attainment of this objective (Zack, 1999). For instance, vendors can be added or switched with changing technologies (Gilley and Rasheed, 2000). This will allow quick access and exploitation of value enhancing new technology. The very nature of outsourcing enables an organization to achieve higher levels of flexibility (Lutchen, 2004). In addition to the flexibility in its IT resource, with outsourcing, an organization can have access to the learning and knowledge stocks that are readily available. This has been referred to as the 'commercial' exploitation; which focuses on 'know-how' (DiRomualdo and Gurbaxani, 1998). With non- core activities outsourced, organizations can focus on developing their IT human resources (Feeney and Wilcocks, 1998). IT staff can focus on more on 'high skill' activities (Lever, 1997), pursue exploration activities and continuous skill enhancements (DiRomualdo and Gurbaxani, 1998), and work towards better interrelationships within the organization (Feeney and Wilcocks, 1998). Motivation to outsource has been linked to effective deployment of human resource, access to advanced technology resource, and knowledge stock. This focus on resource enhancement has been called 'the strategic perspective' (Lee et al., 2003). Even practitioner oriented literature resonates a similar tone (Lutchen, 2004).

Therefore we hypothesize:

H_{1a}: *Dynamic IT outsourcing management has a positive association with Dynamic IT knowledge resource management*

H_{1b}: *Dynamic IT outsourcing management has a positive association with Dynamic IT technology resource management*

H_{1c}: *Dynamic IT outsourcing managemen has a positive association with Dynamic IT human resource management*

3.5.2 Dynamic IT knowledge resource management and Capabilities (Systems Development, Change Management, and Dynamic IT-Strategy Planning)

In today's hypercompetitive business environment, strategic advantage is often attributed to the perceptive management of knowledge resource. Strategic literature has touted knowledge as one of the more significant resources that an organization nurture (Nonaka and Takeuchi, 1995; Zack, 1999; Grant, 1996). Organization develops this resources through the constant accumulation of new knowledge which is formed both internally (e.g. double loop learning) and from outside (absorbing) and combining this with experienced based learning, e.g. 'combinative capabilities' (Kogut and Zander, 1992). This has been also referred to as, 'knowledge synergy' (Zack, 1999). Therefore, knowledge is inextricably linked with organizational learning (Huber, 1991; Thomas et al., 2001). Moreover, the constant enhancement of current knowledge stock is lead by learning (Bontis et al., 2002; Holsapple and Joshi, 2003). As put succinctly by Zack (2005), "*Knowledge is a static snapshot of the learning trajectory of an organization,*

and understanding how knowledge may confer a competitive advantage at some point in time or over time requires understanding the parallel role of organizational learning". Elaborating on this proximity of knowledge and learning, the construct of IT knowledge resource management is purported to be reflected by the higher order learning, which includes the ability to absorb from external environment. For instance lessons from past IT projects are understood by all and past mistakes in earlier IT initiatives are rarely repeated. In addition, employees are absorbing new IT and are encouraged to experiment with new IT.

Literature has suggested that learning is an essential determinant of effective change management (Orlikowski and Hofman, 1997). The learning processes that lead to knowledge are considered important not only for recognizing payoffs from IT investments, but also the process of effectively managing change (Markus and Benjamin 1997; Wilcocks et al. 1997). Strategic management literature empirically argues that learning has a vital role in the outcome of information technology (Tippnis and Sohi, 2003). However, the knowledge stocks that are created through learning do not directly affect the outcome i.e. performance but are channeled through other resources and capabilities such as planning (Powell and Dent-Micallef, 1997; Neo, 1988). Learning disabilities also severely impede the development of a system (Lyytinen and Robey, 1999; Zhu et al., 2006). This suggests that the knowledge developed through the learning processes is an important determinant of the ability to put an IT systems together effectively to meet the challenges of dynamic business requirements.

The dynamic management of knowledge, which is a critical organizational resource is vital to the dynamism is IT- strategy planning, managing change, and IT systems development. Therefore we hypothesize:

H_{2a}: *Dynamic knowledge resource management has positive effects on Dynamic IT systems development*

H_{2b}: *Dynamic knowledge resource management has positive effects on dynamic IT change management*

H_{2c}: *Dynamic knowledge resource management positively affects dynamic IT strategy planning*

3.5.3 Dynamic IT technology resource management and Capabilities (Dynamic IT Systems Development, Dynamic IT Change Management, and Dynamic IT-Strategy Planning)

Literature has voiced the significance of a flexible IT infrastructure as an important resource for the long term sustained competitive advantage of an organization (Keen, 1991; Broadbent and Weill, 1997; Sambamurthy and Zmud, 2000).

Allen and Boynton (1991) suggest that the flexibility of IT systems is among the essentials, for responding with agility to market conditions. Similarly, Rockart et al. (1996) suggest that a flexible IT infrastructure is an essential capability in an every changing global economy. Similar thoughts are echoed in practitioner oriented literature, where the infrastructure is considered a 'foundational IT capability', and its value is undisputable when it comes to speedily developing IT systems (Lutchen, 2004). Further, Duncan (1995) observed that an organization's IT infrastructure flexibility may

facilitate strategic innovations in business processes. Based on prior research, Sambamurthy and Zmud (1999) suggest that IT infrastructure management is one of the important effectors of IT-induced innovation.

Change management capabilities of organizations are affected by its IT infrastructural capabilities. According to Broadbent and Weill (1999) there is a strong association of higher level of IT infrastructure capabilities and the ability to implement extensive changes relatively quickly. Similarly, the development of a system is also facilitated by the quality of the IT infrastructure (Ross et al., 1996; Duncan1995), as well as planning (Broadbent and Weil, 1997).

Therefore, we hypothesize:

H_{3a}: *Dynamic IT technology resource management positively affects the dynamic IT systems development*

H_{3b}: *Dynamic IT technology resource management positively affects the dynamic IT change management*

H_{3c}: *Dynamic IT technology resource management positively affects dynamic IT strategy planning*

3.5.4 Dynamic IT Human Resource Management and Capabilities (Dynamic IT Systems Development, Dynamic IT Change Management, and Dynamic IT strategy Planning)

Dynamic IT personnel Management is essential, given the dynamic nature of IT. Organizations need to ensure that IT personnel remain more productive, in order to harness the capability to stay competitively afloat (Nelson, 1991). Lee et al. (1995) empirically find that IT personnel need to have business skills apart from just technology skills. Literature has also validated that the skill enhancement as well as cross functional knowledge of IT personnel are an essential program in organizations that have an eye to stay ahead in the competitive curve (Byrd and Turner, 2000). In a recent survey of selected organizations, Agarwal and Ferratt (2002a) found support for the conjecture that competitively sharp organizations almost always invest in IT personnel job encouragement and development. In an extension of the aforementioned study, Ferratt et al. (2005) empirically established the positive effects of investment in IT personnel. The capability of an IT personnel, is also considered essential to achieving a stronger fit between IT and business strategies (Bassellier and Benbasat, 2004). Moreover, communications skills along with technical and business knowledge are suggested to be essential in achieving business and IT alignment (Luftman, 2000). Through a comprehensive review of related literature Nelson (1991) suggests that IS personnel should be able to deal with new situation connected with an IS systems. Similarly, the role of IS personnel had been suggests to include stronger ties with rest of the business, and organizational planning (Bassellier and Benbasat, 2004; Feeney and Wilcocks, 1998). Therefore, we hypothesize:

H_{4a}: *Dynamic IT Human Resource Management has a positive influence on the dynamic IT systems development*

H_{4b}: *Dynamic IT Human Resource Management has a positive influence on the dynamic IT change management*

H_{4c}: *Dynamic IT Human Resource Management has a positive influence on the dynamic IT strategy planning process*

3.5.5 Dynamic IT Systems Development and IT enabled ambidextrous innovative capability

The ability to develop a systems faster than you competition and meet the challenging business requirement are essential to competitiveness (Ross et al., 1996). Competitiveness can be realized in today's world through enablement of ambidexterity in the innovation effort that is possible in part by new IT systems. (Tushman and O'Reilly, 1996). In strategy literature, it has been argued that in hypercompetitive environments, those organizations that are not only alert but can also respond quickly, are able to achieve successful outcomes (Zaheer and Zaheer, 1997). Similarly, in the context of IS, the ability to collect information on emerging technology and creativity of the IS personnel coupled with the ability to put a new IS systems quickly, has positive bearing on enabling the innovative endeavors.

In today's highly competitive business environment, the ability to innovate is considered indisputable. Literature on systems development, especially software development has stressed that the agile development processes are critical to innovative

abilities (Highsmith and Cockburn, 2001). The contribution of information technology, moreover the speed at which an information system can be contrived has immense implications for an organization's innovative ability (Hill, 1992). Structures that encourage extensive user participation are essential precondition for radical innovation (Ettlie et al., 1984). Similarly, Information technology systems capabilities are mechanism for configurability which is essential to achieving ambidexterity (Van Den Bosch et al., 1999).

Therefore, we hypothesize:

H_5: *Dynamic IT Systems Development process positively impacts an organization's IT enabled ambidextrous innovative capability*

3.5.6 Dynamic IT change management and IT enabled ambidextrous innovative capability

The IT assets literature stresses the significance of relationship in capability enhancement (Ross et al., 1996; Rockart et al., 1996). One such significant relationship is between TI and rest of the business. This helps in ensuring that IT technology 'risks' can be shared (Bhatt and Grover, 2005) and lowering of resistance to new technology by having the user participate at all levels of an implementation project (Barki and Hartwick, 1994; Nambisam et al. 1999). In a recent study of organization wanting to speedily innovate in an Internet based environment (Hackbarth and Kittenger, 2004), found that user involvement is important for executing innovation.

In a continuance of thought, effective change managing in an implementation process can greatly impact the progression of innovation (Damanpour, 1991; Nah et al., 2003). In a case study at Bose Corporation, Harkness et al. (1996) discovered that that the company's ability to sustain innovations was greatly facilitated by its change management practices, what is called, *'Managed Transformation'*. Also, literature has validated that lack of change management practices stands out as the most severe source of difficulty in business reengineering projects (Teng et al., 1995; Grover et al., 1995). Therefore, we hypothesize:

H_6: *Dynamic IT Change Management positively impacts an organizations' IT enabled ambidextrous innovative capabilities*

3.5.7 Dynamic IT Strategy Planning and IT enabled Ambidextrous innovative capability

Literature has established the significance of alignment of IT with business strategy (Henderson and Venkatraman, 1993; Segars and Grover, 1998a; Sambamurthy and Zmud, 1999). Recently, Agarwal and Sambamurthy (2002b) developing on studies of Lind and Zmud (1995), Nambisan, et al., (1999), and Brown and Sambamurthy (2002), voiced that innovation is greatly facilitated by the networking of business and IT executives, implying the need for a strategic fit between IT and business strategy. Further literature has established that the integration of business planning and IT planning greatly impacts an organization's performance (Henderson, 1990; Ross et al., 1996). In an empirical study of IS and business strategy integration (Teo and King,

1997) found evidence to support the positive effects of information systems planning integration with the planning cycle of the organization. In another study based on the Miles and Snow (1978) typology of business strategies, Sabherwal and Chan (2001) empirically found strong association of IT-strategy alignment with the business strategies of '*Analyzers*' and '*Prospectors*'.

Systems theorists such as Ackoff (1974) have suggested that dynamic organization that are able to thrive in a turbulent environment, must continuously evaluate their business plans. Similarly, Mintzberg (1978) argues that planning is not a linear process that runs on a pre-mediated time line. Literature has empirically established that a planning process which can incorporate dynamism, has a positive impact on its success (Segars and Grover, 1998a; Segars et al., 1998b; Teo and King, 1997). Ackoff (1974) has argued through the thesis of '*Interactive planning*' that this continuous planning greatly impacts an organization's ability to innovate. Similarly, in strategy literature it has been empirically established that the flexibility in planning, where a systematic planning process is adaptable to changing requirement, is positively associated with innovation (Barringer and Bluedorn, 1999). Similarly, flexibility of planning, in terms of managing dexterity (i.e., rational planning and adaptive planning), have been empirically established in IT literature as a significant factor in managing hyper-competition (Segars and Grover, 1999). Therefore we hypothesize:

H_7: *Dynamic IT-Strategy Planning is positively associated with IT enabled Ambidextrous Innovative Capabilities.*

Table 3.2 presents a summary of all the hypothesized relationships among the constructs and Figure 3.3 illustrates the hypothesized relationships.

	Table 3.2: Summary of Hypothesized Relationships
H_{1a}:	Dynamic IT outsourcing management has a positive association with Dynamic IT knowledge resource management
H_{1b}:	Dynamic IT outsourcing management has a positive association with Dynamic IT technology resource management
H_{1c}:	Dynamic IT outsourcing management has a positive association with Dynamic IT human resource management
H_{2a}:	Dynamic IT knowledge resource management has positive effects on the Dynamic IT systems develop
H_{2b}:	Dynamic IT knowledge resource management has positive effects on Dynamic IT change management
H_{2c}:	Dynamic IT knowledge resource management has positive effects on Dynamic IT strategy planning
H_{3a}:	Dynamic IT technology resource management positively affects the Dynamic IT systems development
H_{3b}:	Dynamic IT technology resource management positively affects the Dynamic IT change management
H_{3c}:	Dynamic IT technology resource management positively affects on dynamic IT strategy planning
H_{4a}:	Dynamic IT human resource management has a positive influence on Dynamic IT system development

Table 3.2- *Continued*

H_{4b}:	Dynamic IT human resource management has a positive influence on Dynamic IT change management
H_{4c}:	Dynamic IT human resource management has a positive influence on Dynamic IT-Strategy planning process
H_5:	The dynamic IT systems development process positively impacts IT enabled Ambidextrous Innovative Capability
H_6:	The dynamic IT change management process positively impacts IT enabled Ambidextrous Innovative Capability
H_7:	Dynamic IT strategy Planning positively impacts the IT enabled Ambidextrous Innovative Capability

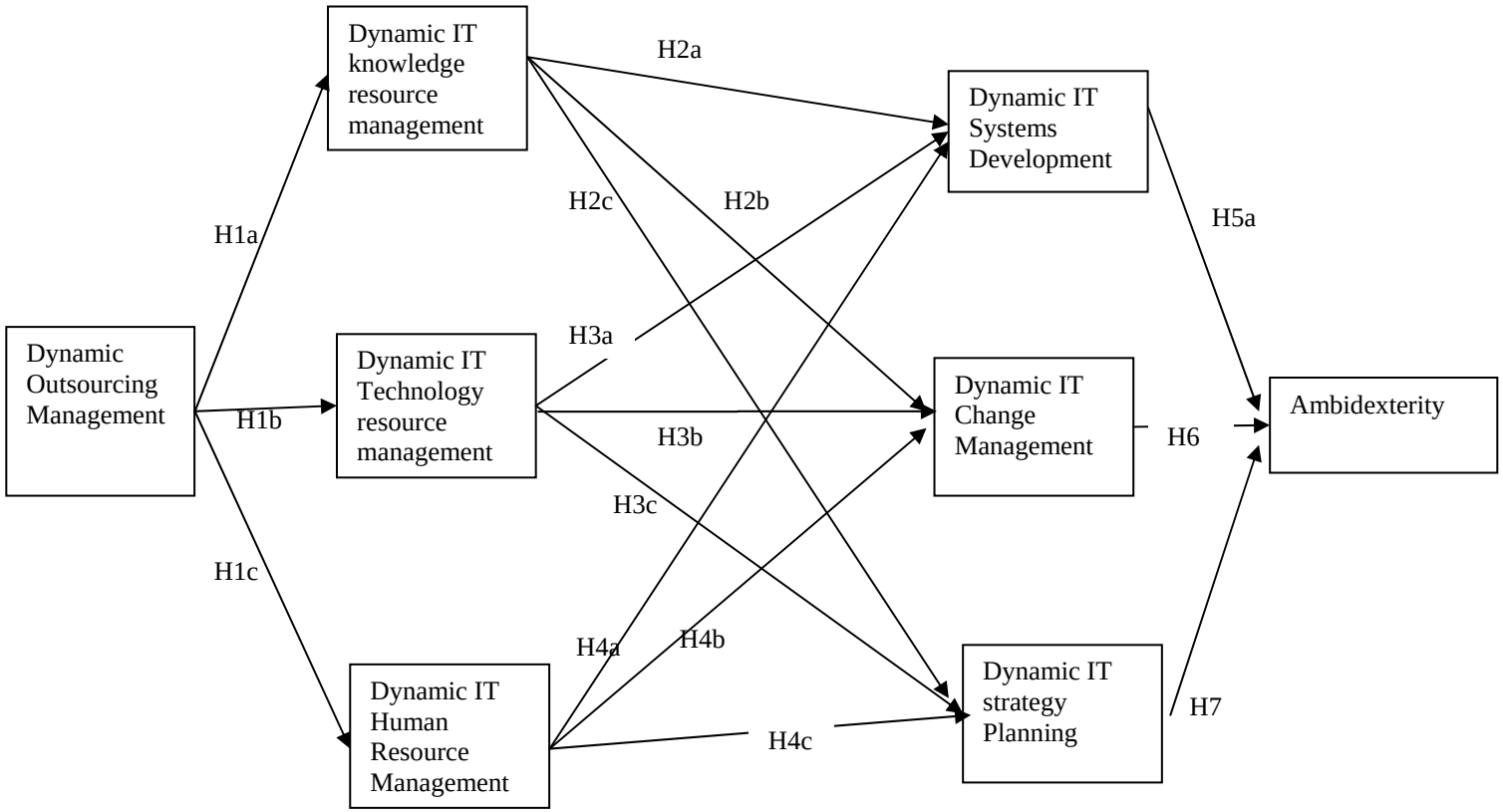

Figure 3.3: Hypothesized Relationships

3.6 Summary

In this chapter we outlined the model and the theories that inform the model such as organizational information processing theory, general systems theory, and the viable systems model theory. We then discussed the hypothesized relations between the construct that construe ‘resources’, ‘capabilities’ and ‘IT enabled Ambidextrous Innovative Capability’. Finally, we discussed the predictive relationship between ‘resources’ and ‘capabilities,

In the next chapter we discuss the specific constructs, their respective definitions and their measurement items.

CHAPTER 4

RESEARCH CONSTRUCTS

In this chapter we present the construct that are presented in the study. These construct have been group to comprise three levels. Level one concerns resource management. At level two, we examine capabilities. These capabilities form the foundational capabilities that organizations possess and develops, which in turn influence the third level of capabilities which are IT enabled ambidextrous innovative capabilities. These capabilities are those that entrench an organization to bring to fruit the combinations of its intentions and strategic objectives. Such objectives are considered essential for sustained competitive advantage in a market place characterized by turbulence and hypercompetition (D'aveni, 1994; Zohar and Morgan, 1996; Bogner and Barr, 2000).

First we present a discussion on the capabilities, followed by a discussion on the resource management and finally the IT enabled ambidextrous innovative capability.

4.1 Capabilities

At the foundational level, an organization's dynamic Information technology capability is the essential key to achieve the ambidexterity. Without this set of nucleus capabilities, the IT enabled Ambidextrous Innovative Capability will be difficult to

invoke. Underlying the broad definition of capability are several smaller key capabilities. These are: Dynamic IT-Strategy Planning; Dynamic IT Change Management; Dynamic IT System Development. Each of these constructs is discussed in the paragraphs that follow.

4.1.1 Dynamic IT Strategy Planning

Organizations are acknowledged to be both knowledge intensive (Grant, 1996; Nonaka, 1994) and information (knowledge) processing entities (Galbriath, 1974). One of most significant capabilities that such organizations possess is that of coordinating its complex set of activities (Malone and Rockart, 1991). Coordination becomes essential because organizations facing complexity and change must mange ideas, convert ideas into workable solutions, manage diversity of knowledge for a common purpose, and creating a supporting institutional infrastructure to attain their innovation goals (Van De Ven, 1986). To facilitate this coordination, it is critical that an organization possess superior abilities to forge internal partnerships and relationships (Henderson, 1990, Henderson and Venkatraman 1994; Ross et al., 1996). The significance of such strategic alignment and internal organizational relationships, has formed a long tradition in research (e.g. Sambamurthy, and Zmud, 1992, 1996b; Reich and Benbasat, 1996, 2000; Brown and Magill, 1994; Teo and King, 1997; Segars and Grover, 1998a; Chatterjee et al., 2002).

This concept of dynamic IT- strategy planning is informed by the theory of coordination (Malone and Crowstone, 1990, 1994; Crowstone, 1997) and what Kogurt

and Zander (1992) have called '*combinative capabilities'*. The coordination theory states that the processes which are designed by any organization are dependent on the mechanism of coordination that assists in managing dependencies among various business functions (Malone and Crowstone, 1994, Crowstone, 1997). Managing these dependencies (Malone and Crowstone, 1994) are often accomplished through alignment and relationships in an organizational setting (Henderson and Venkatraman, 1994; Ross et al, 1996; Rockart et al, 1996). In the context of IS, the IT strategy needs to be integrated with the strategic objectives of the organization (King and Teo, 2000, 1997, Henderson and Venkatraman, 1993; Prahalad and Krishnan, 2002). Achieving two-way strategic alignment and effective relationship with line managers are part of the eight imperatives for an organization outlined by Rockart et al. (1996). Therefore, strategic alignment of IT with rest of the organization is an important capability. This understanding is also in lines of the Anthony's (1965) classification of management activity of '*strategic planning*'. In a similar view this construct espouses the notion of knowledge synergies. Knowledge synergies within the organization have been proposed to be a major factor in affecting the dynamism of an organization (Tanriverdi and Venkatraman, 2005). Similarly, "*Seller's creation of value is analogous to a symphony orchestra in which the contribution of each subgroup is tailored and integrated- with a synergistic effect.*" (Narver and Slater, 1990). Therefore, the ability of an organization to effectively integrate its business and IT strategy are essential in achieving dynamism (Tanriverdi, 2006). Moreover, the use of specific strategy integration mechanism facilitates the dynamism is IS-strategy integration (Brown and Ross, 1999).

The construct of Dynamic IT-Strategy Planning is concerned with the alignment of IT with the strategy of the business. Mintzberg (1978), states that a strategy is identified by a plan. Planning research has since long argued for a planning system that is reflective of an adaptable planning process, where there is a balance between following guidelines and incorporating change (Pyburn,1983; Earl, 1993; Segarrs and Grover, 1999). This in essence, is reflective of the dynamic IT strategy planning process. This adaptive dynamism has been referred to as the 'Adaptive Strategy', where the organization is highly receptive to the inputs (in our case, new IT) from the environment and modifies its strategy to enhance its competitive advantage (Chaffe, 1985). In an allied thought, literature has recommended incorporating emerging IT in the strategy of the business to make it more dynamic (Boynton and Zmud, 1987; Henderson and Venkatraman, 1993). In parallel, IT planning literature has empirically validated the positive organizational impacts of not only the supporting and influencing role if IT on business strategy but also the concurrency of IT and business planning (Teo and King, 1996). In the context of high velocity environment, Eisenhardt (1989) signals the importance of studying the frequency of decision making, i.e. planning. This significance has been empirically validated in literature (Segars et al., 1998b). We therefore, formally define the construct as, "***the ability to follow a dynamic planning process which incorporates IT with business planning"***. The representative items appear in Table 4.1

Table 4.1: Dynamic IT-Strategy Planning Measures	
Items	**Source**
1. Our IT planning process is disciplined yet adaptive to internal and external changes. 2. IT and business planning are developed concurrently in the same integrated planning process. 3. IT planning is able to take changes in business strategies into consideration 4. Our top IT managers are able to introduce new IT that often influences the strategic directions of business. 5. Business strategies are often influenced by emerging IT that may provides decisive advantages against our competitors. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1, 3-5 are new scales informed by Tanriverdi, 2006; Pyburn,1983; Earl, 1993; Segars and Grover,1999; Boynton and Zmud, 1987; Henderson and Venkatraman, 1993; Luftman, 2002 Item 2 is adopted from Teo and King., 1997

4.1.2 Dynamic IT Change Management

This construct is concerned with the post IT – Strategy integration. It answers the question of what is next. The next step is to ensure that this (IT – Strategy) integration is able to percolate to all levels within the organization. At this level, two factors come into prominence, they are: managing implementation and managing change. Managing for implementation success is considered a critical aspect in most organization IT systems (Davenport, 1990). The dynamism created in managing implementation projects is largely depended on social aspects than technology itself (Teng et al, 1998; Scott and Vessey, 2002). Research on the social aspect of success in implementation, has attributed it to the involvement of the user (Ivés and Olsen 1984;

Tait and Vessey, 1988; Baronas and Louis, 1988). However research later established that success is predicted more effectively by the extent of user participation (Barki and Hartwick, 1994; McKeen, 1994; Ross et al, 1996; Hunton and Beeler, 1997; Wixom and Watson, 2001). Participation of the user is distinct from user involvement (Barki and Hartwick 1989) and has been found to be stronger indicator since it includes a user's beliefs and attitudes (Barki and Hartwick 1989). Prior literature has made a clear distinction between the two (e.g. Jarvenpaa and Ives, 1991; Kappelman and McLean, 1991).

The other important aspect of Change Management is the ability of the organization to effectively mange change associated with the implementation process. Change Management literature dates back to the classical Lewin (1947), theory of change. The theory suggest three sequential change phases: 1) unfreezing- creates a climate for change and encompasses the idea of disconfirmation of existing stable patterns 2) moving- analysis, design and installation, 3) Refreezing- institutionalizing the change, where an equilibrium is enforced at a new level. Alternatives to Lewin's theory proposed that the model is valid only for stable and predictable environment and therefore a model for change management has to reflect dynamism (Mintzberg, 1994). Subsequently, informed by the work of deliberate and emergent strategies by Mintzberg (1994), Orlikowski and Hofman (1997) offer an undated to the theory to include change along with stability. The significance of change management is an important ability in managing an IT implementation project (Grover et al., 1995; Kettinger et al., 1997). Effective change management associated with an IT implementation project needs the

involvement of a project champion or the involvement of a top management (Beath, 1991; Gratton & Goshal, 2005; Subramani, 2004). In addition, communication and planning for defraying the resistance to change is an essential ingredient in the change management process (Brown, 2006).

Effective change management fits in with the management control theory, as articulated by Anthony (1965). Given the preceding discussion, we formally defined, Change Management as," ***the ability to effectively manage the change process in integrating new IT within the context of the organization***". The representative items appear below in Table 4.2.

Table 4.2: Dynamic IT Change Management Measures

Items	Source
1. We have high-level champions and/or sponsors to effectively facilitate the change process in new IT initiatives. 2. We have excellent top management support for the change effort involved in implementing new information systems. 3. We are able to plan and effectively manage people's resistance to change during systems implementation. 4. We are good at communicating with people affected by the changes while implementing a new IT system. 5. We have competent project team members who effectively facilitate the change process involved in new IT initiatives. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1, 2,5 are new items, informed by Beath, 1991; Gatton and Goshal, 2005; Subramani, 2004 Items 3 and 4 are adapted from Brown (2006)

4.1.3 Dynamic IT Systems Development

The concept of systems development refers to the ability to develop new technological systems. Such development is speeded up through constant experimenting by the employees of the new systems (Jarvenpaa and Leidner, 1998). This process involves the challenge of meeting constant IT requirement of business that operate in a hyper-competitive environment. Essential to the concept of systems development is habit of keeping an eye out for emerging technology (Jansen et al, 2005), and the speed with a competitive challenge can be answered by developing an IT system. These aforementioned facets have been referred to as 'alertness' or 'information orientation' 'responsiveness' (Marchand et al., 2000; Zaheer and Zaheer, 1997). Therefore, this construct has a tuning into the notion of anticipation and being able to react with speed (Wade and Hulland, 2004). The process of developing systems can no longer 1) work in isolation of the business, user participation are considered critical; 2) information requirements have become organizationally integrated; 3) development time has to be quick, in order to respond to the changing requirements (Rockart, et al., 1996). Essential to the development of a system is the participation by a user that has an impact of the success of the system (Barki and Hartwick, 1994; Hunton and Beeler, 1997). An organization's use of information technology to enhance its competitive edge can be augmented when its able to acquire the capability to develop systems on-time i.e. with speed (Ross et al., 1996). In order to energize the system development process i.e. to be in tune with changing requirements, keeping up with new technology is essential (Lyytinen and Robey, 1999). Moreover, systems are distinct from 'routines' i.e.

resources, in that they are more explicit and observable (Van Den Bosch et al., 1999). We formally define dynamic IT systems development as, "***the ability to effectively develop new IT systems to meet dynamic business requirements".*** The representative items are in Table 4.3.

Table 4.3: Dynamic IT System Development Measures

Items	Source
1. Compared to our competitors, we are able to successfully develop and deliver new IS systems faster. 2. Users always participate in and contribute to successful IT development projects. 3. In our organization, IT innovations often come from employees, leading to the development of many new IT/IS systems. 4. We constantly collect information on new technologies, through trade shows, conferences, etc, in order to launch innovative IS development projects. 5. We have been effective in developing new IT/IS systems to meet dynamic business requirements. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	All items are new scales, informed by Hunton and Beeler, 1997; Jansen et al., 2005; Zaheer and Zaheer, 1997; Jarvenpaa and Leidner, 1998; Barki and Hartwick, 1994

4.2 Resources

Under the umbrella concept of resources we discuss the Dynamic IT technology resource management, Dynamic IT human resource Management, and Dynamic IT knowledge resource management.

4.2.1 Dynamic IT Technology Resource Management

IT infrastructure emerged as one of the most important IT management requirement, in a study by Brancheau et al. (1996). IT infrastructure is considered important for the overall competitiveness of an organization (Keen, 1991; Venkatraman, 1991; Weill et al., 2002). Broadbend and Weill (1997) have specifically asserted that, "*An Information Technology infrastructure is vitally important to companies...*"

IT infrastructure components such as computer and communications technologies and IT personnel together provide shared IT services (Broadbent and Weill, 1997). In other words, IT infrastructure is an enabling foundation of shared IT capabilities. IT infrastructure flexibility renders it dynamic (Venkatraman, 1991). With a rapidly changing and evolving market, organization needs to respond as soon as possible. The ability to respond and to anticipate change requires responsive Information Technology infrastructure, which is highly flexible (Quinn, 1992). Therefore, the flexibility of IT infrastructure is essential to achieving organizational goals (Davenport and Linder, 1994; Venkatraman, 1991). Similarly, Ross and Rockart (1996b) suggest that increased competitiveness requires a certain degree of dynamism which can be achieved through a flexible infrastructure. Moreover, as organizations

integrate electronic business with the traditional business practices the capability to keep the Information Technology infrastructure is considered vital (Weill and Vitale, 2002).

Literature encompasses two main aspects of infrastructure. These are the technology assets and human assets (Ross et., al, 1996; Broadbent and Weill, 1997; Duncan, 1995). These two aspects of IT assets and human resources have been neatly captured by Byrd and Turner (2000) definition, *"…the shared IT resources consisting of a technical physical base of hardware, software, communications technologies, data, and core applications and a human component of skills, expertise, competencies, commitments, values, norms, and knowledge that combine to create IT services that are typically unique to an organization.*". However, although the construct of IT infrastructure and IT personnel is related they are distinct (Broadbent and Weil, 1993; 1997; Henderson and Venkatraman, 1994). Therefore, we discuss the IT personnel management as a separate construct. For the purpose of our thesis we separate these two constructs and focus on IT infrastructure.

Dynamic IT Infrastructure resource Management is concerned with keeping the IT infrastructure malleable, in order to keep up with the demands of rapidly changing and evolving market conditions (Brown and Sambamurthy 1999; El Sawy, 1999; Sambamurthy and Zmud, 2000). In other words, the question raised is how to keep the IT infrastructure flexible enough to adapt to changing requirements. In light of the arguments presented in this section, we formally define Dynamic Information Technology Resource Management as, "***the ability to sustain a high level of flexibility***

and quality of IT infrastructure for supporting evolving organizational initiatives."

The representative items for this construct appear below in Table 4.4.

Table 4.4: Dynamic IT Technology Resource Management Measures	
Items	**Source**
1. We enforce standards that ensure compatibility of new IT platforms with existing ones 2. We follow processes through which legacy IT systems do not limit the development of new IT systems. *3.* We are able to integrate different and distributed IT systems by keeping the data architecture flexible. *4.* We do a good job in making evolutionary changes to our IT platforms over the years in order to support our business initiatives. *5.* By linking different and distributed IT platforms, our IT infrastructure has helped us to integrate internal and inter-firm business processes. 6. We are effective in supporting new strategic initiatives by keeping IT systems scalable. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1-2 adapted from Duncan, 1995 Items 3-6 are informed by Broadbent Weil, 1999; Duncan, 1995; Henderson and Venkatraman, 1994; Brown and Sambamurthy 1999

4.2.2 Dynamic IT Human Resource Management

As previously noted, IT personnel is related but distinct from IT infrastructure (Broadbent and Weil, 1993; 1997; Henderson and Venkatraman, 1994). Therefore, the management of IT personnel is separate from that of managing for flexibility of IT infrastructure. IT human resource is considered as one of the three important assets

related to IT (Ross, et al, 1996). The IT personnel is considered valuable and indispensable, when they demonstrate the ability to understand the organization's business and develop a certain degree of proactiveness (Reich and Benbasat, 2000; Roepke et al., 2000). More importantly, since skills of IT personnel tend to erode rapidly in light of evolving IT (Agarwal and Ferratt, 2002a) their ability to upgrade skills is crutial (Broadbent and Weil, 1997). The capability of an IT personnel to establish greater connection with others in the organization along with achieving a stronger fit between IT and business strategies (Bassellier and Benbasat, 2004), is highly dependent on the business knowledge of IT personnel (Nelson, 1991; Lee et al., 1995; Brown and Sambamurthy, 1999). Under the contingency perspective (Lawrence and Lorsch, 1967), involving IS integration, business competence of IS executive has been found to essential (Teo and King, 1997; Byrd and Turner, 2000) was the best predictor of the extent of integration of IS with rest of the business planning. Literature has alluded to this, as the development of 't-shaped' knowledge (Hansen and Otinger, 2001). Further, literature asserts that building this dynamic capability in IT personnel enables them to be increasing valuable to an organization (Feeney and Wilcocks, 1998).

Along with the management of IT personnel that supports their dynamic ability, empowerment in workplace has been established in the literature as an essential ingredient in organizational success (Kanter, 1983; Thomas and Velthouse., 1990; Spreitzer, 1995). Such empowerment and motivation has been suggested to lead to improved trust among organizational personnel (Locke and Schweiger, 1979). In a study of several organizations to ascertain successful IT personnel recruitment and

retention practices, Agarwal and Ferratt (2002a) discovered that training and reward were on the top of the list.

Dynamic IT Personnel Management is the capability of an organization to manage its IT personnel so that they are motivated, knowledgeable about the business functions and can work is different job settings. We therefore, formally define, Dynamic IT Human Resource Management as, "***IT personnel's capabilities to meet the organization's changing IT requirements***". The representative items for this construct appear below in Table 4.5.

Table 4.5: Dynamic IT Human Resource Management Measures

Items	Source
1. Our IT personnel are able to upgrade their skills in keeping with our IT thrust. 2. Our IT personnel often come up with innovative ideas for new IT initiatives. 3. Our IT personnel have excellent business skill, enabling them to develop IT solutions that satisfy business needs. 4. Our IT personnel are good at communicating in non-technical terms. 5. Our IT personnel have excellent technical skill, enabling them to develop IT solutions using the latest techniques. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1 is adapted from Broadbend and Weill, 1997 Items 3 adapted from Bassellier and Benbasat, 2004 and informed by Rockart et al., 1996 Items 2, 4,5 are new items, informed by Bassellier and Benbasat, 2004; Byrd and Turner, 2000; Reich and Benbasat, 2000

4.2.3 Dynamic IT Knowledge Resource Management

Knowledge has been considered as one of the most significant resource in literature (Nonaka and Takeuchi, 1995; Grant, 1996, 2005). Inextricably linked to the theory of knowledge creation is the concept of 'learning' (Huber, 1991; Thomas et al., 2001). Knowledge resource management has been associated with the concept of organizational learning than any other (Grant, 2005). Often learning has been referred to as new knowledge (Kogut and Zander, 1992). Learning is considered a key to developing intangible resources and people based resources, such as stocks of knowledge (Itami, 1987). Learning embodies the enrichment in the status of an organization's knowledge resource (Holsapple and Joshi, 2003). Dynamic IT knowledge resource management is reflective of the concept of learning cycle. Organization are considered dynamic because they are constantly scanning the environment, making sense of the new knowledge along with the prior understanding and applying it for an outcome , and applying the lesson learnt (Daft and Weick, 1984). Literature has emphasized the importance of learning as a conscious management technique for sustained competitive advantage (Szulanski, 1996; Zollo and Winter, 2002). In the strategic literature, learning is related to the concept of '*strategic sense making*' (Thomas et al., 1993, 2001; Schwandt, 2005; Duncan and Weiss, 1979). Thus, this learning cycle is the essence of a dynamic learning capability

The construct of dynamic IT knowledge resource management is therefore derived from two major concepts: information gathering and assimilation of new knowledge in conjunction with the old, and learning from the application of such

knowledge. The former concept is what we call ‘Absorptive capability’ and the latter, ‘Learning capability’. Both these concepts are discussed in the paragraphs that follow.

4.2.3.1 Absorptive Capability

The concept of absorptive capacity was introduced in the learning literature by economist Cohen and Levinthal (1989; 1990), in their seminal work on the effects of ‘R and D’ units in organizations. They defined absorptive capacity as “*Firm’s ability to identify, assimilate, and exploit knowledge from the environment is what we call a firm’s ‘learning’ or ‘absorptive capacity*” (Cohen and Levinthal, 1989). They further added that absorptive capacity is, *“…the ability to predict the nature and commercial potential of a technological advances*” (Cohen and Levinthal, 1990). In essence, absorptive capacity is the ability of an organization to take advantage of new external information (Cohen and Levinthal, 1989; 1990; 1994). Similar ideas are resonated in knowledge process theories, and the concept of knowledge integration (Grant, 1996; Van Den Bosch et al., 1999). In organizational literature, absorptive capacity also shares a similar though in concept of what is called ‘combinative capabilities’ (Kogurt and Zander, 1992). The phase of identifying knowledge is the attention that management gives to new ideas and potential needs of that organization (Van De Ven, 1986).

Absorptive capability encases the views of *acquire* and a*ssimilate*. This conceptualization of absorptive capability has been called ‘*potential absorptive capacity*‘(Zahra and George, 2002); ‘*value* and *assimilate*’ (Cohen and Levinthal, 1990); ‘*Know-what’* and ‘*Know-why’* (Lane and Lubatkin, 1998); the concepts of ‘*intelligence gathering*’, ‘*dissemination*’, and ‘*shared mindset*’ of the information

orientation construct (Jaworski and Kohli, 1993; Day, 1994). Acquire relates to scanning for new and potential IT. Assimilate is the next stage; forming an understating of what can be done with the new/ potential IT. Both the acquirement and assimilation of new IT happens at two levels. At top level there is a dedicated team or the top management and then through a process of percolation, others in the organization are able to develop an understanding as well. It is also critical that both 'acquire' and 'assimilate' have a short cycle time.

Dynamic Absorptive capability is reflective of the IT knowledge that an organization is able to garner (Boynton and Zmud, 1994). Organizations have processes that enable constant intelligence gathering on new and potential IT (Benamati and Lederer, 2001; Wheeler, 2002). This is followed by formulating a perspective on the potentiality of the identified IT (Wheeler, 2002). Formally defined, Dynamic Absorptive capability "**the *ability to acquire and absorb knowledge and the competency related to emerging information technologies***". The representative items for this construct appear below in Table 4.6.

Table 4.6: Dynamic Absorptive Capability Measures	
Items	**Source**
1. We provide incentives to our employees and encourage them to learn and absorb new information technologies. 2. We have effective education and training programs for our employees to acquire critical new IT skills. 3. Our employees constantly learn new IT. 4. Our employees are innovative in their use of existing IT. 5. Our employees are good at experimenting with emerging IT. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Item 1-2 informed by Jiang and Klein, 1999; Moore, 2000 Items 2-5 are new items informed by Cohen and Levinthal, 1990; Wheeler, 2002

4.2.3.2 Learning Capability

The importance of learning in organizational transformational literature has been voiced often (Robey and Sahay, 1996; Robey and Boudreau, 1999). Learning refers to the concept of behavior changing as a resultant of experiences, mistakes and wisdom garnered Learning has been described in literatures as a change in behavior resulting from experience (Fiol and Lyles, 1985; Levitt and March, 1988; Huber, 1991; Barabba and Zaltman, 1991; Slater and Narver, 1995). Organization must continually adapt and leverage their other abilities in order to deal with rapidly changing environment and achieve dynamism (Dodgson, 1993; Teece et al., 1997; Eisenhardt and Martin, 2000).

Several converging definitions of learning are present in literature. For instance, DiBella and Nevis (1998) define Organization Learning (OL) as "*the capacity or processes within an organization to maintain or improve performance based on*

experience"; Hurley and Hult, (1998) define OL as "*Knowledge or insights that influence behavior*". Huber (1991) has defined OL as a process that enables an entity to increase its range of potential behavior through its processing of information or knowledge. From there various definitions, is it evident that experiences of an organization are critical to stay dynamic. Such experience can be both positive and negative. Learning occurs not only from application of new knowledge but also from the previous application of knowledge to minimize the mistakes of the past. In line with this, Argyris and Schön (1978) define organizational learning as: "*the detection and correction of error*".

Learning is usually considered to be of three types, Single Loop; Double Loop and Deutro (Argyris and Schön 1978). *Single-loop learning* is about detection and correction or 'errors', where organizations continue with their present policies and goals. Dodgson (1993), states that single-loop learning can be equated to activities that add to the knowledge-base or firm-specific competences or routines without altering the fundamental nature of the organization's activities. This is similar to the notion of 'absorptive capability' as discussed earlier. Single-loop learning has also been referred to as "*Lower-Level Learning*" by Fiol and Lyles (1985), "*Adaptive Learning*" by Senge (1990), "*Non Strategic Learning*" by Mason (1993), and "*Responsive Market Orientation*" by (Narver and Slater, 1990; Slater and Narver, 1995). *Double-loop learning*- In addition to detection and correction of errors, the organization questions and modifies its existing norms and strategic objectives. This involves changing the organization's knowledge-base or firm-specific competences or

routines (Dodgson, 1993). Double-loop learning is also called "*Higher-Level Learning*" by Fiol and Lyles (1985), "*Generative Learning*" by Senge (1990),"*Strategic Learning*" by Mason (1993), and "*Proactive Market Orientation*" by (Narver and Slater, 1990; Slater and Narver, 1995). Mason (1993) defines strategic learning as "*the process by which an organization makes sense of its environment in ways that broaden the range of objectives it can pursue or the range of resources and actions available to it for processing these objectives*." Based on the various understandings advanced in literature above, double loop learning subsumes single-loop learning. *Deutero-learning*.-This is demonstrated by an organization that practices both single-loop learning as well as double-loop learning. The organizations must be aware that learning must occur. Being aware of ignorance stimulates learning (Nevis et al., 1995). Simply put, learning has three levels. At level one, the organization simply uses new knowledge to adapt or respond (correction of error) to the shifts in the marketplace, without changing its strategic objectives. At the second level, the organization is able to modify its behavior i.e. change its strategic objectives. While at the third level, the organization is able to not only respond to the demands of the market place, modify its strategy based on its past experiences, but also constantly evaluate the very nature of its business.

With reference to IS research, literature had found that negative information (errors) enhances learning (Sussman and Sproull, 1999; Sein and Santhanam, 1999), and without double loop learning, organization tend to gravitate towards stasis and are unable to be dynamic (Stein and Vandenbosch, 1996). Hamel and Prahalad (1993) state that learning processes in the form of capabilities are essential for organization's

viability. From the view point of IT, learning reflects the experience of IT deployment that are considered important for future IT deployment. In strategy formulation, learning has been emphasized as central aspect in organization transformation (Henderson and Venaktraman, 1993). We formally state learning capability as, "**the *ability to successfully apply lessons learned from previous IT experience towards future IT initiatives***". The representative items for this construct appear below in Table 4.7.

Table 4.7: Learning Capability Measures

Items	Source
1. Lessons from past IT projects are effectively shared throughout the organization. 2. We have effective communication channels, such as discussion groups and forums, to learn from previous IT implementation efforts. 3. Lessons from past IT projects are well documented and understood. 4. Similar mistakes in IT initiatives are seldom repeated. 5. Previous experience is always an important input to new IT decisions. 6. We have a rigorous process for post-implementation IT project reviews. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1-5 are new items informed by Nevis et al., 1995; Fiol and Lyles, 1985; Senge, 1990; Argyris and Schön 1978; Huber, 1991; Leonard, 1995 Items 6 is adapted from Day, 1994

4.3 Dynamic IT Outsourcing Management

This construct is about managing your IT vendors i.e. your outsourcing business partners in order to leverage the relationship with vendor and take advantage of outsourcing your IT function. Outsourcing has three primary objectives. These are: controlling costs and enhancing the efficiency of IT, improving the overall contribution of IT to business, leveraging existing expertise in the marketplace, and attainment of flexibility in the infrastructural resource (DiRomualdo and Gurbaxani, 1998; Straub, 2004; Zack, 1999). One of the first pioneering efforts in offering to delineate the advantages of outsourcing was done by (Loh and Venkatraman, 1992), where they employ the diffusion of innovation theory. Traditionally research on IT outsourcing has looked into it from the viewpoint of cost reduction and the economic theory of reducing transaction costs (Ang and Straub, 1998; Wang, 2002). However, research has also found that there are other advantages of outsourcing, such as the quality information (Teng et al., 1995).

The quality of the partnership has been found to impact the dynamism of an organization (Grover and Cheon, 1996; Lee and Kim, 1999; Kishore et al., 2003). With today's net enabled economy, the traditional advantages of cost and economics of scale (Lacity and Hirschheim, 1993) do not appear to be the only critical reason to outsource IT (Tardiman, 2000; Lacity and Wilcocks, 2001). Further, based on a literature review on outsourcing, Dibbern et al., (2004) revealed a focus on capability enhancement and the ability to transform the organization (DiRomulando and Gurbaxani, 1998; Fowler and Jeffs, 1998). In the similar vein, Lee et al. (2004) empirically suggest, based on

residual rights theory of networks, that organizations in order to achieve more dynamism through knowledge transfer and acquisitions will seek long term relationships with the outsourcing partners.

Consistent with the new theorization of the benefit of outsourcing, organizations need to forge new outsourcing partnerships, as well as leverage its current outsourcing partnerships, in order to facilitate strategic advantage, beyond economic advantage. Such capability development (on an on-going basis) is what we call 'Benefit of Outsourcing'. Therefore, we formally define it as, "***ability to benefit from outsourcing***". The representative items for this construct appear below in Table 4.8.

Table 4.8: Dynamic IT Outsourcing Management

Items	**Adapted from**
1. We have access to skilled IT personnel through our outsourcing providers which we otherwise would not have. 2. Our outsourcing vendors can provide less costly IT human resource than we can. 3. We have access to technologies through our outsourcing providers which we otherwise would not have. 4. Our outsourcing vendors can provide less costly IT infrastructure (such as data center and networking) than we can. 5. Outsourcing enables us to implement IT projects that we otherwise would not be able to. 6. Outsourcing has reduced the risk of technological obsolescence. 7. Outsourcing has afforded us more resources for enhancing our core competency and new strategic initiatives. 8. Outsourcing enables us to develop new IT systems much faster. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1-4 are adapted from Lee et al., 2004 Items 5 is new scales, informed by Lee and Kim, 1999; Grover and Cheon,1996 Items 6-8 are new scales informed by DiRomulando and Gurbaxani, 1998; Zack, 1999;

4.4 IT Enabled Ambidextrous Innovative Capabilities

This construct is concerned with innovation capabilities. Organizations have two dominant approaches to innovation. There are exploration and exploitation (March, 1991). This positioning of mantle capabilities can be understood from the perspective of 'Ambidexterous Organizations' (Duncan 1976; Tushman and O'Reilly, 1996; He and Wong, 2004; Jansen et al., 2005). Brown and Eisenhardt (1997) and Eisenhardt (2000) have referred to this as the 'management of paradox of efficiency and effectiveness'. The IT literature refers to this in the concept of 'IT value' and observes that achieving both efficiency and effectiveness are two components to IT value (Melville et al., 2004). In this concept of ambidexterity, an organization must be able to mange both evolutionary (incremental) change, as well as revolution (rapid) change. Ambidextrous organizations are able to develop skills to sustain themselves in market that can be stable, at the same time have skills to adapt to constantly changing market conditions. In other words, an organization is able to act in response to the incremental market changes and also possess the ability to anticipate major market shifts and respond according. This collective ability is the key to sustained competitive advantage. In similar vein, this concept of ambidexterity is allied in meaning with 'dynamic stability', where organizations through knowledge management are able to achieve both efficiency and effectiveness (dynamism) in their products, as well as processes (Boynton and Victor, 1991). Converging on the similar thoughts, organizational change management literature also suggests that there are two basic changes i.e. episodic and continuous, which emphasize short run adaptability as well as long run adaptability

(Weick and Quinn, 1999) This concept has been further refined to 'contextual ambidexterity', which is a capability where not only does a business unit aligns its activities but also meets (adaptability) the reconfigurability challenges bought about by turbulent market conditions (Gibson and Birkinshaw, 2004). Figure 4.1 illustrates the position of ambidextrous organization.

		EXPLOITATION	
		Low Efficiency	***High Efficiency***
EXPLORATION	***High Effectiveness***	**Revolutionary** Enactment Episodic change Invention/Innovation	**Ambidexterity** Dynamic stability
	Low Effectiveness	**Decay**	**Evolutionary** Reactment Continuous Incremental change

Figure 4.1: Ambidexterity Matrix

This capability includes both explorative innovation, i.e. variation, experimentation, flexibility, and risk taking, as well as exploitative innovation, i.e. efficiency, selection, production, selection, and execution (March, 1991). The concept of innovation in general addresses the implementation of new idea, products and processes (Thompson, 1965). The ability to innovate is reflected by the concept of 'capacity *to innovate'*. Capacity to innovate alludes to an organizations ability to adopt

or implement the new idea or insight successfully (Hurley and Hult, 1998). This idea is also similar to the concept of 'pre-diffusion of innovation' (Rogers, 1983).

4.4.1 Explorative Innovation Capability

Explorative Innovation Capability is the ability of organizations to match the usefulness identified in a new IT, i.e. new knowledge (Levinthal and March 1993; McGarth, 2001) with new opportunities for competitive advantage (Wheeler, 2002). In essence, the organization discovers new actions that are promising. According to Davila et al. (2006), "*exercise in exploration where there might be something relevant in a particular direction but what will be found is unknown*". This is similar in idea to that proposed by Burns and Stalker (1961) of having 'organic structure' rather than a 'mechanistic structure' that impedes innovation. These varying ideas tie in with the notion of an organization that ventures out, takes risks, and is open to experimentation (March, 1991). Ideas similar to explorative innovative capability are reflected in other literature. For instance, in entrepreneurial literature, the concept of entrepreneurial orientation alludes to the ability to be proactive, taking risks (Mintzberg, 1973; Lumpkin and Dess, 1996; Sambamurthy et al., 2003). Likewise, the typology of '*prospectors*' (Miles and Snow, 1978); '*strategic orientation*' (Venkatraman, 1989) are similar in idea to explorative abilities.

The concept of explorative innovation goes beyond just products and services. With the ability of applying IT, the organization now possesses the ability to make radical structural changes (Malone and Rockart, 1991). This thought is in line with

structuration theory literature (Giddens, 1979) and adaptive structuration theory (Desanctis and Poole, 1994). This aspect of IT having an impact on the organization structure has been studied in literature as 'structuration duality', (Orlikowski, 1990; Grover et al., 1997). Therefore, explorative innovative capability is the ability of an organization to take risks, experiment by using the new enabling Information Technology to bring about radical changes not only to its products and services but also changes its structure and form. We formally define Explorative Innovative Capability as the "***ability to leverage IT to create fundamentally new products/ processes/ structures***". The representative items for this construct appear below in Table 4.9.

Table 4.9: Explorative Innovative Capability Measures

Items	Source
1. We have used IT creatively in introducing new products or services. 2. We are able to use IT innovatively to open up new markets. 3. We are good at exploring the potential of IT for breakthrough business performance 4. IT has been used innovatively in fundamentally transforming the structure of our organization. 5. We excel at innovative applications of IT with decisive strategic business impacts. 6. We have been successful in using IT to radically improve business processes and procedures. 7. We are good in implementing high-risk IT projects involving new technologies. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1 is adapted from He and Wong, 2004 Item 2 is informed by Wheeler, 2002 Items 3-7 are new scales informed by Levinthal and March, 1993; Davila et al., 2006; March 1991; Mintzberg, 1973; O'Reilly and Tushman, 2004

4.4.2 Exploitative Innovation Capability

Exploitative ability is explained by adjectives such as: efficiency, selection, production, selection, and execution (March, 1991). Eisenhardt (2000) has referred to this as the other side of the 'paradox' i.e. efficiency. Exploitation builds on what is already know. Davila et al. (2006) define exploitation as, "*exercise in problem solving, where the goal is know, but how to get there needs to be solved*" Exploitative innovative capability is concerned with the organization making incremental changes to its existing products, services and structures. This ability to make incremental adjustments and improvement to existing products and services is considered when organizations are faced with to compete in mature and stable market at times of discontinuous change (Tushman and Anderson, 1986), need to focus on enhancing existing products and services, apart from radical innovations (Sorensen and Stuart, 2000). Exploitative innovative capability is closely allied with a 'conservative model of innovation', as apposed to an 'entrepreneurial model' (Miller and Friesen, 1982). The conservative model suggests that the motivation to innovate basically stems from the view point of security, i.e. the need to stay competitive.

Exploitative innovate capability is the ability of the organization to utilize its new knowledge of the value of new Information Technology, to enable it make improvements in its existing stock of products and services. Similarly, be able to make small adjustments to its structure. We formally define exploitative innovate capability as the "***ability to leverage IT to improve existing products/ processes / structures***". The representative items for this construct appear below in Table 4.10.

Table 4.10: Exploitative Innovative Capability Measures	
Items	**Source**
1. We are good at using IT to gradually improve service and/or product quality over time. 2. Over the years, IT has been successfully used to incrementally improve our business processes and procedures. 3. We do very well with IT projects that use proven technology and are generally less risky. 4. Our organizational structure has improved steadily over time as a result of IT implementation. 5. We are making gradual but steady progress in using IT to reduce costs. 6. We are good at using IT for maintaining satisfactory business performance. © James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006	Items 1,5 are adapted from He and Wong, 2004 Item 3 is adapted from Venkatraman, 1989 Items 2, 4, 6 are new scales. Item 4 is informed by Miller and Friesen, 1982; March, 1991; Tushman and Anderson, 1986; O'Reilly and Tushman, 2004

4.5 Conclusion

This chapter discussed the major construct of our study. We outlined the three sets of constructs (Resources, capabilities and IT enabled ambidextrous capabilities) as centripetal to an organization's dynamic IT capability. The 'capabilities' comprise of: Dynamic IT strategy Planning; Dynamic IT Change Management; Dynamic IT Systems Development. While 'Resources' are: Dynamic IT Resource Management; Dynamic IT Human Resource management, and Dynamic IT Knowledge Resource management (Absorptive capability and learning capability).

The constructs are informed by an array of major theories such as systems theory, science of cybernetics, Information processing theory, Knowledge creation theory, learning theory, structuration theory, and a host of other organizational theories. Further, Anthony's (1965) management activities classification (Strategic planning, Management control, and Operational control), Cybernetics (Weiner, 1948), and Duncan's (1976) notion of 'ambidexterity' helps in summarizing the constructs. For instance, the constructs of Dynamic IT strategy planning capability falls under the purview of 'strategic planning'; Change Management under the purview of 'management control'; Dynamic IT Infrastructure Management, Dynamic IT personnel management, and Dynamic IT vendor management, all can be grouped under 'Operational Control'. Similarly, absorptive capability and dynamic learning are informed by Cybernetics, and exploration/exploitation fall under IT enabled Ambidextrous Innovative Capability.

CHAPTER 5

RESEARCH METHODOLOGY

Based on Venkatraman's (1991) suggestion, we specified the domain of organizational dynamic IT capability construct *apriori*. This means that, the dimensions of Dynamic IT Outsourcing Management, Dynamic IT Knowledge Management, Dynamic IT Technology Management. Dynamic IT Human Resource Management, Dynamic IT Strategy Planning, Dynamic IT Change Management, Dynamic IT Systems Development, and IT enabled Ambidextrous Innovation were guided by theoretical justification. We then validated the constructs with data. An overview of the conceptualization and measurement is represented in Figure 5.1.

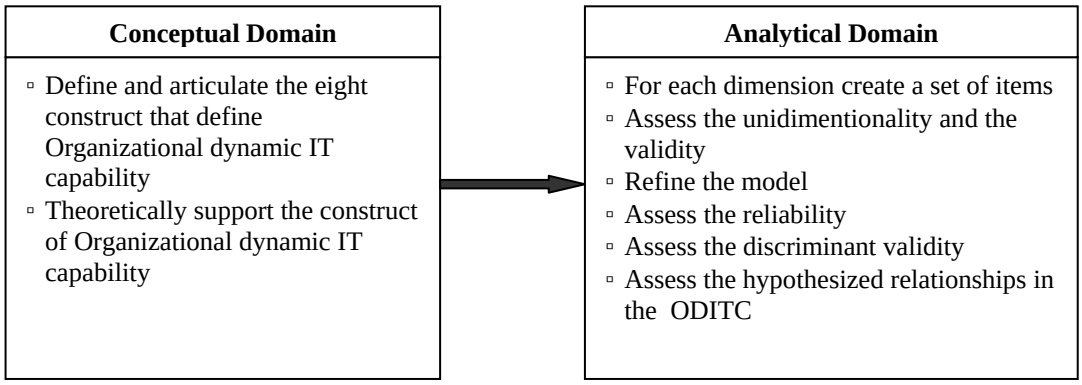

Figure 5.1: Overview of the Conceptualization and Measurement of ODITC (Adapted from Venkatraman, 1989)

This chapter discusses the research framework in terms of the processes pursued is accordance with the scientific analysis process in business research. This is followed

by a discussion of how we will assess the fit of the research instrument and establish its reliability and validity. Then the procedure for data collection, followed by 'sample size' requirements is outlined. Finally, we discuss our justification for choosing the statistical analysis method, Partial Least Squares approach.

5.1 Research Framework

As suggested by Churchill (1979) and endorsed by Venkatraman (1989), we follow the framework that is widely accepted in business research for the measurement of complex models (Figure 5.2). Although this framework was suggested in the context of developing marketing constructs, its generalizable approach has made it suitable for IT research (Sethi and King, 1994; Straub, 1989).

Based on this generalized framework the first step is to specify the domain of the construct (i.e., what is being included and what is not included in the definition of the construct). Such definitions flow from an intensive review of the literature. For our thesis, we identified the constructs after an extensive search of the IT literature and other literature in related disciplines.

The next step was to create a multi-dimensional scale for the each of the dimensions (constructs). This was done by borrowing and/or adapting from existing scales through a review of the literature and using the expertise of academicians or industry experts. In the case of new constructs, experts can offer valuable insights and ideas for developing the scale for the constructs.

For our thesis, we scrutinized existing measurements for the representativeness of the construct. Their fit was based on face validity and their proximity with the definitional value of the construct. To minimize the effects of mono-method bias, we developed multiple measurement items for each construct (Churchill, 1979). All items were constructed using a Likert-type unidimensional scaling using a seven-point scale (agree- disagree).

5.1.1 Instrument Purification

After determining the initial set of items for the instrument, we begin our first instrument purification process. This process of purification was to ensure that the meaning we have attached to each of the items is the same in meaning that potential respondents will attach to the items. This process helps in ensuring the completeness of the constructs that are operationalized. A secondary aim of this purification process was to minimize items that were ambiguous, words that are confusing and open to multiple interpretations. This helped in establishing the validity of the instrument in the final stages. For this purpose, we engaged the expertise of fellow doctoral student and research scholars to get their feedback. This exercise was done following a q-sort methodology, as suggested in literature (McKeown and Thomas, 1988; Moore and Benbasat, 1991). The preliminary instrument with its items is attached in Appendix B.

5.1.2 Instrument Purification (pretest)

After going through the first purification process and deriving a set of testable scale set, we pretest the preliminary instrument. This involves administering the instrument to a set of sample respondents. Apart from completing the instrument, this small sample was asked to comment on the instrument concerning any issue they had while trying to fill it out, such as wording or layout. This exercise helped in further fine tuning the scales in the instrument.

The questionnaire was pre-tested with a sample of ten respondents who were either CIOs or senior IT mangers (VP level or higher) in various industries. The purpose of the prestest was to 1) identify and remove items that were ambiguous and unclear, 2) determine whether the instructions were clearly understood 3) determine whether the items included in the questionnaire were elaborate enough to capture the constructs or if any other items needed to be included., and 4) assess the general comfort level in terms of time taken to respond.

Based on the results of the prestest, the instrument was once again subjected to another round of the purification process. The resulting final instrument was once again tested with four senior IT mangers. All the items in this preliminary instrument were either adapted from existing scales or developed, based on a combination of theory, literature, and feedback from industry experts.

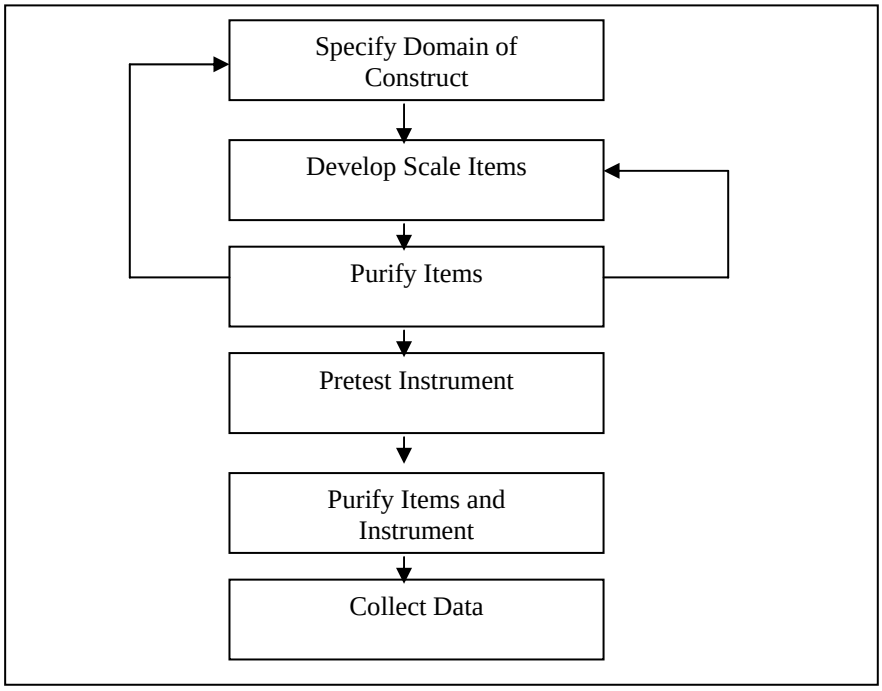

Figure 5.2: Framework for Developing the Instrument

5.2 Measuring Instrument

The final research instrument was developed following guidelines suggested in the literature through a process that involved adapting previous validated items, developing new items that were informed by theory and previous literature, pilot-testing, and interviews with senior IT executives. This process was essential to fit our specific needs for this research without distorting the purpose it was meant to serve. This final instrument was then hosted online. The final instrument which was administered online is in Appendix E (© James T.C. Teng, Anurag Jain, and Sridhar Nerur, 2006). Table 5.1 outlines the final instrument with the constructs and the item counts.

Table 5.1: Item map			
Constructs	**First Order Sub-Constructs**	**No. of Items**	**Source**
Dynamic IT Strategy Planning	None	5	All items are new scales, except for 1 item that was adapted from Teo and King, 1997
Dynamic IT Change Management	None	5	All items are new scales, except for 2 item that was adapted from Brown, 2006
Dynamic IT Systems Development	None	5	All items are new scales
Dynamic IT Technology Resource management	None	6	All items are new scales that are informed by Broadbent and Weill, 1999; Duncan, 1995, except for 2 items that was adapted from Duncan, 1996
Dynamic IT Human Resource Management	None	5	All items are new scales. 1 item was adapted from Broadbent and Weill, 1997. 1 item was adapted from Byrd and Turner, 2000
IT Outsourcing Management	None	8	All items are new scales, except for 2 item that was adapted from Lee et al., 2004
Dynamic IT Knowledge Resource Management	Absorptive Capability	5	All items are new scales
	Learning	6	All items are new scales, 1 item is informed by Day, 1994
IT enabled Ambidextrous Innovative Capability	Exploitative Capability	5	All items are new scales, except for 3 item that was adapted from He and Wong, 2004; Venkatraman, 1989
	Explorative Capability	6	All items are new scales were informed by , except for 2 item that was adapted from He and Wong, 2004; Wheeler, 2002

5.3. Sample Size

Chin (1998) suggests the selection of a sample size for the Partial Least Squares (PLS) technique depends on finding the largest of the following two possibilities criteria. 1) The block with the largest number of formative indicators (i.e., the measurement equation that is the largest) or 2) The dependent latent variable which has the largest number of independent variables affecting it. In either case, the sample size is calculated as ten times of either 1 or 2, whichever is greater (Chin, 1998). In our case the largest number of indicator variables is three, as reflected by hypotheses H2, H3, and H4. Therefore, applying the heuristic as suggested in the literature (Gopal et al. 1993; Chin, 1998), the minimum sample size required would be 30 respondents. However, Goodhue et al. (2006) suggests that the rule of thumb of "ten times" should not be used as a guideline except to ensure sufficient power. Keeping the significance of power, we determined the sample size requirement from that perspective. Therefore, based on Cohen's (1992) power table, the sample size was determined to be at the minimum of 108.

5.4. Power Analysis

Type I error is the probability of rejecting the null hypothesis, when in fact it is true. Type II error is the probability of failing to reject the null hypothesis when it is not true. In other words, it is the likelihood of failing to detect the relationship between variables. In order to mitigate this, '*statistical power'* is considered. It is the probability

of not making the Type II error (Baroudi and Orlikowski, 1989; Sackett and Larson, 1990). The power is determined by the function of effect size. However, literature offers differing views on the inclusion of 'statistical power' in social science research. For instance, Sackett and Larson (1990) state, "*It is rare to find a theory in industrial and organizational psychology that offers a hypothesis about expected effect size*". They further add that, "*Type I error has historically been viewed as a more serious risk than type II error*". Through a review of MIS research, Baroudi and Orlikowski (1989) suggest a statistical power of 0.80. For this study, alpha is set at 0.05; power is set at 0.80, and the effect size as medium.

5.5 Survey Administration and Data Collection

The research survey was designed to be administered 'online'. The online method has the advantages of flexibility, low cost, and speedier data gathering. In terms of the effectiveness of online surveys, research has shown online surveys to be comparable and in certain situations more effective than postal surveys (Verma and Jin, 2005) .

CIO magazine was contacted for getting the responses for the survey, as the readers tend to be senior IT managers. An email describing the scope of this thesis along with a link to a sample of the actual survey was sent to CIO magazine. Please see Appendix C for a copy of the email. CIO magazine sent electronic newsletters to the pool of potential respondents along with a link to the survey (Appendix D). The responses generated from the first mailing generated a sample size of seventy-four (this

is what we categorize as ‘early’ responses). Since this was an inadequate sample size, a call to participate in the survey was sent again after a two week hiatus through an electronic newsletter by CIO magazine. This exercise resulted in a sample of fifty-two (this is what we categorize as ‘late’ responses), bringing the total to one hundred twenty-six.

5.6 Data Preparation

Data was collected in the form of one hundred twenty-six total responses. In the first set we got seventy-four responses, and in the second set we got fifty-two responses. From these, we dropped 3 cases from the first set and 2 from the second set based on obvious pattern of responses and missing values greater that 5 per case. Data with fewer missing values (less than 5) were imputed using Expectation Maximization (EM) method. The EM method is suggested to be a better approach with least bias, over, methods such as, list-wise deletion, pair-wise deletion and means substitution. These methods either reduce the sample size or bias the results (Hair et al., 2005). We finally arrived at a useable set of one hundred and twenty-one responses.

5.6.1 Informant Bias

One of the suggestions to overcome key informant bias is to assess informant competency (Straub et al., 2004). Since, the unit of analysis is at organizational level, responses from respondents who were senior IT mangers (VPs, Sr. VPs, Exec. VPs, Directors, and CIOs) were retained in the study for analysis. These titles are reflective

of the general Senior IT Management function in an organization (Stephens et al., 1992). The median of years of experience was 8 years. With relevant job titles and experience we believe the respondents were good representatives of the organizations they represented. Moreover, responding to the survey was completely voluntary. This was also in line with the general guidelines of the Institutional Review Board (IRB) requirements.

5.6.2 Outliers

Date were analyzed to identify outliers that included both univariate and multivariate perspectives (Hair et al., 2005). A univariate outlier is a case that falls on the outer range of a distribution. A multivariate outliers can be considered as a case which has an abnormal combination of values for a number of variables. In the case of a univariate outlier, the case should have values with a standardized score greater than the range of 3 to 4 standard deviations for large data set (Hair et al., 1998). Mahalanobis Distance was used to identify multivariate outliers. There were two cases that could be considered outliers. After examining each case individually, no "abnormality" was found in the data and so they were included in the data set.

5.7 Demographics

The sample characteristics showed that the respondents were predominantly male (Table 5.2), comprising almost seventy-nine percent of the responses. A majority

of the respondents were in the age group of 40-49, with an almost equal distribution on either side. While the majority of the respondents had 5-10 years of IT experience.

Table 5.2: Sample Demographics			
Gender	**Frequency**	**Percent**	**Cumulative Percent**
Male	96	79.3	79.3
Female	25	20.7	100.0
Total	121	100.0	
Age	**Frequency**	**Percent**	**Cumulative Percent**
20-29	2	1.7	1.7
30-39	31	25.6	27.3
40-49	54	44.6	71.9
50-59	26	21.5	93.4
60+	8	6.6	100.0
Total	121	100.0	
Experience In Years	**Frequency**	**Percent**	**Cumulative Percent**
1- 4	28	23.1	23.1
5-10	48	39.7	62.8
11-15	24	19.8	82.6
16-25	14	11.6	94.2
25+	7	5.8	100.0
Total	121	100.0	

Table 5.2- *Continued*

Industry type	Frequency	Percent	Cumulative Percent
Consulting	7	5.8	5.8
Financial	28	23.1	28.9
IT	9	7.4	36.4
Manufacturing	15	12.4	48.8
Healthcare/ Medical	9	7.4	56.2
Government	5	4.1	60.3
Education	28	23.1	83.5
Hospitality	2	1.7	85.1
Legal	2	1.7	86.8
Media/ Marketing/ Advertising	6	5.0	91.7
Retail/ Wholesale	1	.8	92.6
Telecom	2	1.7	94.2
Others (Insurance, Contract research, Construction, Oil and Gas, Not-for-profit)	7	5.8	100.0

5.8 Non-Response Bias

The mail survey technique has been attributed with no-responses bias based on the assumption that a possibility exists for responses to differ between those respondents who answered and those who did not. However, in the vast majority of

leading IS research published, estimating non-response bias has not been considered significant (Sivo et al., 2006) Nonetheless, we believe it is important that we check for this bias. Three suggested methods of estimating non-response bias are: 1) comparison with known values for the population, 2) subjective estimations, and 3) ehe extrapolation method (Armstrong and Overton 1977).

Due to the inability to access known values of the population or subjective estimates, we will use the estimation procedure of extrapolation. In this method, late respondents are treated as non-respondents. Therefore, testing for differences between early and late respondents can be considered equivalent to a test between respondents and non-respondents. The late respondents were those who responded after two weeks.

Table 5.3 provides a t-test comparing responses for early (71) and late (50) respondents across an item that is randomly selected from each construct. The test for all items showed no significant difference between the respondents. This provides sufficient evidence to conclude that there is little reason to suspect a non-response bias in the responses from the survey.

Table 5.3: t- test for difference between early and late respondent based on items

Item: (PP3)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	5.153846	1.944712	-0.18842	Not significantly different
LATE	50	1-7	5.204082	2.040816		
Item: (CM4)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	4.492308	2.253846	-1.10505	Not significantly different
LATE	50	1-7	4.795918	1.915816		

Table 5.3- *Continued*

Item: (SD2)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	5.169231	1.455288	-0.82482	Not significantly different
LATE	50	1-7	5.367347	1.820578		
Item:(IT3)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	4.892308	1.628846	0.311987	Not significantly different
LATE	50	1-7	4.816327	1.694728		
Item: (PS 4)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	4.492308	1.785096	-1.14099	Not significantly different
LATE	50	1-7	4.77551	1.636054		
Item: (OS4)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	3.738462	3.071154	1.181426	Not significantly different
LATE	50	1-7	3.346939	3.064626		
Item: (LR5)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	5.123077	1.578365	0.440485	Not significantly different
LATE	50	1-7	5.020408	1.437075		
Item: (Expl1)						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	71	1-7	4.969231	1.686538	-0.18678	Not significantly different
LATE	50	1-7	5.020408	2.645408		

To further assess whether there is non response bias reflected by the data, t-tests were done across various demographic characteristics such as, gender, age, years of experience, and industry type to assess differences between early and late responses, Based on the non–significant results of the t-test, one can reasonably conclude that no difference exists between early and late responses (Table 5.4). This enables us to conclude that we are free from non response bias.

Table 5.4: t- test for difference between early and late respondent based on demographics						
Gender						
Sample	N	Range	Mean	Variance	T statistics	T- Test Results
EARLY	71	1-2	1.1857	0.1530	0.6111	Not significantly different
LATE	50	1-2	1.1429	0.1250		
Age						
Sample	N	Range	Mean	Variance	T statistics	T- Test Results
EARLY	71	1-6	4.1143	0.9433	0.2913	Not significantly different
LATE	50	1-6	4.0612	0.9753		
Experience						
Sample	N	Range	Mean	Variance	T statistics	T- Test Results
EARLY	71	1-5	2.2857	1.3665	1.0898	Not significantly different
LATE	50	1-5	2.0612	1.0170		
Industry						
Sample	N	Range	Mean	Variance	T statistics	T- Test Results
EARLY	71	1-16	7.5072	19.1360	0.3316	Not significantly different
LATE	50	1-16	7.2449	16.2304		

5.9 Summary

In this section we discussed our research approach that was based on data collection through a survey instrument. The survey instrument was developed in accordance with recommendations in literature. This also ensured that we are consistent with other research approaches and have face validity. After thorough pilot testing the final survey instrument was administered online. The respondents were all senior IT mangers. The sample size was adequate to fulfill the requirement for effective analysis with a partial least squares approach, as well as ensuring that we are within the prescribed tolerance for sufficiency of power. Data collected was filtered for outliers and missing values to minimize biased results. In addition, an extrapolation test for non-response bias was

conducted. The test confirmed that our data did not suffer from this malaise. After the data is ready for analysis, we discuss the results of the data analysis in the next chapter.

CHAPTER 6

RESULTS AND DATA ANALYSIS

There are two possible approaches for analyzing the data for this study – first generation and second generation statistical approaches (Gefen et al., 2000). The first generation approaches have limitations in analyzing data when more than one layer of relationships exists in the model. For example, consider a situations where there are two mediating variables in sequence between a predictor and criterion variable. The first generation techniques cannot simultaneously analyze multiple relationships. Rather, they have to break the model into several individual analyses, each considering one layer at a time. Another limitation of first generation approaches is that all measurement is made with error and the measurement error is generally lumped into a residual error term (Barclay et al. 1995).

Another approach is to use second generation statistical tools or structural equation modeling (SEM) techniques. SEM permits the simultaneous analysis of multiple criterions and predictor constructs. Unlike first generation techniques, SEM not only assesses the structural model (i.e. relationships amongst a set of independent and dependent constructs) but also the measurement model (i.e. loadings of observed items onto their latent variables) simultaneously in the same analysis (Gefen et al., 2000). The two most widely used SEM techniques in the IS field are: 1) the covariance based

approach, popularly referred by the name of the software package, 'LISREL' ((Joreskog and Sorbom 1986) and 2) the partial least squares (PLS) approach (Wold 1982)

The results of this research were analyzed using partial least squares approach (PLS). PLS is a structural equation modeling technique that uses a component-based approach to estimation. This places a minimal demand on sample size and residual distributions (Fornell and Bookstein, 1982). For this study, PLS is selected for several reasons such as predictive accuracy, sample size requirements, lack of need for the assumption of multivariate normality, and explanation of complex relationships (Chin, 1998). Multivariate normality is not a requirement for estimating PLS parameters (Barclay et al., 1995). PLS is designed to explain variance (i.e., to examine the significance of relationships and their ensuing R^2, similar to linear regression). Consequently, PLS is suited for predictive applications and theory building (Chin 1998).

PLS is selected since the objective of this thesis is to demonstrate the affect of the dynamic capabilities on an organizations' ability to be ambidextrous. Furthermore, the PLS approach has also been widely endorsed in IT research (e.g. Gopal et al. 1992; Agarwal and Karahanna 2000;Wasko and Faraj 2005; Majchrzak et al., 2005). The measurement model was tested using the statistical software 'PLS Graph v.3.0'. The recommended procedures for testing with PLS in IT/IS, as well as other literature was followed (Chin, 1998; Hulland, 1999).

The PLS algorithm consists of an iterative procedure that involves outer and inner models. The outer model represents a weighted aggregate of its own indicators.

The inner model refers to weighted aggregate of other component scores that are related to the construct in the theoretical model. During each iteration, the inner model estimates are used to obtain the outside approximation weights while outer model estimates are used to obtain the inside approximation weights. In the first PLS iteration, an initial outer value is formed by simply summing the loadings. Then, the regression weights are estimated and these estimates are used as weights in a linear combination to give an inner value. This value is used in simple regressions to estimate new loadings. The next step uses the estimated loadings, transformed into weights, to form a new linear combination (Barclay et al. 1995). The iterative procedure ends when the percentage change of each outside approximation weight relative to the previous round is less than .001 (Chin 1998).

Having decided on using PLS, the data were analyzed using measurement and structural models as described by Hulland (1999). The following sections discuss the various models and provide discussion on data analyses.

Note: A comparison of PLS and LISREL (Co-variance based approach) is presented in Appendix B adopted from Chin et al, (2003).

6.1 Measurement Model

The PLS graph estimates parameters for both the links between measures and constructs (i.e., loadings) and links between different constructs (i.e., path coefficients) simultaneously. However, the PLS model is recommended to be analyzed and interpreted sequentially in a two stages (Hulland, 1999): 1) the assessment of the

reliability and validity of the measurement model and 2) the assessment of the structural model. Doing so, ensures that the research instrument demonstrates adequate reliability as well as factorial validity before attempting to draw conclusions about the nature of the relationships among constructs.

For this thesis we followed suggested requirements for establishing the psychometric properties for instrument development. These are: reliability, unidimensionality of the measurement items, and discriminant validity (Venkatraman, 1991; Sethi and King, 1994).

6.1.1 Reliability

Reliability has been defined as the consistency with which the scores are free from errors and the measures assess a given score (Crano and Brewer, 2002; Penhauzer and Schmelkin, 1991). In other words, reliability is the assessment of the degree of consistency between the items in a given scale (Hair et al., 2005). Thus, reliability helps in establishing the '*repeatability*' of a measurement scale. In other words, reliability is often referred to as the 'internal consistency'; the degree to which the group of items used to assess a construct reflect a true, common score for the construct (Bagozzi, 1982a).

Reliability assessment is necessary because we have to take into account the attenuation effects of the measurement error on the correlations between variables. According to the psychometric theory, there are several ways to reduce the impact of measurement error on the correlations between variables apriori: 1) write the items out

clearly, 2) make instructions clear to follow; 3) follow standard norms for administering the instrument, 4) make the subjective scoring rules are clear as possible, and 5) if possibly, train the respondents (Churchill, 1979; Nunnally and Bernstein, 1994).

The statistical diagnostic measure for reliability often suggested in measurement literature is the Cronbach's alpha (Gerbing and Anderson, 1988; Nunnally and Bernstein, 1994; Hair et al, 2005). The suggestion for the upper limit of the Cronbach's alpha value is 0.70. In the case of exploratory research, the upper limit of 0.60 is acceptable (Hair et al., 2005). For our purposes we have used composite reliability (Fornell and Lacker ,1981) as an indicator for reliability. The interpretations of composite values are similar to that as suggested for Cronbach's alpha (Nunnally, 1978). Composite reliability examines the ratio of non-random variance associated with all measures of a construct to the total variance associated with these measures based on the following calculation:

$$\rho_c = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum_i \text{var}(e_i)}$$

where λ_i is the component loading to an indicator and $\text{var}(e_i) = 1 - \lambda_i^2$ (Werts et al. 1974). Moreover, the measure of composite reliability is not influenced by the number of items in the scale.

The reliability of the instrument and the constructs it reflects is presented in Table 6.2, along with the test for discriminant validity. All composite realiabilities are above the suggested guidelines of 0.70, indicating that we have the required level of reliability.

6.1.2 Convergent Validity and Unidimensionality

In this aspect of validity, we establish that only a single construct ties in with a set of measures (items) (Anderson and Gerbing, 1982; Anderson et al., 1987). According to Gefen and Straub (2005), convergent validity is shown when the t-values of the outer model loadings are greater than 1.96. As shown above in Table 6.1, the convergent validity for all the constructs is established, since the t-values are greater than the required level. This suggests that the items are related with their respective constructs. In other words, the results determine that the individual items in presence of other items converge into the construct with which they are theoretically associated, not with any other construct.

Table 6.1: Item Weights and Loadings

Construct	Item	Weight	Loading	T-Statistic*
DynamicIT Outsourcing Management	os1	0.1564	0.7236	7.8588
	os2	0.1312	0.7031	7.9681
	os3	0.1118	0.7517	9.1348
	os4	0.2237	0.7163	5.2844
	os5	0.1154	0.7844	7.2574
	os6	0.1628	0.8779	9.1254
	os7	0.1828	0.8843	10.3690
	os8	0.1819	0.8535	8.7434
Absorptive Capability	ac1	0.1238	0.7451	18.6672
	ac2	0.1384	0.8066	18.9969
	ac3	0.1511	0.8712	38.0860
	ac4	0.1350	0.7319	15.0487
	ac5	0.1339	0.7269	11.3479

Table 6.1- *Continued*

Learning	lr1	0.1330	0.8512	32.7942
	lr2	0.1186	0.7879	19.3633
	lr3	0.1101	0.7937	18.0304
	lr4	0.1088	0.6545	9.3768
	lr5	0.1150	0.6280	8.0919
	lr6	0.0668	0.4623	3.4883
Dynamic IT Resource Management	it1	0.1722	0.7452	18.0464
	it2	0.1918	0.8134	22.5278
	it3	0.2039	0.8601	39.2737
	it4	0.1942	0.8197	24.0457
	it5	0.1976	0.8478	22.9033
	it6	0.2389	0.8941	52.8714
Dynamic IT Human Resource Management	ps1	0.3053	0.8311	35.7270
	ps2	0.2744	0.8408	29.2673
	ps3	0.2440	0.8303	22.3342
	ps4	0.2105	0.7486	15.0178
	ps5	0.2192	0.7089	13.5191
Dynamic IT Systems Development	sd1	0.3070	0.8000	29.4790
	sd2	0.2571	0.7213	17.5537
	sd3	0.2179	0.6432	6.8725
	sd4	0.2326	0.6719	9.2746
	sd5	0.3160	0.8626	31.4924
Dynamic IT Change Management	cp1	0.2179	0.7632	15.8056
	cp2	0.2078	0.7438	18.5526
	cp3	0.2591	0.8860	45.1228
	cp4	0.2691	0.8023	22.5020
	cp5	0.2858	0.8178	30.3475

Table 6.1- *Continued*

Dynamic IT Strategy Planning	pp1	0.2957	0.8512	30.2177
	pp2	0.2019	0.7680	14.4308
	pp3	0.2970	0.8683	31.5022
	pp4	0.2442	0.8277	18.3797
	pp5	0.1873	0.7116	9.7665
IT enabled Exploitation Innovative Capability	expl1	0.1023	0.8167	25.1532
	expl2	0.1093	0.8455	29.3175
	expl3	0.0941	0.7841	18.6027
	expl4	0.1037	0.8131	25.7468
	expl5	0.0884	0.7260	14.1141
	expl6	0.1029	0.7955	18.3809
IT enabled Exploitation Innovative Capability	expr1	0.0956	0.7868	14.8448
	expr2	0.1048	0.8092	15.9356
	expr3	0.0985	0.7851	13.6552
	expr4	0.0769	0.6911	12.9996
	expr5	0.1006	0.8265	19.7675
	expr6	0.0977	0.8390	24.4006
	expr7	0.0882	0.7293	14.4639

Note: T-Statistics are for loadings, not weights. *All loadings are significant at $p < .001$

6.1.3 Discriminant Validity

Discriminant Validity is exhibited when a measure does not correlate highly with another measure from which it should differ (Bagozzi. et al., 1982b; 1982c; 1991). Similar to the assessment of convergent validity, we will test for discriminant validity using the technique of 'factor analysis' as suggested in the literature (Gefen et al., 2000; Hair et al., 2002; Straub et al., 2004)

There are two approaches suggested in the literature to be followed for assessing discriminant validity with the PLS approach (Gefen and Straub, 2005; Chin, 1998). First, establish that the measurement items load highly on their theoretical construct and none of the items should load more highly on another construct (i.e., loadings should be higher than cross-loadings). Second, the square root of the average variance extracted (AVE) for each construct should be larger than the inter-construct correlations. The average variance shared between the construct and its indicators should be larger than the variance shared between the construct and other constructs (Fornell and Lacker, 1981).

Based on the first suggested approach for assessing discriminant validity, the cross-loading were derived from the re-scaled data matrix output from PLS graph and edited using a spreadsheet (Appendix F). In our case, this test for discriminant validity indicates that the items load onto their respective factors (constructs), thereby confirming that we have established discriminant validity.

With the second suggested approach to assess discriminant validity, we check the ratio of the square root of the AVE (Average Variance Extracted) for each construct, with the correlations of constructs with all other constructs.

AVE measures the amount of variance in a construct accounted for its indicators relative to measurement error (Fornell and Lacker, 1981). The threshold for AVE is 0.50, signifying that 50 percent or more variance of the indicators has been accounted for by the construct (Fornell and Lacker, 1981). In the event, that the AVE value is less than 0.50, then the validity of the indicators and the construct may be questionable. This

is so because the measurement error would be larger than the variance that is accounted for by the construct. As shown by comparing the inter-construct correlations and the square root of AVE (see Table 6.2), all constructs share more variance with their respective indicators than with other constructs. Hence, these results support the convergent and discriminant validity of the research constructs proposed in the model.

Table 6.2: Correlations of Constructs, Composite Reliability, AVE

	CR	**AVE**	CM	SD	IN	PS	OS	PP	LR	Expr	Expl	AC
Dynamic IT Change Mngmt (CM)	0.901	0.647	**0.80**									
Dynamic IT Systems Development (SD)	0.860	0.554	0.73	**0.74**								
IT Technology Resource Mngmt (IN)	0.930	0.691	0.71	0.71	**0.83**							
IT Human Resource Mngmt (PS)	0.894	0.630	0.69	0.73	0.64	**0.79**						
Dynamic IT Outsourcing Mngmt (OS)	0.929	0.624	0.27	0.14	0.32	0.10	**0.79**					
Dynamic IT Strategy Planning (PP)	0.903	0.652	0.74	0.73	0.72	0.57	0.22	**0.81**				
Learning (LR)	0.905	0.620	0.66	0.61	0.63	0.65	0.14	0.59	**0.79**			
Explore (EXPR)	0.948	.0722	0.65	0.69	0.67	0.56	0.29	0.69	0.63	**0.85**		
Exploit (EXPL)	0.953	0.771	0.70	0.69	0.77	0.60	0.33	0.68	0.54	0.67	**0.89**	
Absorptive Capability (AC)	0.925	0.712	0.71	0.70	0.69	0.61	0.14	0.72	0.67	0.70	0.69	**0.84**

Note: CR: Composite Reliability; AVE: Average Variance Extracted ; Boldface numbers on the diagonal are the square roots of the AVE values

6.2 Structural Model

After testing for reliability and validity of the measurement model, the hypotheses are tested through the examination of the structural model. The structural model reflects the hypothesized linkages between the constructs and defines the strengths of the relationships among the constructs. Using the PLS approach to test the structural model, we estimate the path coefficients which indicate the strength of the relationships between the predictor (IV) and dependent variables and the sample coefficient of determination (r^2 value). The coefficient of determination represents the amount of variance in the dependent variable as explained by the independent variables. The assessment of r^2 and the path coefficients indicates whether the model is performing well or not. The variance represented by r^2, is a measure of the predictive power of the model and it is interpreted in the same way as r^2 in regression analysis (Barclay et al., 1995). To hold the hypothesized relationships, the path coefficients should be significant and they should also be consistent in the direction of the relationships as hypothesized in the research model. To test for significance, the bootstrapping resampling procedure was used with 200 samples (Chin 1998). PLS Graph provides both 'bootstrapping' (Efron and Tibshirani 1994), as well as 'jackknifing' (Gray and Schucany, 1972) estimation procedures. Jackknifing, considered as an approximation to the bootstrap, is viewed as the less efficient of the two (Efron and Tibshirani, 1994) . Therefore, for the purpose of this study we selected the 'bootstrap' estimation procedure. Moreover, since we were not constrained by computational time, bootstrapping provided us with more efficiency.

To investigate the specific hypotheses, t-statistics for the standardized path coefficients were assessed. The estimation supports most of the hypothesis. Table 6.3 contains the path coefficients and summarizes the hypothesis tests. Figure 6.1 display the structural model, along with the constructs and their hypothesized relationships. The results of the PLS estimation along with the path coefficients and the r^2 values are displayed in Figure 6.2.

We also investigated the paths of the overall model (i.e., the relationship between resources and capability, as well as the relationship between capability and ambidexterity). All the paths are significant at $p<0.01$, lending support to the model. The t-statistic values along with the path coefficients and r^2 values are in Figure 6.3.

Table 6.3: Path Coefficients and Summary of Hypothesized tests

Hypothesis	Path	Coefficient	Standard Error	T-stat	Result
H1a	OS → LR	0.1620	0.1248	1.2985*	Supported
H1b	OS → IN	0.3230	0.1035	3.1213***	Supported
H1c	OS → PS	0.0990	0.0930	1.0386	Not Supported
H2a	LR → SD	0.2630	0.0656	4.0116***	Supported
H2b	LR → CM	0.3750	0.0836	4.4839***	Supported
H2c	LR → PP	0.3990	0.0849	4.7017***	Supported
H3a	IN → SD	0.2890	0.0839	3.4456***	Supported
H3b	IN → CM	0.2700	0.0864	3.1242***	Supported
H3c	IN → PP	0.4110	0.0895	4.5937***	Supported
H4a	PS → SD	0.3610	0.0826	4.3726***	Supported
H4b	PS → CM	0.2590	0.1173	2.2077**	Supported
H4c	PS → PP	0.0350	0.1186	0.2952	Not Supported
H5	SD → AD	0.3350	0.1322	2.535***	Supported
H6	CM → AD	0.2530	0.0792	3.1951***	Supported
H7	PP → AD	0.3170	0.1372	2.3104**	Supported

***: significant at 0.01 level
** : significant at 0.05 level
* : significant at 0.1 level
OS= Dynamic IT Outsourcing Management; LR= Dynamic IT Knowledge Resource Management; IN= Dynamic IT technology resource management; PS= Dynamic IT Human Resource Management; SD= Dynamic IT Systems Development; CM= Dynamic IT Change management; PP= Dynamic IT Strategy Planning; AD= IT enabled Ambidextrous Innovative capability

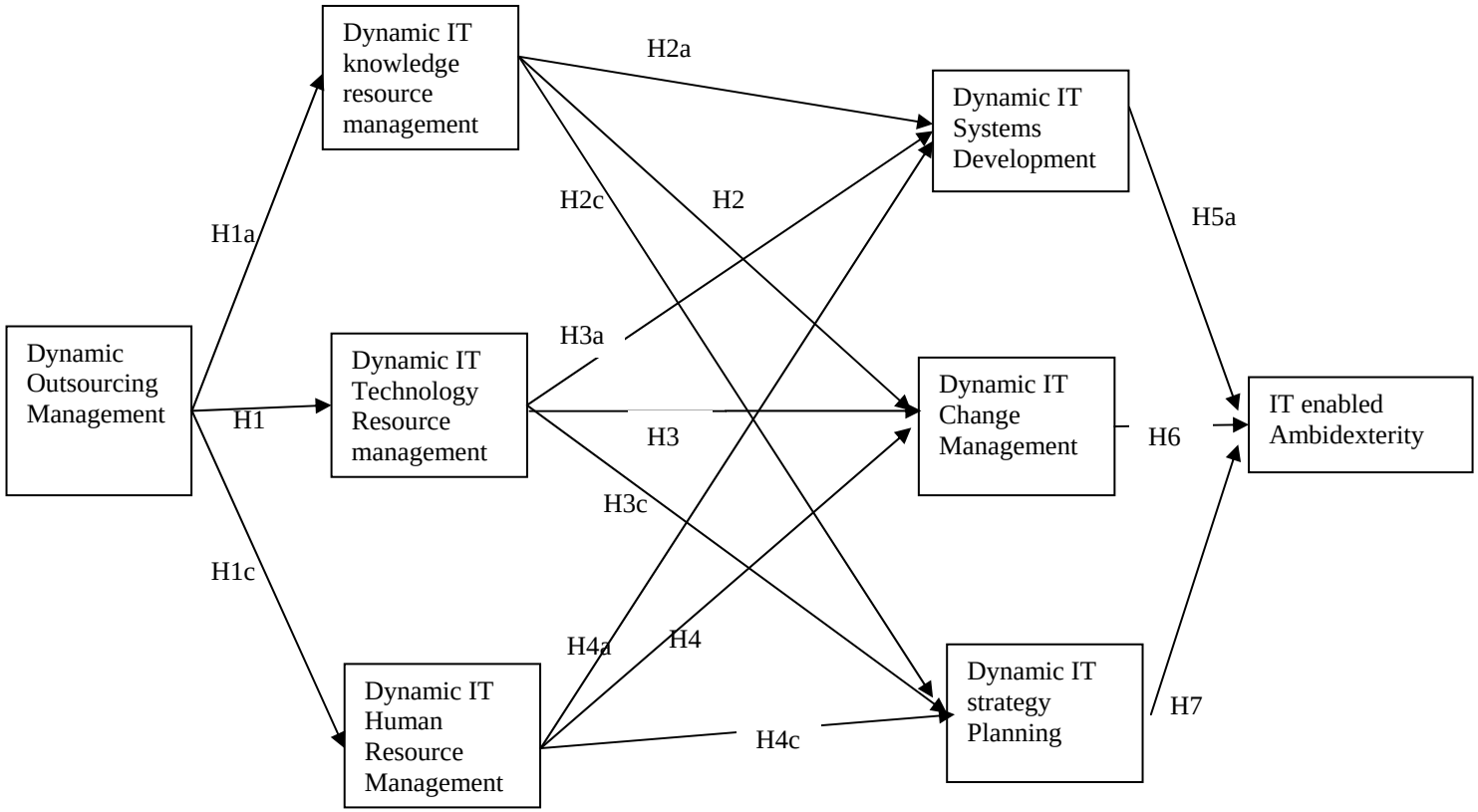

Figure 6.1: Structural Model with Hypothesized Relationships

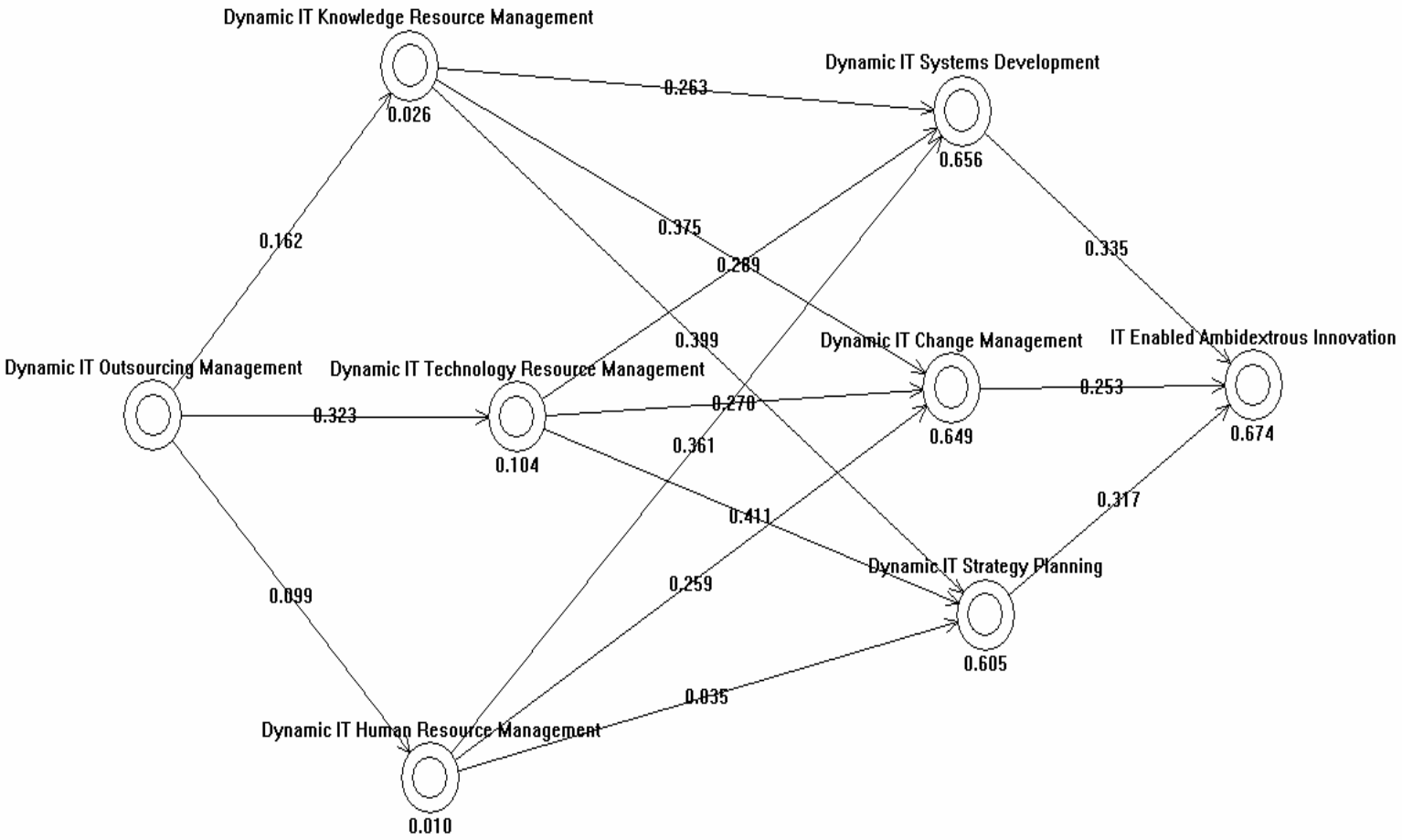

Figure 6.2: Structural Model with path coefficients and r^2 (the values appear under the construct)

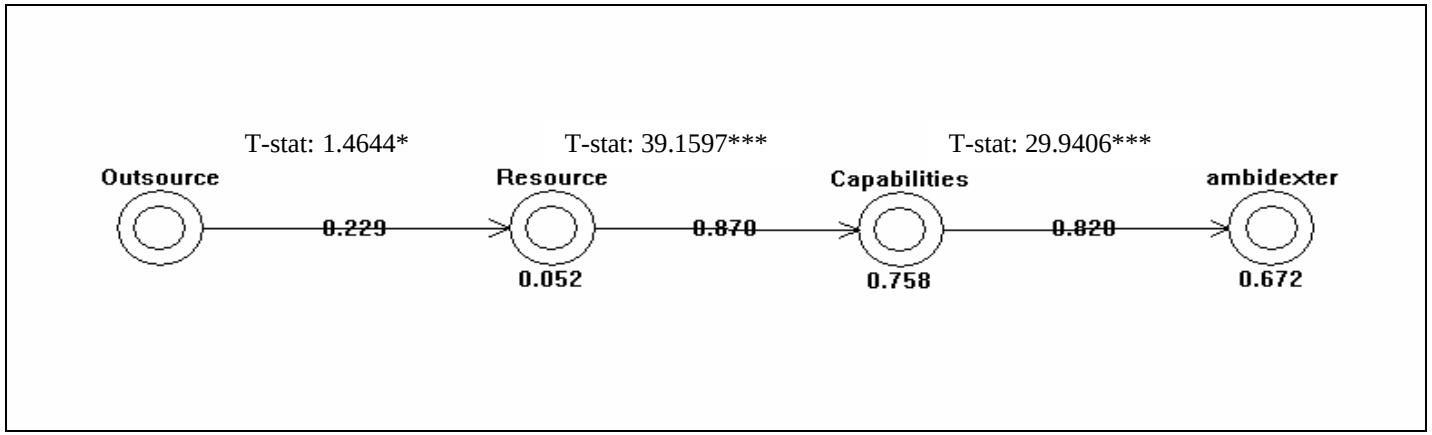

Figure 6.3: Overall Structural Model with path coefficients and r^2 (the values appear under the construct).
(***: significant at 0.01 level; **: significant at 0.05 level; *: significant at 0.1 level)

6.2.1 Hypotheses testing

As mentioned earlier, to investigate the specific hypotheses, t-statistics for the standardized path coefficients were assessed along with the level of significance. The summarized results are presented in table 6.3. We will now discuss each specific hypothesis.

Hypothesis 1a: Dynamic IT Outsourcing Management positively affects Dynamic IT Knowledge Resource. This hypothesis was supported ($b = 0.1620$, $t = 1.2985$, $p<0.10$). Support for this hypothesis implies that an organization's IT knowledge resource management is positively influenced to a certain degree by its ability to outsource its Information Technology needs.

Hypothesis 1b: Dynamic IT Outsourcing Management positively affects Dynamic IT Technology Resource Management.. This hypothesis was supported. ($b = 0.3230$, $t = 3.1213$, $p<0.01$). This suggests that the greater the ability to outsource, the more dynamism can be injected into the IT infrastructure of an organization.

Hypothesis 1c: Dynamic IT Outsourcing Management positively affects Dynamic IT Human Resource Management. This hypothesis was not supported. ($b = 0.0990$, $t = 1.0386$). The organization's outsourcing activities has the propensity to enervate its own IT personnel, in terms of making them less dynamic. This result appears consistent with the other results of hypothesis H1a and H2b. With outsourcing, new technology and ideas are available to strengthen the IT infrastructure and help create new knowledge. However, the resident IT personnel are likely to be less challenged, since the burden now shifts to the third party (outsourcer as apposed to the

outsourcee). This non- significant relation is further supported by the low correlation coefficient value of 0.099 and a very small r^2 value of 0.01.

Hypothesis 2a: Dynamic IT Knowledge Resource Management positively influences Dynamic IT Systems Development. This hypothesis was supported. (b = 0.2630, t = 4.0116, p<0.01). The learning from the past experiences and mistakes creates new knowledge. This new knowledge helps in cutting down on the time for the development of an IT system. Therefore, the more an organization learns, the greater is its potential to develop an IT systems faster.

Hypothesis 2b: Dynamic IT Knowledge Resource Management positively influences Dynamic IT Change Management. This hypothesis was supported. (b = 0.3750, t = 4.4839, p<0.01). Similar to hypothesis 2a, the new knowledge has the potential to shorten as well as enable a smoother transitioning to new systems. Thereby, leading to a greater and perhaps a faster acceptance of an IT system.

Hypothesis 2c: Dynamic IT Knowledge Resource positively influences Dynamic IT Strategy Planning. This hypothesis was supported. (b = 0.3990, t = 4.7017, p<0.01). The learning from previous experiences coupled with learning as a result from previous errors has the potential to enhance the planning process. Moreover, the evidence from Hypotheses H2a and H2b suggest that Dynamic IT Strategy Planning, Dynamic IT Systems Development and Dynamic IT Change Management are linked.

Hypothesis 3a: Dynamic IT Technology Resource Management positively affects Dynamic IT System Development. This hypothesis was supported. (b = 0.2890, t

= 3.4456, p<0.01). The more dynamic the IT infrastructure is, the greater is the possibility that a system can be developed faster.

Hypothesis 3b: Dynamic IT Technology Resource Management positively affects Dynamic IT Change Management. This hypothesis was supported. (b = 0.2700, t = 3.1242, p<0.01). The more capable the infrastructure is to support the changing IT initiatives of an organization, the more likely that the change management process will be effectively seen through.

Hypothesis 3c: Dynamic IT technology resource management positively affects Dynamic IT Strategy Planning. This hypothesis was supported. (b = 0.4110, t = 4.5937, p<0.01). The more capable the infrastructure is to support the changing IT initiatives of an organization, the more likely the organization will be able to follow a Dynamic IT Strategy Planning process.

Hypothesis 4a: Dynamic IT Human Resource Management positively influences Dynamic IT Systems Development. This hypothesis was supported. (b = 0.3610, t = 4.3726, p<0.01). The greater is the ability of the IT personnel to respond to changing requirement, the faster the IT systems can be developed.

Hypothesis 4b: Dynamic IT human resource Management positively influences Dynamic IT Change Management. This hypothesis was supported. (b = 0.2590, t = 2.2077, p<0.05). The greater the ability of the IT personnel to respond to changing requirement, the more likely it is that the change management process will be effective.

Hypothesis 4c: Dynamic IT Human Resource Management positively influences Dynamic IT Strategy Planning. This hypothesis was not supported. (b =

0.0350, t = 0.2952). The ability of the IS personnel to respond to changing requirement has no association with an organization's ability to plan dynamically. This non-significant relation is further supported by the low correlation coefficient value of 0.0350.

Hypothesis 5: Dynamic IT Systems Development positively affects the IT enabled Ambidextrous Innovative Capability. This hypothesis was supported. (b = 0.3350, t = 2.535, $p<0.01$). The faster an IT system can be available to the organization, the faster the innovative thrust will have access to new IT in order to improve or fundamentally be able to work on its products, processes, structures.

Hypothesis 6: Dynamic IT Change Management positively affects the IT enabled Ambidextrous Innovative Capability. This hypothesis was supported. (b = 0.2530, t = 3.1951, $p<0.01$). Efficient change management will lead to faster and greater percolation of IT systems. With new and innovate IT systems in place the organization can have newer abilities to improve or fundamentally change its products, processes, and structures.

Hypothesis 7: Dynamic IT Strategy planning positively affects the IT enabled Ambidextrous Innovative Capability. This hypothesis was supported. (b = 0.3170, t = 2.3104, $p<0.05$). With a Dynamic IT Strategy Planning process, new IT that is identified can be evaluated from the perspective of improving or fundamentally creating new products, processes, structures. This hypothesis ties in with hypotheses 5 and 7. In fact, this relationship precedes the relationship of IT enabled Ambidextrous Innovative

Capability with either hypothesis 5 or 7. It is usually after a plan is created, that a system is developed and the associated changes are managed efficiently and effectively.

6.3 Summary

In this section we tested for the reliability and the factorial validity of the instrument. We found that the instrument and the constructs meet the criterion for sufficient reliability and factorial validity (Convergent and Discriminant Validity). After that we tested the hypothesized relationships among constructs. We concluded that the Dynamic IT outsourcing management has non-existent impact on Dynamic IT human resource Management, some impact on Dynamic IT knowledge resource and has a positive impact on Dynamic IT technology resource management. Each of the resources (Dynamic IT knowledge management, Dynamic IT technology resource management, and Dynamic IT human resource management) have a positive impact on the group of constructs that we collectively address as Capabilities (Dynamic System Development, Dynamic Change Management, and Dynamic IT strategy Planning). However, the relationship between Dynamic IT human resource Management and Dynamic IT Strategy Planning was not significant. Put differently, each of the 'Resources' except Dynamic IT human Management positively impacts the individual construct under the umbrella of 'Capability'. However, all 'Capabilities' have a statistically significant relationship with IT enabled Ambidextrous Innovative Capability.

CHAPTER 7

DISCUSSION AND CONCLUSION

7.1 Discussion

The aim of this research process is to delineate an essential set of capabilities and resources in the context of Information Technology - what we call 'Dynamic IT Capabilities'- that are the foundational imperatives for IT driven innovation.

Organizations are increasingly accepting the power of IT capabilities, recognizing that organizational IT contributes to innovation endeavors (Wheeler, 2002; Sambamurthy et al., 2003; Pavlou, 2005). Ostensibly, CIOs and senior IT managers are now asking questions, such as: "What are these capabilities?", "How do I know that I have Dynamic IT Capability?", "Is there a way to assess the dynamic capability health of my organization's IT?"

Our research in identifying these core dynamic capabilities has evolved over an extensive synthesis of the practitioner and academic literature. Our assertions are created through a triangulation of: a) rich trans-disciplinary theories such as General Systems Theory, Dynamic Capability theory, The Resource Based View; b) Research disciplines of Organization Science, Management Science, Organization Behavior, Marketing, Information Systems/IT research, and Sociology; and c) Extensive discussions and personal interviews with senior IT mangers and CTO/CIOs.

We attempt to go beyond and deeper than the typical IT governance frameworks, and apply robust theories for practical purposes. Our research idea stems from the widely held belief that Dynamic Capabilities are paramount for the survival of an organization in today's turbulent and hypercompetitive business environment. Therefore, a complete understanding of what it takes to have 'Dynamic IT capability" is necessary to excel in today's aggressive business environment, marked by an increasing need to innovate.

This research had two main goals. The first was to create a framework that illustrated the relationships between the 'Resources' (Dynamic IT knowledge management, Dynamic IT human resource Management, Dynamic IT technology resource management) and the 'Capabilities' (Dynamic IT strategy planning, Dynamic IT Systems Development, Dynamic IT Change Management). We created a framework that not only highlighted the various dynamic capabilities but also how they are organized, rather than simply bundle them together. Put differently, we proposed a set of essential dynamic IT capabilities as well as their relationship under the schema of Dynamic IT Capabilities. The other endeavor was to subject this framework to empirical testing through a model and establish the validity of the various relationships, which were operationalized through the hypotheses. For this we created a causal model that was fit for testing. However, in the empirical model, not all the hypotheses (relationships) were supported. Although, not all hypotheses were found to be significant, the directions of the relationships (positive or negative) agreed with the model. The successful agreement of most of the relationships brings out the usefulness

of the model. It also contributes to strengthening the underlying theories used in the framework. Figure 7.1 presents the hypothesized relationship with the level of significances. The relationship between 'Dynamic IT Outsourcing management' and 'Dynamic IT Human Resource Management', as well as the relationship between 'Dynamic IT Human Resource Management' and Dynamic IT Strategy Planning' was not statistically supported. In the case of the former relationship, intuitively, if an organization is outsourcing its IT function, then the onus of upgrading skills in keeping with IT; excellence in technical skill, which enables development of IT solutions using the latest techniques (i.e. a core resource), is now transferred to the IT personnel performing the outsourcing. Practitioner literature suggests that one of the common misunderstandings of outsourcing is the need to eliminate competence (Saunders et al., 1997; Lutchen, 2004). The outsourcing of IT must be done with certain circumspection, based on the maturity of the IT systems and its uniqueness to the organization's endeavors (Grover and Teng, 1993). Therefore, it may not be possible for internal IT human resource to flourish in the event competitively critical systems and/or novel technology are outsourced. The IS outsourcing literature has suggested that access to skilled personnel is among the 'gaps to filled' with outsourcing (Teng et al., 1995; Saunders, 1997; Lee and Kim, 1999). This reinforces that point that in such cases, organization may choose to shy away from investing in their own IT personnel (i.e. encouraging learning new technology, developing business knowledge). From a psychological perspective, the word 'outsourcing' can be misconstrued as a potential job loss by personnel, leading to de-motivation (Bettis et al., 1992).

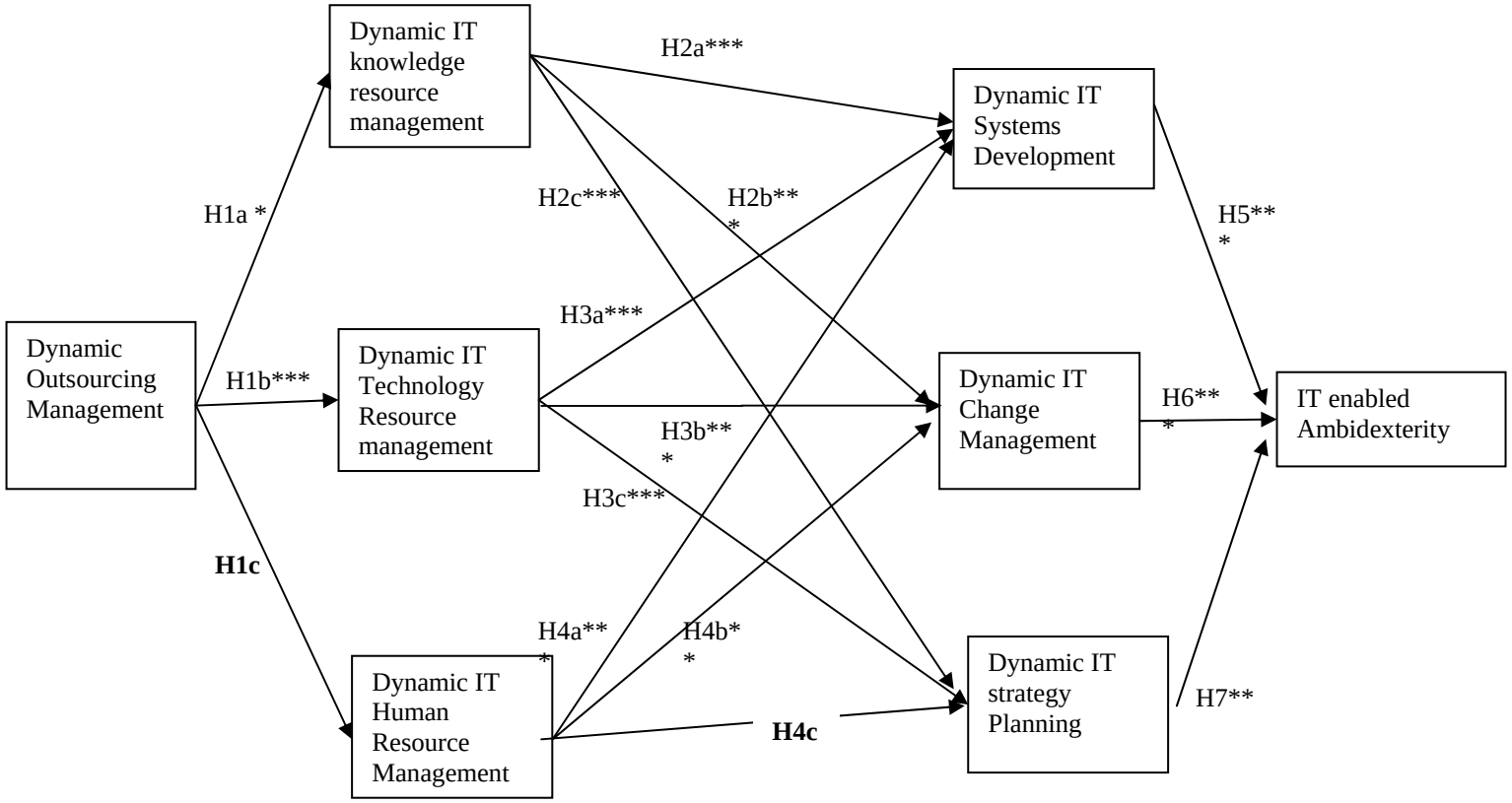

Figure 7.1: Hypothesized Relationships with the levels of significances
(***: significant at 0.01 level; **: significant at 0.05 level; *: significant at 0.1 level)

In the latter case of relationship between human resource and planning, it appears that planning is more often done with a focus on the IT infrastructure in mind rather than what the personnel are capable of. Another reason could be that there is a high turnover of IT personnel in organizations (Baroudi, 1985; Guimaraes and Igbaria, 1992; Moore, 2000), and therefore, focus on planning is done with less emphasize on the capabilities of the IT human resource.

Interestingly, although outsourcing was found to be positively associated with IT knowledge resource management, the association was weak. When an organization increases in span and incorporates new avenues for knowledge, it has the potential to become more aware. Likewise, when an organization builds external networks, it has access to new knowledge through these new channels of learning (Doz and Prahalad, 1991). Similarly, through outsourcing, organization are able to enhance their learning especially in joint research and development, new product development environment (Chen, 2005). However, on the flip side, when an organization outsourcers, it does not have the capability to learn from its own mistakes, this value based knowledge is almost non-existent. The strategic value of IT systems comes into view only after the users have learned about its possibilities through trial and error, and various applications of those systems (Earl, 1996). In a study of specialized case of outsourcing, i.e. strategic alliances, Larsson et al. (1998) put forth the concept of 'learning dilemmas', where the learning can be stymied by the exploitation tendencies, lack of trust, communication of the partnering firm.

Outsourcing can have a positive impact on IT technology resources. When an organization is required to keep with ever changing requirements, its IT infrastructure has to also keep pace with the these need. The more scaleable, flexible an infrastructure can be rendered the more the organization can rise to challenges such as putting up a new systems faster, planning its business and IT strategies more effectively. Since, IT is constantly called to expand its scope and flexibility; outsourcing is an excellent process to achieve such objectives (Lee et al., 2003).

Overall, outsourcing appears to be akin to a double edged sword; while on one hand it can give you access to new IT and free up resources, it can constrain the quality of other essential dynamic resources. Literature has often stressed that approach to outsourcing must be make with due diligence and thorough analysis of the objectives it aims to satisfy (Feeney and Wilcocks, 1998; Grover and Teng, 1993; Earl, 1996).

Support for hypotheses H2a-c, the positive impact of absorbing knowledge and learning from mistakes on Systems Development, Effective Change Management, and Dynamic IT strategy planning was established.

The association between knowledge resource management and IT strategy planning was particularly strong. Lessons from past implementations along with mistakes form new learning experiences. These experiences coupled with new knowledge that is created while employees try new possibilities, greatly speed up the process of putting an IT system together. At the same time this also offers greater insights, thereby making the Dynamic IT Strategy Planning process more effective. This organization knowledge in the form of insights and new knowledge can greatly

augment an organization's capabilities (Garvin, 1993). Dynamic IT Strategy Planning can be considered as one of these capabilities. Organizational resources can greatly contribute in making planning more effective (Vitale et al., 1986). Such resources comprise of insights from past and new knowledge. Similarly, empirical based findings suggest the association between learning with planning (Tippins and Sohi, 2003).

The association between knowledge resource and IT change management was also strong. The valuable lessons learnt along with new knowledge greatly facilitate the process of effectively managing change (Kettinger and Grover, 1995; Hendry, 1996; Orlikowski and Hofman, 1997; Armenakis and Bedeian, 1999). For instance, the organization can better plan or even improvise their plan for managing the change process; top management could have learnt through past experiences that their direct involvement with the change management process will greatly facilitate its implementation and its completion.

The relationship of knowledge resource management with IT system development although significant was not as strong as with either dynamic IT strategy planning or dynamic IT changes management.

Dynamic IT Infrastructure was found to be positively associated with all the 'Capabilities' (IT Systems Development, Effective Change Management, and Dynamic IT strategy Planning). These relationships (H3a-c) were empirically supported.

The strongest association of Dynamic IT Infrastructure was with IT strategy planning. The flexibility of an IT resource can also greatly help in the decision process that is involved in IT based innovation (Duncan, 1995). Technology resources that are

flexible and accommodating, allow for more latitude in planning (Keen, 1991). Armed with the knowledge that the organization has superior resources to put to use, the planning process can be made more aggressive. Organizations can also plan for and embrace new avenues for business by harnessing the potential of newly introduced IT. For example, using data warehousing to plan and turn a business around (Cooper and Watson, 2000).

Scalable IT infrastructure can also help in overcoming the reluctance to upgrade, since business workflows would not have to come to sudden halts or even have to slow down. Migration to new generation of platforms canl be smoother, involving minimal resistance to change. Since a system can be more or less seamlessly accommodated through data architecture that is flexible and service oriented (SOA), the development of an IT system can be done relatively faster.

Dynamic Human Resource Management, was empirically found to related to Dynamic IT Systems Development and Dynamic Change Management. It seems intuitively that greater the skills of the IT personnel and more they are willing to try new approaches, constantly challenging the old development process, and expanding their business knowledge, the more likely they are going to contribute to the speed with which an IT system is put together. At the same time, they can work alongside with other non-IT organization personnel more effectively by allaying fears and educating them. This approach can greatly contribute to a much smoother change management process, resulting in faster acceptance of a new IT system with the desired results.

Strong direct relationship was found for an organization's IT enabled ambidextrous innovative capability and the capabilities of Systems Development, Change Management, and Dynamic IT Strategy Planning. The availability of a new innovation (IT system) to the organization can be brought into play, in order to support the innovative endeavors. By enabling disparate systems in the organization to be connected, silos of information can be collated for greater potential (Feld, 2004). With a change that is overcome and accepted, new IT is welcomed and become part of the organization's fabric. This new technology give another opportunity to expand the innovation thrust, be it to make incremental improvements to the business work flows or radically new business models. Likewise, with strategic business planning that is able to take new IT into account, new avenues for making improvement or creating fundamentally new and different products, processes, and structures become feasible.

7.2 Contribution

Academic research as well as practitioners interested in the concept of IT dynamic capability and innovation, will find merit in the arguments of this thesis. They can increase their understanding in this new and fertile area of scientific scrutiny. Past research broke new ground by attempting to open the 'black-box' of capability, we took this enthusiasm further and brought the focus to a finer point- the domain of (Organizational IT Dynamic IT Capability). While augmenting the demystification process of Dynamic Capabilities, we also demonstrated that the components within the 'box' not are arranged in a random fashion but rather they have a clear relationships and

order. The first level (order) is what we refer to as ‘resources’ comprising dynamic IT knowledge resource management, dynamic IT human resource management, and Dynamic IT technology management. The second level (order) is what we labeled as, ‘Capabilities’ comprising Dynamic IT strategy planning, Dynamic IT systems development, and Dynamic IT change management. Finally, the last level is ‘IT enabled ambidextrous innovative capability’, which comprises IT led exploitative innovation and IT led explorative innovation. Logically, you need to have the resources that work with to energize you, only then you can achieve you target. We will use the metaphor of a ‘battle soldier’ to illustrate. The resources are the training, the weaponry, the capabilities are the skills in mobilizing and making use of the training and weapons, for the final outcome, i.e., exploit or explore. In a sense, we feel have make the first break through in putting the horse before the cart. In addition to a cogent arrangement of what constitutes dynamic IT capabilities, we also have enriched the definition of Dynamic IT Capability-”*An organization's capabilities to enable and sustain exploitative and explorative business innovations through dynamic management its IT resources and deployment of information systems solutions”*.

The validated framework not only highlights the various capability factors but also presents the relationship among them. In specific, the various contributions of this thesis are summarized as:

1. Define the construct of organizational dynamic IT capability
2. Offer greater clarity on the relationship among the various constructs

3. Present an arrangement of the various ODITC constructs that are informed by trans-disciplinary theories such as the General Systems Theory
4. Offer a clarity between what constitutes ‘resources’ and what ‘capabilities’ and their relationship. How do they all fit?
5. Offer a validated instrument that can be used in future dynamic capability research.
6. Lastly, this organizational dynamic IT capability framework will serve to answer practitioner questions such as, “How do I know I have dynamic capability?”

7.2.1 Contribution to Research

On the academic front, research in dynamic IT capabilities is a rich phenomenon which present challenges to researcher. It is an ongoing extension of the Resource Based View, and a theory of sorts in its own right. Dynamic capability view is a macro level theoretical construct, which encompasses almost all aspects that surround an organization in terms of technical, behavioral and economic aspects. This characteristic renders it an extremely fertile ground for scientific inquiry from multiple disciplines. Previous research has conceptually defined dynamic capability from multiple view points and the definition is still shaping up. Moreover, the empirical foundations are still being built.

Through this thesis we have answered the call for the above mentioned challenges. We not only theoretically establish that construct of organizational dynamic

IT capability and explain its components but also empirically validate it at an organizational level.

We have offered a definition of Dynamic IT capability. In doing so, we uncovered and established empirically the set of constructs that define dynamic IT capability. Through this exercise, we also validated a model that presents the various capabilities at different levels and how they all fit; their relationship. In this process, we created a validated scale that can serve as a starting point to greater research in this area.

The theoretical advances achieved should present abundant opportunities for further advances in this area of inquiry, both theoretically and empirically.

7.2.2 Contribution to Practitioners

Organization management is increasing accepting the power of IT capabilities, insisting that organizational IT contribute to innovation endeavors. The CIO is not seen anymore as a passive senior executive but a partner in creation of the business strategies.

Our research ideas stem from the widely held belief that Dynamic Capabilities are paramount for the survival of an organization in today's turbulent and hypercompetitive business environment. Therefore, a complete understanding of what it takes to have 'Dynamic IT capability" is necessary to excel in today's aggressive business environment, marked by an increasing need to innovate. Practitioners often ask: "How do I know my organization has dynamic IT capability? "

The constructs of dynamic capability detailed through our framework, enable practitioners to ascertain if they possess most or some of these capabilities. This also in

turn enables them to assess the level of their capabilities. The robust items in our survey instrument provide a diagnostic assessment of specific capabilities that can be used to evaluate an organization's current level of Dynamic IT Capability in key areas including:

- IT leadership in relation to business strategy
- Change management in implementing IT iterative
- IT infrastructure for meeting evolving organizational needs
- IT human resource for supporting changing organizational requirements
- Maturity of outsourcing for acquiring additional IT resources
- IT knowledge management

Armed with this, they now have a better understanding of the gaps that exists in their processes and workflows and the fixes they need to put in place and finding answer to questions such as: 'What is our current level of Dynamic IT Capability? What do I need to add/work on?'

7.3 Limitations

The study is a cross-sectional study. This is inherent in survey research. With data collected at one point in time, it becomes a challenge to infer causality and therefore we suggest caution when interpreting the results. Nevertheless, we consider this a necessary but acceptable risk to infer associations between the various constructs.

Another limitation factor of this study is the low response. Although, it is difficult to estimate a response rate when the sample population is unknown, we tested

for non-response bias. To ascertain the risk posed by response rate bias, we carried out extrapolation test, which determined the risk to be non-significant.

This study could have benefited from connecting this framework other measures. For instance, in the study we could have incorporated financial measures for performance. However, this study was in the spirit of an exploratory study, we stopped at validating the model with the various relationships among the capability constructs.

7.4 Future Studies

In our study, while we focused on only the key constructs of dynamic capability, we feel there are many more promising avenues for future research.

One of the avenues rich for exploration is in the measurement of the final outcome measure of performance. Performance too can be measured from several points. One could be perceptual measure, while the other option is to use performance metrics.

In this study we did not analyze for any moderation effect of the environment. It is possible that some of the constructs interact with environment variable and change the composition of the relationships amongst constructs. For instance, environmental uncertainty could potentially change the significance of relationships and offer insights into new arrangements for the constructs.

In the spirit of an exploratory research, this study was conducted free of the fetters of any particular context. However under differing context, such as new product development, mature markets, the constructs might show other interesting relationships.

Moving from a generalized context to a specific context will also give a more specific implication for practitioners in that arena. For instance, research in the context of a mature market might reinforce the findings that IT personnel management does not play such a significant role in the overall schema of dynamic capability.

Lastly, this research represented a 'snapshot' in time. Let us represent this snapshot by the letter,'*t*'. Let us represent a future snapshot in time by '*t+1*'. This research does now illustrate what could possibly happen among the relationships of the constructs between two time periods (i.e., between 't' and 't+1'). This limitation could be overcome by a study that is longitudinal. Possible changes in the relationships, if any, may be inferred by comparing the results between the time *'t'* and the time *'t+1'*. Endeavors in such direction may perhaps yield interesting results

7.5 Conclusion

The resource based view along with the dynamic capability view, has provided strategic insights to the successful management of valuable resources. However, the field is IT dynamic capability has just taken roots. This study drew on the rich body of knowledge in the strategic management and IT fields along with the rich theories general systems theory, organizational cybernetics and the information processing theory of organizations to define the construct of organizational dynamic IT capability. In addition we attempted to bring lucidity to the relationship among the various constructs that constitute dynamic IT capabilities. In this we also created a better distinction between 'resources' and 'capabilities' and outlined their relationship. To

address the objectives of this thesis, a survey instrument was developed, that was informed by theory and previously validated research and vigorously tested. Then, data was collected from senior IT manager, including CIOs across several industries. A partial lest square regression analysis was performed using PLS graph. The results provide excellent support for the reliability of the instrument and the validity of the organizational dynamic IT capability model. While, the hypothesized relationships among the construct were found to be significant, the relationship between Dynamic IT outsourcing management with Dynamic IT human resource management, and Dynamic IT human resource management with Dynamic IT strategy planning were not supported.

Developing and nurturing dynamic IT capabilities are becoming a almost 'must' for organizations who are keen on remaining competitive. Competition, customers or the business environment is no longer predictable but marked by changing customer needs, new business models and hyper competition. Although, a Dynamic IT capability encases obvious and ostensible benefits, it nevertheless creates its own set of challenges. Therefore, both practitioners and academicians want to constantly augment their understanding of how to achieve success in innovation and the contributing dynamic capability factors.

We have developed a theoretical framework of the relationship of resources (dynamic IT technology resource management, dynamic IT knowledge resource management, and dynamic IT human resource management); capabilities (Dynamic IT Strategy Planning, Dynamic IT Change Management, and Dynamic IT System Development); IT enabled Ambidextrous Innovative Capability (ability to invoke IT for

exploration and exploitation). The systematic theoretical development of relationships between each individual capability captured in the framework is relevant to both practitioners and academicians. This thesis brings out the interplay among resources, capabilities and ambidexterity. What is dynamic IT capability is given meaning and what constitutes this concept is discussed. The study satiates academic curiosity and rigor without sacrificing practical relevance.

APPENDIX A

TABLE OF IS RESEARCH ARTICLES DISCUSSING CAPABILITIES

Summarization of the conceptualization of dynamic capability in IS literature		
Author and Publication	**Gist of the article**	**Key Constructs**
Miller (1989), Proceedings of ICIS	Discusses several instruments that measure UIS- a organizational effectiveness construct	UIS
Ross, et al. (1996), SMR	Outlines 3 IT capabilities such as: Competent IT HR, IT architecture and Standards, and Strong investment by management in IT	IT capability
Clark, (1997), MISQ	Stresses the importance of change readiness IT Capabilities specific to systems. These include, delivering IT products in short bursts, and developing IS workforce with entrepreneurial skills	IT capabilities (change readiness IT capabilities)
Clemons and Row (1991), MISQ	Sustaining IT advantage by exploiting unique Resources of the firm. A RBV	Resources
Mata et al. (1995), MISQ	Uses RBV to explain sustained competitive advantage.	Resource/ Capability (used interchangeably)
Jarvenpaa and Leidner (1998), MISQ	Try to differentiate between resource and dynamic capability	Dynamic Capability
Ravichandran and Lerwongsatein (1998), Proceedings of AMCIS	Attempts a distinction among Resources, Capabilities and Competencies. Claims that resources and capabilities are antecedents to competencies	Resource/ Capability

Table- *Continued*

Feeny and Wilcocks (1998), SMR	Proposed a set of core IS capabilities. However, they read more as enabling Factors for capabilities. They argue for better relationship between IT and other business functions	Core IT capabilities
Bharadwaj and Sambamurthy (1999), Proceedings of ICIS	One of the :first attempts at capturing DC perspective. Uses Grant (1991); Amit and Shoemaker, 1993 distinction between resource and capabilities. Proposes IT capability as an organization wide constructs that is reflected in 6 concepts. These are: IT business Partnerships, Eternal IT linkages, Business IT Strategic Thinking, IT Business Process Integration, IT management and IT infrastructure	IT Capabilities
Bharadwaj, (2000), MISQ	Concept of IT as an organizational capability. Investments in IT capabilities lead to superior firm performance. Based on Grant's view, the author proposes that IT capabilities as the ability to mobilize and deploy IT based resources of IT infrastructure, IT resources of technical and managerial skills, and intangibles such as knowledge assets, customer orientation and synergy	IT capability
Heijden, (2000), Proceedings of ICIS	Operationalizes Feeny's 3 core IT capabilities that relate to IT- business relationship.	IT core capabilities

Table- *Continued*

Sambamurthy and Zmud, (2000), ISR	Based on Bharadwaj, Ross, authors conceptualize IT Capabilities as combinations (value- added contributions) of IT assets and routines. Makes a distinction between IT capabilities and IT tasks based on (value-added contributions of IT - assets and routines, interdependency between assets and routines, and dynamism	IT capabilities
Choi and Choi (2001), Proceedings of AMCIS	IS Infrastructural capabilities. Has 3 constructs that appear to be more like antecedents for IT Capability	IT capability
Gold et al. (200I) JMIS	Authors feel that capabilities are preconditions for KM success. These capabilities are: Absorptive capacity, Social capital and infrastructure in the form of technology, structure and culture. However, there is little distinction between capabilities and resources	Capabilities
Ravichandran and Lerwongsatein (2002), Proceedings of ICIS	Uses RBV.	IT capabilities
Butler and Pyke, (2003), Proceedings of ECIS	Discussed how SME can develop their competencies for achieving dynamic capabilities	Dynamic capabilities
Yu, Seunghee, et al (2003), Proceedings of ICIS	Authors are of the opinion that organizational routines/processes allow an organization to cope with disruptive and complex technologies	Organizational capabilities

Table- *Continued*

Santhanam and Hartono (2003), MISQ	Talks about higher order capabilities e.g. DC. Results indicate that performance differential could be due to higher order capabilities.	IT Capability
Sambamurthy, et al (2003), MISQ	Argue that IT investments and capabilities influence Firm performance through organizational capabilities, i.e. Considered dynamic capabilities (which are: agility, digital options and entrepreneur alertness), strategic processes (capability- building, entrepreneurial action, and coevolution adaptation). Also, the authors differentiate between resource picking and capability building. Capability building mechanism is defined as DC	Organizational Capabilities, DC
Tarafdar and Gordon (2004), Proceedings of ICIS	Proposed 5 dimensions of IT capabilities based on Bharadwaj (1999). These are: IT infrastructure, IT Human Resource, IT related intangible resources, IT governance, and IT coordination	IT capability
Wade and Hulland, (2004), MISQ	Based on a review of RBV in IS, the author feels that resources' can be categorized into 2 fields: IS assets and IS capabilities. Further, they define assets as resources and capabilities that sense and respond to market changes. Assets and capabilities both define the set of resources available to a firm	Resources/ Capabilities
Peppard and Ward, (2004), SISJ	Authors are of the opinion that IS capability literature has a limited defined IS capability and they propose a more comprehensive definition of IS organization capabilities and attempt to distinguish it from Competencies.	IS capability, Competencies

Table- *Continued*

Melville, et al (2004), MISQ	Based on IT value literature review, proposes a model of IT value. The combination of IT resources and complementing business resources lead to business processed that affect firm performance	IT value
Tarafdar and Gordon (2005), Proceedings of ECIS	Similar to the author's earlier paper in ICIS 2004	IT capability
Guillemette, M., at al (2005), Proceedings of ICIS	The various roles of IT archetypes such as: Partner, Systems Provider, Infrastructure builder, Leader, and Coordinator	IT roles and transformation
Butler and Murphy (2005), Proceedings of ECIS	Conceptualizes capabilities as the efficient and effective application of the experiential knowledge of the finn's personnel.	IT capabilities/DC
Lee, One-Ki, et al (2005), Proceedings of PACIS	Discusses specific forms of capabilities, such as Cross functional capability, combinative capability, org learning and organizational agility. Classify different levels of IT capabilities	IT Capabilities
Wheeler (2002), ISR	Considers dynamic capability in the context of net enablement. Outlines four mechanism for this capability. These are: Identifying opportunities, Choosing the IT, Matching the IT with economic opportunities and Assessing customer value. All these activities will involve learning	Dynamic capability
Zahra and George (2002),ISR	Extends Wheeler's thought to include Entrepreneurship as a formative construct for Dynamic capability.	Dynamic capability

Table- *Continued*

Bhatt and Grover, ISR, 2005	Differentiate between value capabilities and dynamic capability	Dynamic capability
Pavlou, 2005,Doctoral dissertation	Builds on Teece's work. Proposed specific components of dynamic capability in a new product development environment. Uses reconfigurability as a proxy for dynamic capability. The components of dynamic capability are: learning, collective mindset, openness, coordination	Dynamic capability
Piccoli and Ives, B., MISQ, 2005	Propose a framework that postulates that 'barriers to erosion' are essential of sustained competitive advantage. These barrier are formulated as a consequence of learning and asset stock accumulation	Dynamic capabilities

APPENDIX B

INSTRUMENT BEFORE PILOT TEST

ODITC

Directions:

Please indicate the extant to which you agree or disagree with the following statements, on a scale ranging from 1 = strongly disagree, 4= neutral, 7= strongly agree.

These statements relate to the ability of an organization to follow an adaptive planning process which incorporates IT with business planning.

1. We have a planning process that is disciplined yet adapting to internal and external changes.
2. IT and business planning are developed concurrently in the same integrated planning process.
3. Our IT and business planning are able to accommodate each other, when faced with new challenges.
4. IT planning is able to take changes in business strategies into consideration
5. Whenever deemed necessary, we can adjust our business plans to leverage new enabling information technology opportunities.
6. Business strategies are often influenced by emerging information technology that offers opportunities to develop innovative products, processes, or structures.
7. We are able to incorporate the competitive potential of new information technology in our business planning process.

These statements relate to the ability of the organization to effectively manage the change process and integrate new IT within the context of the organization.

5. We effectively integrate new information systems with business work processes.
6. We have effective high-level champions and/or sponsors for our new IT initiatives.
7. We have excellent general top management support in implementing new information systems.

8. Our major IT implementation efforts are effectively phased to enhance user acceptance and systems success.
9. Users actively and effectively participate in new IT initiatives.
10. We are able to plan and effectively manage organizational resistance to change
11. We are able to communicate reasons for changes caused by a new IT system

These statements relate to the ability to ensure that a high level of flexibility and quality of IT infrastructure can be sustained in support of different organizational initiatives

5. We enforce standards that ensure compatibility of new IT platforms with existing ones.
6. We follow processes through which legacy IT systems do not limit the development of new IT systems
7. We are able to integrate different and distributed IT systems by keeping the data architecture flexible.
8. We are able to make evolutionary changes to our IT platforms over the years in order to support our business initiatives.
9. We are able to facilitate integration of cross-functional business processes by linking different and distributed IT platforms.
10. We are able to meet our organizational objectives, by keeping IT systems scalable.
11. Through our IT infrastructure, we are able to facilitate the integration of business processes linking suppliers and customers.

These statements relate to the ability to constantly update and enhance IT personnel's skills and knowledge to meet the organization's changing IT requirements

6. We are able to maximize the productivity of our IT personnel in support of the organization's initiatives.
7. We constantly upgrade IT personnel's skills in keeping with our IT thrust.

8. Our IT personnel try their best to work on the organization's IT agenda.
9. We provide incentives to encourage innovation and creativity amongst our IT personnel.
10. IT personnel are encouraged to come up with new and novel ideas that are helpful to our critical IT initiatives.
11. We do a good job in helping our IT personnel to develop technical as well as business knowledge.
12. We train our IT personnel to communicate better with users in non-technical terms.

These statements relate to the ability of acquiring additional IT capabilities through external relationships that help us meet the shifting business requirements.

9. We are able to develop external relationships that help us in our current and future needs.
10. We are able to build mutual trust with our business partners which benefit us both in the short and long run.
11. Our IT vendors are able to help us deploy minor as well as major IT projects.
12. We are able to have better access to skilled IT personnel through our IT vendors.
13. Our IT vendors are able to help effectively manage our IT resources.
14. Our IT vendors provide us with excellent opportunities to access leading-edge information technologies.

These statements relate to the ability of the organization to acquire and absorb knowledge and the competency related to emerging information technologies.

6. We constantly collect information on new developments in IT so we can thoroughly understand its potentials.
7. We regularly participate in activities such as trade shows and conferences to acquire new knowledge on IT.
8. In our organization many IT innovations are initiated by employees.

9. Our organizational culture is conducive to learning and absorbing new information technologies.
10. We have effective education and training programs to help our employees acquire critical new IT skills.
11. Our employees constantly learn new IT.
12. Our employees are good at experimenting with novel IT.

These statements relate to the ability of the organization to successfully apply lessons learned from previous experience towards future IT initiatives.

7. Lessons from past IT projects are effectively shared throughout the organization
8. We have effective communication channels, such as discussion groups and forums, to learn from previous IT implementation efforts.
9. Past mistakes in IT projects are well documented and understood.
10. Similar mistakes in IT initiatives are seldom repeated.
11. Blunders in previous IT projects help us to make fewer mistakes in new IT initiatives.
12. IT decisions are carefully examined based on previous experience.
13. We have a rigorous process for post-implementation IT project reviews.

These statements relate to the ability to leverage IT to improve current products/ processes / structures.

7. We are good at using IT to gradually improve product/service quality.
8. IT has been used successfully to incrementally modify our business processes and procedures.
9. We are successful in using IT to reduce cost.
10. We do very well with IT in projects where the expected returns are certain.
11. Our organizational structure has improved steadily as a result of IT implementation.

These statements relate to the ability to leverage IT to create fundamentally new products/ processes/ structures.

8. We used IT creatively in introducing new products or services.
9. We are able to use IT innovatively to open up new markets.
10. We are good at exploring the potential of IT for breakthrough business performance.
11. IT has been used innovatively in transforming the structure of our organization.
12. We excel at innovative applications of IT.
13. We have been successful in using IT to radically improve business processes and procedures.

APPENDIX C

SOLICITATION TO CIO MAGAZINE

Dear Sir,

My senior colleagues at the University of Texas and I are working on a very exciting research that is concerned with Dynamic IT Capabilities and its contribution to overall organization dexterity in innovation.

We believe that this important and useful research will help to significantly shed light to the very pertinent questions that all senior mangers and CIOs have been asking, "How do I know that my organization's IT is geared to face the turbulent and hyper-competitive landscape"? Is there a way to assess these capabilities? As a continued research effort, we also attempt to address questions such as. "How do I achieve a balance in my approach to innovate incrementally or radically"? To attend to these very significant questions, we feel that your readers are the best qualified to answer our research questionnaire.

We would like to propose a partnership with you to pursue the goals of this research. In exchange for an e-mail from you to your members promoting our on-line survey, we would be more than willing to provide you with the study findings which you can publish in your journal. The information collected will be secured and responses will not be connected to specific individuals in any way. A sample survey is available for your review at: http://www2.uta.edu/infosys/survey/aj/sample/ page0.asp

If you would be willing to participate in this study and partner with us, or if you would simply like more information before making such a decision, please do not hesitate to call me at 978-542-6894. If you prefer e-mail, you may contact me at ajain@salemstate.edu.

Your timely response will be greatly appreciated. Thank you for your time and consideration.

Anurag Jain

APPENDIX D

CALL TO PARTICIPATE IN SURVEY BY CIO MAGAZINE

There's no shortage of creative ideas for making businesses more competitive. Now let's explore how to turn those ideas into reality.

What Should You Do to Build Your Capacity to Innovate?

Tuesday, October 17, 2006

Let’s assume your IT department is in pretty good shape. But you want to boost your capacity for innovation. Where to start?

Researchers at the University of Texas, Arlington College of Business Administration are tackling this question with a survey that probes which of several key IT management capabilities are most important not only to an organization’s ability to innovate, but to its ability to survive.

Anurag Jain, research associate for the project, is looking for CIOs and senior IT managers to take the survey, which you can find here . I think it’s worth a few minutes of your time because it has potential to generate some concrete action items for IT organizations that are trying to learn how to, or get better at, innovating. Here’s why:

It’s accepted wisdom that the best IT departments are good at the following:

Alignment with the business

Managing change

Establishing trusted relationships with vendors and outsourcers

Managing infrastructure systematically

Assimilating information about new technologies

Deriving best practices and lessons learned from past performance

Ensuring their IT staffs up to date technical skills and have good business savvy.

But there's little conclusive research, says Jain, as to which of these characteristics have the biggest impact on one's ability to innovate. So Jain and his colleagues (who include James T.C. Teng, professor of information systems and operations management, and assistant professor Sridhar Nerur) intend to correlate how survey participants rate their proficiency in these areas with what they report about their success at innovation. When the results are tabulated, Jain expects to learn in which areas highly innovative companies do best. (we'll report the results here sometime in December). We'll find out, for instance, whether the skills of your internal staff are relatively more important than having strong partnerships with your outsourcers.

There's even more value in the next step, however: using the survey as a diagnostic tool to identify what aspects of your own IT organization need shoring up. Jain says that once he knows which capabilities are key to innovation, he'll develop a self-assessment tool that CIOs can use to rate their own capabilities. He expects to have the tool ready in the first quarter of 2007, at which point I'll link to it.

However, to develop the tool Jain needs data from at least a few hundred participants (as an extra incentive, those who take the survey get a chance to win one of several well-regarded management books and can get their own copy of the survey results). Jain's also made it easy for you to link back to CIO.com when you're done with the questionnaire.

If you do take the survey, let me know what you think about it.

APPENDIX E

FINAL SURVEY INSTRUMENT

The University of Texas at Arlington

When its time to innovate your organization's ability to operate dynamically will be highly dependent on making the right IT decision. Which capabilities are significant? Is it your leadership? The state of your infrastructure? Your ability to leverage outsourcing? Or are there other capabilities? The aim of this research is to offer insights into these important capabilities and their impact on an organization's ability to innovate.

To find out which capability matters most to innovation, take the survey. Enter your email address at the end to receive a copy of the results and have a chance to win one of today's "must read" IT management books*.
Your participation in this survey is completely voluntary

START...

* The Drawing
- 20 Winners will be be drawn at random from those who respond to this survey
- Winner will be informed along with a list of IT management books to choose from.
- Prizes include titles such as: *IT Governance, Enterprise Architecture as Strategy, Blue Ocean Strategy, Seeing What's Next, Fast Innovation, The Only Sustainable Edge, The Agile Enterprise, Conquering Complexity in Your Business, Managing IT as a Business, The Joy of SOX, The Medici Effect, Winning Through Innovation, The Innovator's Dilemma, etc.*

All responses will be kept completely confidential and not linked to any specific individual- You may contact Office of Research Compliance 817-272-3723 at University of Texas- Arlington regarding confidentiality. If you have any questions please contact Anurag Jain at: 987-542-6894 or e-mail: ajain@salemstate.edu

Research Team:
Anurag Jain, Research Associate
James T.C. Teng, West Distinguished Professor
Sridhar Nerur, Assistant Professor

The following statements describe the ability to follow an adaptive planning process which incorporates IT with business planning.

Please indicate the extent of your agreement with each of the following statements using the following scale:
1 = Strongly Disagree; 3 = Neutral; 7 = Strongly Agree

	1	2	3	4	5	6	7
	Strongly-Disagree			Neutral			Strongly-Agree
Our IT planning process is disciplined yet adaptive to internal and external changes.	☐	☐	☐	☐	☐	☐	☐
IT and business planning are developed concurrently in the same integrated planning process.	☐	☐	☐	☐	☐	☐	☐
IT planning is able to take changes in business strategies into consideration.	☐	☐	☐	☐	☐	☐	☐
Our top IT managers are able to introduce new IT that often influences the strategic directions of business.	☐	☐	☐	☐	☐	☐	☐
Business strategies are often influenced by emerging IT that may provides decisive advantages against our competitors.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to effectively manage the change process in integrating new IT within the context of the organization.

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
We have high-level champions and/or sponsors to effectively facilitate the change process in new IT initiatives.	☐	☐	☐	☐	☐	☐	☐
We have excellent top management support for the change effort involved in implementing new information systems.	☐	☐	☐	☐	☐	☐	☐
We are able to plan and effectively manage people's resistance to change.	☐	☐	☐	☐	☐	☐	☐
We are good at communicating with people affected by the changes while implementing a new IT system.	☐	☐	☐	☐	☐	☐	☐
We have competent project team members who effectively facilitate the change process involved in new IT initiatives.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to sustain a high level of flexibility and quality of IT infrastructure for supporting evolving organizational initiatives.

	1	2	3	4	5	6	7
	Strongly-Disagree			Neutral			Strongly-Agree
We enforce standards that ensure compatibility of new IT platforms with existing ones.	☐	☐	☐	☐	☐	☐	☐
We follow processes through which legacy IT systems do not limit the development of new IT systems.	☐	☐	☐	☐	☐	☐	☐
We are able to integrate different and distributed IT systems by keeping the data architecture flexible.	☐	☐	☐	☐	☐	☐	☐
We do a good job in making evolutionary changes to our IT platforms over the years in order to support our business initiatives.	☐	☐	☐	☐	☐	☐	☐
By linking different and distributed IT platforms, our IT infrastructure has helped us to integrate internal business processes, and provide links to suppliers and customers	☐	☐	☐	☐	☐	☐	☐
We are effective in supporting new strategic initiatives by keeping IT systems scalable.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to effectively develop new IT systems to meet dynamic business requirements.

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
Compared to our competitors, we are able to successfully develop and deliver new IS systems faster.	☐	☐	☐	☐	☐	☐	☐
Users always participate in and contribute to successful IT development projects.	☐	☐	☐	☐	☐	☐	☐
In our organization, IT innovations often come from employees, leading to the development of many new IT/IS systems.	☐	☐	☐	☐	☐	☐	☐
We constantly collect information on new technologies, through trade shows, conferences, etc, in order to launch innovative IS development projects.	☐	☐	☐	☐	☐	☐	☐
We have been effective in developing new IT/IS systems to meet dynamic business requirements.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to acquire additional IT capabilities through outsourcing vendors.

	1	2	3	4	5	6	7
	Strongly-Disagree			Neutral			Strongly-Agree
We have access to skilled IT personnel through our outsourcing providers which we otherwise would not have.	☐	☐	☐	☐	☐	☐	☐
Our outsourcing vendors can provide less costly IT human resource than we can.	☐	☐	☐	☐	☐	☐	☐
We have access to technologies through our outsourcing providers which we otherwise would not have.	☐	☐	☐	☐	☐	☐	☐
Our outsourcing vendors can provide less costly IT infrastructure (such as data center and networking) than we can.	☐	☐	☐	☐	☐	☐	☐
Outsourcing enables us to implement IT projects that we otherwise would not be able to.	☐	☐	☐	☐	☐	☐	☐
Outsourcing has reduced the risk of technological obsolescence.	☐	☐	☐	☐	☐	☐	☐
Outsourcing has afforded us more resources for enhancing our core competency and new strategic initiatives.	☐	☐	☐	☐	☐	☐	☐
Outsourcing enables us to develop new IT systems much faster	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to IT personnel's capabilities to meet your organization's changing IT requirements.

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
Our IT personnel are able to upgrade their skills in keeping with our IT thrust.	☐	☐	☐	☐	☐	☐	☐
Our IT personnel often come up with innovative ideas for new IT initiatives.	☐	☐	☐	☐	☐	☐	☐
Our IT personnel have excellent business skill, enabling them to develop IT solutions that satisfy business needs.	☐	☐	☐	☐	☐	☐	☐
Our IT personnel are good at communicating in non-technical terms.	☐	☐	☐	☐	☐	☐	☐
Our IT personnel have excellent technical skill, enabling them to develop IT solutions using the latest techniques.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to acquire and absorb knowledge and the competency related to emerging information technologies.

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
We provide incentives to our employees and encourage them to learn and absorb new information technologies.	☐	☐	☐	☐	☐	☐	☐
We have effective education and training programs for our employees to acquire critical new IT skills.	☐	☐	☐	☐	☐	☐	☐
Our employees constantly learn new IT.	☐	☐	☐	☐	☐	☐	☐
Our employees are innovative in their use of existing IT.	☐	☐	☐	☐	☐	☐	☐
Our employees are good at experimenting with emerging IT.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to successfully apply lessons learned from previous IT experience towards future IT initiatives.

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
Lessons from past IT projects are effectively shared throughout the organization.	☐	☐	☐	☐	☐	☐	☐
We have effective communication channels, such as discussion groups and forums, to learn from previous IT implementation efforts.	☐	☐	☐	☐	☐	☐	☐
Lessons from past IT projects are well documented and understood.	☐	☐	☐	☐	☐	☐	☐
Similar mistakes in IT initiatives are seldom repeated.	☐	☐	☐	☐	☐	☐	☐
Previous experience is always an important input to new IT decisions.	☐	☐	☐	☐	☐	☐	☐
We have a rigorous process for post-implementation IT project reviews.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to leverage IT to improve existing products / processes / structures.

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
We are good at using IT to gradually improve service quality over time.	☐	☐	☐	☐	☐	☐	☐
Over the years, IT has been successfully used to incrementally improve our business processes and procedures.	☐	☐	☐	☐	☐	☐	☐
We do very well with IT projects that use proven technology and are generally less risky.	☐	☐	☐	☐	☐	☐	☐
Our organizational structure has improved steadily over time as a result of IT implementation.	☐	☐	☐	☐	☐	☐	☐
We are making gradual but steady progress in using IT to reduce costs.	☐	☐	☐	☐	☐	☐	☐
We are good at using IT for maintaining satisfactory business performance.	☐	☐	☐	☐	☐	☐	☐

Please Continue...

These statements relate to your organization's ability to leverage IT to create fundamentally new products/ processes/ structures.

	1	2	3	4	5	6	7
	Strongly-Disagree			Neutral			Strongly-Agree
We have used IT creatively in introducing new products or services.	☐	☐	☐	☐	☐	☐	☐
We are able to use IT innovatively to open up new markets.	☐	☐	☐	☐	☐	☐	☐
We are good at exploring the potential of IT for breakthrough business performance.	☐	☐	☐	☐	☐	☐	☐
IT has been used innovatively in fundamentally transforming the structure of our organization.	☐	☐	☐	☐	☐	☐	☐
We excel at innovative applications of IT with decisive strategic business impacts.	☐	☐	☐	☐	☐	☐	☐
We have been successful in using IT to radically improve business processes and procedures.	☐	☐	☐	☐	☐	☐	☐
We are good in implementing high-risk IT projects involving new technologies.	☐	☐	☐	☐	☐	☐	☐

Please Continue

1. Gender ☐ Male ☐ Female

2. Age Less than 20

3. How many years have you worked in your organization? 1 years.

4. Your Job title ?

5. The following describes my organization's primary business at my location? (select one)

☐ Consultant/Professional ☐ Service ☐ Educational
☐ Financial ☐ Hospitality
☐ Information Technology ☐ Legal
☐ Manufacturing ☐ Media/Marketing/Advertisement
☐ Health Care/Medical ☐ Retail/Wholesale
☐ Service Provider ☐ Telecommunications
☐ Transportation ☐ Utility
☐ Government ☐ Others

Please Click here to end the survey

Thank You for completing this research survey

The objective of this research is to understand the dynamic IT capabilities that enable innovations in organization.

To receive a copy of the results and be entered in the drawing, please enter your e-mail address below. This email address will be kept confidential and in no way be linked to your survey. We will use the email strictly to send you the results and inform the winners of the 'Must Have' IT management book drawing.

Email

Submit

APPENDIX F

CROSS LOADINGS

Cross Loadings										
	Change Management	**Systems Development**	**Dynamic IT Technology**	**HR Management**	**Outsourcing Management**	**Dynamic Planning**	**Learning**	**Explore**	**Exploit**	**Absorptive Capability**
cp1	**0.7640**	0.6663	0.4867	0.5573	0.2112	0.5406	0.4780	0.3960	0.5144	0.4482
cp2	**0.7467**	0.5931	0.4870	0.4120	0.2584	0.5523	0.3687	0.3584	0.5831	0.4925
cp3	**0.8867**	0.5929	0.5795	0.5366	0.2569	0.5582	0.5530	0.5390	0.5921	0.6034
cp4	**0.8002**	0.5788	0.5919	0.5926	0.1460	0.6243	0.6299	0.6528	0.4937	0.5851
cp5	**0.8164**	0.5451	0.6630	0.6367	0.2144	0.6779	0.5747	0.5966	0.6186	0.6704
sd1	0.5492	**0.8016**	0.5800	0.5921	0.1314	0.5154	0.4827	0.6295	0.6139	0.5189
sd2	0.6012	**0.7224**	0.5357	0.5180	0.2786	0.5255	0.3881	0.3937	0.5936	0.4657
sd3	0.4739	**0.6411**	0.3848	0.4716	0.0382	0.4356	0.4179	0.4684	0.3225	0.4652
sd4	0.4714	**0.6719**	0.4444	0.4419	-0.0157	0.5780	0.4289	0.4650	0.3885	0.5755
sd5	0.6256	**0.8616**	0.6532	0.6490	0.0746	0.6592	0.5368	0.5747	0.5958	0.5949
it1	0.5120	0.4808	**0.7452**	0.5604	0.2593	0.5156	0.5466	0.4064	0.6369	0.4840
it2	0.5296	0.5889	**0.8134**	0.5365	0.3124	0.5514	0.5276	0.5151	0.6010	0.5451
it3	0.6290	0.6007	**0.8600**	0.5853	0.2697	0.5733	0.5304	0.5557	0.6129	0.5488
it4	0.5875	0.5663	**0.8197**	0.4522	0.1939	0.5914	0.5255	0.5260	0.6638	0.5904
it5	0.5678	0.5453	**0.8478**	0.4482	0.3072	0.6132	0.4258	0.5998	0.6178	0.5414
it6	0.6762	0.7264	**0.8941**	0.5873	0.2597	0.7353	0.5749	0.6913	0.7022	0.7228
ps1	0.5841	0.7296	0.6087	**0.8313**	0.0383	0.5804	0.5769	0.4601	0.5141	0.6539
ps2	0.5541	0.6531	0.5487	**0.8408**	0.0823	0.4891	0.5501	0.4749	0.5619	0.5405
ps3	0.5909	0.5253	0.3947	**0.8302**	0.0188	0.3863	0.4583	0.4285	0.4501	0.3598
ps4	0.5127	0.4476	0.3760	**0.7484**	0.1375	0.3357	0.4786	0.3749	0.3976	0.3192
ps5	0.4759	0.4611	0.5637	**0.7090**	0.1270	0.4290	0.4923	0.4598	0.4415	0.4760
os1	0.1928	0.1299	0.2375	0.0754	**0.7236**	0.1752	0.0163	0.2185	0.3347	0.1189
os2	0.1565	0.0786	0.1993	0.0247	**0.7031**	0.0885	0.1112	0.1979	0.1832	0.0917
os3	0.1353	0.0324	0.1698	0.0361	**0.7517**	0.0912	0.0507	0.1481	0.2825	0.0217
os4	0.2254	0.1832	0.3400	0.1125	**0.7163**	0.2488	0.1813	0.3294	0.2514	0.1249
os5	0.2318	0.0415	0.1754	0.0477	**0.7844**	0.1975	-0.0012	0.1072	0.2597	0.0465

Cross Loadings										
os6	0.2070	0.0808	0.2473	0.0128	**0.8779**	0.1914	0.1158	0.2306	0.1824	0.0754
os7	0.2492	0.1258	0.2778	0.1272	**0.8842**	0.1295	0.1402	0.2478	0.3048	0.1363
os8	0.2478	0.1354	0.2764	0.1128	**0.8535**	0.2151	0.2028	0.2666	0.2568	0.1996
pp1	0.6394	0.6413	0.7557	0.5334	0.1862	**0.8504**	0.5161	0.5968	0.6936	0.6316
pp2	0.6524	0.5033	0.4716	0.3953	0.1343	**0.7651**	0.4887	0.3891	0.4688	0.4255
pp3	0.6583	0.6529	0.7063	0.5266	0.2118	**0.8688**	0.5205	0.6157	0.6715	0.7413
pp4	0.5394	0.6306	0.4812	0.4284	0.1608	**0.8289**	0.5197	0.6007	0.4910	0.6368
pp5	0.4884	0.4878	0.4124	0.3834	0.1975	**0.7136**	0.3054	0.5366	0.3531	0.3885
lr1	0.5984	0.5995	0.5631	0.5597	0.0830	0.5460	**0.9013**	0.5547	0.5045	0.6652
lr2	0.5581	0.4882	0.4808	0.5001	0.0480	0.5068	**0.8815**	0.5290	0.4050	0.5734
lr3	0.5352	0.4892	0.4697	0.4868	0.1629	0.4182	**0.8769**	0.5830	0.4369	0.5877
lr4	0.5054	0.4530	0.4870	0.5785	0.1990	0.4680	**0.7334**	0.4506	0.4363	0.4753
lr5	0.5066	0.4628	0.6016	0.5630	0.1196	0.5395	**0.6766**	0.4449	0.5018	0.4800
lr6	0.3422	0.3222	0.2929	0.3134	0.0746	0.2110	**0.6025**	0.4211	0.1988	0.2601
expr1	0.5728	0.5753	0.6006	0.4279	0.1926	0.5812	0.4752	**0.8062**	0.6279	0.6488
expr2	0.6069	0.6309	0.6144	0.5222	0.2355	0.6529	0.5710	**0.9161**	0.5530	0.6261
expr3	0.5708	0.5870	0.5684	0.4900	0.2727	0.6213	0.5221	**0.8952**	0.5296	0.5626
expr4	0.4557	0.4622	0.4842	0.3650	0.2930	0.4716	0.5858	**0.7726**	0.4827	0.4839
expr5	0.5960	0.6329	0.5717	0.5004	0.2693	0.5863	0.5384	**0.8973**	0.6059	0.6326
expr6	0.5211	0.6152	0.6081	0.4737	0.2624	0.6156	0.4755	**0.8593**	0.6706	0.6151
expr7	0.4995	0.5584	0.5120	0.5078	0.2366	0.5301	0.6324	**0.7902**	0.5365	0.5731
expl1	0.6080	0.6322	0.6687	0.5512	0.2201	0.6090	0.5194	0.6011	**0.9039**	0.6480
expl2	0.6547	0.6654	0.7518	0.5616	0.2698	0.6559	0.5041	0.6359	**0.9211**	0.7024
expl3	0.5591	0.5679	0.6445	0.5354	0.3738	0.5752	0.3907	0.5719	**0.8733**	0.5531
expl4	0.6486	0.6397	0.6330	0.5346	0.3492	0.5920	0.5300	0.6318	**0.8642**	0.5687
expl5	0.5122	0.5282	0.6227	0.4568	0.2575	0.5559	0.4478	0.4958	**0.8446**	0.5181
expl6	0.6702	0.5910	0.7185	0.5211	0.2541	0.6129	0.4578	0.6048	**0.8603**	0.6383
ac1	0.5809	0.5338	0.5207	0.4909	0.1968	0.5093	0.5657	0.5399	0.5496	**0.7831**
ac2	0.5631	0.6297	0.5871	0.4748	0.1109	0.6263	0.5910	0.6359	0.6154	**0.8672**
ac3	0.6543	0.6662	0.6537	0.5628	0.1051	0.6639	0.6358	0.6337	0.6574	**0.9388**
ac4	0.6014	0.5556	0.5805	0.4442	0.1102	0.6153	0.4971	0.5672	0.5984	**0.8219**
ac5	0.5731	0.5663	0.5776	0.5875	0.0761	0.6196	0.5143	0.5657	0.4916	**0.7978**

APPENDIX G

CONTRASTING PLS AND SEM TECHNIQUES

Comparison of PLS with SEM technique (Adapted from Chin, Marcolin, and Newsted, 2003)		
Dimension	**Covariance Based Structural Equation Modeling (e.g. LISREL)**	**Partial Least Squares (PLS)**
Model Specification for moderators	Tedious and technically demanding - requiring the researcher, in addition to creating product indicators, to operationally: • Specify correlated errors. • Use mean-covariance analysis. • Algebraically calculate both linear and non-linear constraints for model specification. These constraints grow exponentially with the number of interaction terms.	Simple - operationally requires only the creation of product indicators.
Multivariate normality	Assumed	Not assumed
Sample size issues:		
- constraints	Constrained by number of interaction indicators	Independent of indicators (if reflective)
- heuristic rule	Requires about 100-200 minimum for any model, but increases with the number of interaction term indicators due to the number of parameters being estimated.	10 times of most complex regression
- example	1820 sample size required for 12-indicator model in Table 12 (364 parameters times 5 cases per parameter (Bentler and Chou 1988)).	e.g., 30 sample size required for 12 Indicator model of Table 7.
Types of indicators	Reflective only.	Reflective or formative.
Run-time estimation:		
- errors occurring during estimation.	Typical in large models. Might not converge at 40-50 Indicators or greater.	Rare, almost always converges.

Comparison of PLS with SEM technique (Adapted from Chin, Marcolin, and Newsted, 2003)		
- computational time for estimation	Slow (minutes) as indicators in the model go beyond 40-50.	Fast (seconds) for models with hundreds of indicators.
- standard error estimates (e.g., loading and structural paths)	Unknown under Ping's two-step approach.	Estimated using bootstrap re-sampling.
Interaction Constructs Score	Indeterminate - not part of the estimation process.	Determinate - developed to predict the dependent variable.
Conclusion	Technically and operationally demanding, data conditions often not met, and computational solutions may not be obtained.	Operationally simpler, more consistent with data normality and sample size conditions, and solutions normally achievable.

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