IT-Enabled Competitive Advantage:
The Strategic Role of IT on Dynamic Capabilities in Collaborative Product Development Partnerships

Dissertation Summary

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Abstract

This study describes how IT can be strategically used as a source of differential performance outcomes in rapidly changing environments. Drawing from the dynamic capabilities view (Teece, Pisano, and Shuen 1997), a sustainable competitive advantage results from the ability to continuously improve, innovate, and reconfigure resources to match evolving environmental needs. 'Resource reconfigurability' is herein proposed as a dynamic capability that enables managers to create new productive configurations of functional competencies by detecting new opportunities and recombining existing resources in innovative ways. The resource reconfigurability construct is proposed as a higher-order structure, formed by at least four underlying factors - coordination competence, absorptive capacity, collective mind, and entrepreneurial alertness. IT competence is posited as a critical antecedent of resource reconfigurability, acting as the enabling platform upon which reconfiguration occurs. IT competence is also a higher order formative structure, formed by the effective use of project management systems, knowledge management systems, and cooperative work systems. The nomological framework by which strategic IT competence influences competitive advantage through the key mediating variable of resource reconfigurability is also enhanced by examining the role of trust and environmental turbulence as additional antecedents of collaborative dynamic capabilities. The proposed IT-enabled dynamic capability is a complex, scarce, heterogeneous, and valuable combination that is unlikely to be replicated, imitated, or substituted by the competition, forming the basis for competitive advantage.

The proposed structural model is applied to collaborative new product development (NPD) partnerships where strategic groups frequently reconfigure their resources to create superior process efficiencies and product quality and innovation. This dissertation study uses a combination of field interviews and survey methodology. Following 33 semi-structured interviews, the main empirical study with data from 93 NPD managers provides quantitative support for the proposed hypotheses, highlighting the role of IT as an enabler of transformation and strategic flexibility. The results also support the proposed higher-order formative structures of resource reconfigurability and IT competence. A second confirmatory empirical study is in progress.

This study makes several theoretical, empirical, and managerial contributions to the strategic role of IT on competitive advantage. The proposed model identifies, defines, and articulates the mediating effects involved in the IT-competitive advantage relationship, providing a better understanding of the process by which IT influences differential performance outcomes. The author discusses the study's implications, stressing the need for reconceptualizing the role of IT in contemporary organizations.

Dissertation Overview[1]

This dissertation study is divided into six chapters: The first chapter (Introduction) provides the study's rationale and poses the overarching research questions. The second chapter (Literature Review) provides a thorough literature overview that describes the study's theoretical underpinnings. The third chapter (Theory Development) describes the conceptual structural model and proposes a set of testable research hypotheses. The fourth chapter (Research Methodology) describes the research context, data collection methods, measure operationalization, and pilot studies. The fifth chapter (Results) presents the findings of two empirical studies, conducts formal hypotheses testing, and presents a brief interpretation of the results. The sixth chapter (Discussion) discusses the study's findings and insights, its implications for theory, research, and practice, concluding with its limitations, suggestions for future research, and conclusions.

[1] Note: This is a summary version of a longer document that more thoroughly describes this dissertation study. For a copy of the entire dissertation, please e-mail pavlou@marshall.usc.edu.

Introduction (Chapter 1)

Recent advances in information technologies have created substantial changes in the business environment, and especially changes in business practices, short product cycles, and rapid technological developments, and hyper-competitive environments (Segars and Dean 2000; Segars and Grover 1999; Wind and Mahajan 1997). The rate of change has notably increased in terms of technological breakthroughs, shifts in customer preferences, and competitive new product introductions (Brown and Eisenhardt 1997; Sampler 2000). Fast-changing environments can destroy the value potential of existing competencies (Tushman and Anderson 1986), disrupting traditional means of competition (Sambamurthy 2000). Static competencies may result in core rigidities (Leonard-Barton 1992) and inhibit performance (D'Aveni 1994). In today's rapidly-changing environments, organizations need to diversify, adapt, and even reinvent themselves to match evolving market and technological conditions (Eisenhardt and Brown 1999). Digital convergence (Mantena and Sundarajan 2002) also forces organizations to undergo modifications and recombine skill requirements (Madhok and Tallman 1998). The most important means of achieving a competitive advantage in these dynamic markets are innovative moves and strategic flexibility (Barney 1991; Sambamurthy 2000).

A basic premise of this study is that a sustainable competitive advantage comes from the capacity to continuously improve, innovate, upgrade, and configure resources and competencies to match environmental needs (Eisenhardt and Tabrizi 1995; Feeny and Willcocks 1998). There is a broad consensus that any advantage from static competencies is short-lived in rapidly changing environments. Sustainable competitive advantage does not arise from a few transient competencies, but from the dynamic capability to continuously transform new competencies that match changing environmental contingencies. In fact, the dynamic capability to reconfigure and adapt existing resources has been viewed as the leading source of sustainable competitive advantage (Collis 1994; Teece, Pisano and Shuen 1997). Such advantage can primarily be achieved by sensing new

opportunities and fully exploiting existing resources to adapt to new environments (D'Aveni 1994; Ferrier, Smith and Grimm 1999; Young, Smith and Grimm 1996). 'Resource reconfigurability' - the dynamic capability to identify new opportunities, organize effectively and efficiently, change rapidly and continuously, and transform existing resources into new competencies in order to take advantage of these opportunities is herein proposed as a critical success factor in managing radical change in high-velocity industries (Teece and Pisano 1994). As dynamic capabilities receive increased attention and the environment becomes more turbulent, there is an increased need to understand their antecedents and consequences for sustainable competitive advantage (Zollo and Winter 2002).

Despite the multi-trillion investments in IT in the last decade (McWilliams 2001), the only compelling evidence on the role of IT is on the traditional function of automating and improving static functional processes and operational activities (Bakos and Treacy 1986; Ives and Learmonth 1984; Rockart and Scott Morton 1984; Sambamurthy 2000). However, the role of IT has evolved from traditional support of day-to-day operations towards a central strategic, transformation role (Venkatraman and Henderson 1999). While Information Systems (IS) research has convincingly informed theory and practice about the operational role of IT, it has not still provided compelling theoretical and empirical evidence on how IT can enable dynamic capabilities and facilitate change for sustainable competitive advantage. While time and agility can be viewed as sources of competitive advantage (Lengnick-Hall and Wolff 1999; Sambamurthy 2000; Stalk and Hout 1990), the power of IT to enable effective resource reconfiguration in rapidly changing environments has not been adequately examined. There is an emerging consensus that the greatest implications of the Internet and contemporary IT will be in the areas of business strategy, industry reconfiguration, and nature of business competition (Hitt, Keats and DeMarie 1998; Sambamurthy 2000; Sampler 2000; Segars and Dean 2000). Information economics also emphasize information-based dynamic strategies to take advantage of new market opportunities (Shapiro and Varian 1999).

However, despite the extensive use of powerful IT, we know little whether, how, and why IT can help manage change and facilitate effective resource reconfigurations. Based on anecdotal evidence, several practitioner articles recognize that IT could become the driving force behind strategic competitive advantage in turbulent environments (D'Aveni 1994). However, there is little theoretical and virtually no empirical examination of the exact process by which IT enhances dynamic capabilities for competitive advantage. This study draws upon the IS, strategic management, and marketing literatures to describe and prescribe the potential of IT as a strategic differentiator and a critical enabler of resource reconfigurability, aiming to fill a critical theoretical and empirical gap in the strategic IS literature. In sum, this study aims to shed light on the following research question:

What is the strategic role of IT in building dynamic capabilities for sustainable competitive advantage in rapidly changing environments?

The dynamic capabilities perspective is a fruitful area for combining IS and strategic management theory since IT resources can enable gaining a sustainable competitive advantage by supporting organizational processes (Bharadwaj 2000; Porter and Millar 1985; Zahra and George 2002b). In addition, following (Eisenhardt and Martin 2000), dynamic capabilities are embedded in organizational processes necessitating an empirical organizational lens, rather than an economic or formal modeling one (p. 1106). Following an extensive empirical operationalization and measurement of dynamic capabilities, this dissertation study aims to pave the road for future modeling studies that focus on analytically capturing dynamic processes. Organizational capabilities are also embedded in business processes. A 'process-oriented' view has been touted as the most appropriate level for analyzing IT effects (Barua, Kriebel and Mukhopadhyay 1995; El Sawy 2001; Mooney, Gurbaxani and Kraemer 1995). Hence, the study of IT-enabled dynamic capabilities on understanding the origins of sustainable competitive advantage is a promising undertaking.

Literature Review: The Dynamic Capabilities Perspective (Chapter 2)

The dynamic capabilities view (Teece et al. 1997), emerging from the resource based view (Barney 1991; Penrose 1959), endeavors to identify sources of value creation and realization in conditions of rapid change. Specifically, it aims to identify capabilities that can be sources of sustainable competitive advantage, and to explain how these dynamic capabilities can create successful resource configurations given certain environmental conditions (Eisenhardt and Martin 2000; Teece et al. 1997). It is important to differentiate dynamic capabilities from static operational competencies. Static competencies or proficiencies help organizations effectively perform their basic operational activities, such as logistics, marketing campaigns, manufacturing processes, and operational management (Amit and Schoemaker 1993; Madhok and Tallman 1998; Prahalad and Hamel 1990). Dynamic capabilities, on the other hand, is the creative capacity for dynamic improvement and renewal of functional activities, in response to environmental changes (Collis 1994). This is consistent with (Henderson and Cockburn 1994) who discriminate between 'component competence' (managing day-to-day operations) and 'architectural competence' (building new competencies).

Dynamic capabilities govern the organization's ability to learn, adapt, change, and renew over time (Teece and Pisano 1994) (p. 20). Dynamic capabilities are consistent with Schumpeterian competition (Schumpeter 1934; Schumpeter 1942), in the sense that competitive advantage is based on incremental innovation or 'creative destruction' by carefully shaping existing competencies. Broadly defined, dynamic capabilities are the strategic processes by which organizations manipulate resources into new productive configurations of competencies in turbulent environments (Galunic and Eisenhardt 2001). An example of a dynamic capability is to adapt to economic conditions (price-based competition) and switch gears rapidly, from rapid product development to efficient practices. Another example is to recognize technological breakthroughs, changes in customer preferences, and competitors' moves, and quickly reconfigure resources to satisfy demand before competitors.

While the existence of dynamic capabilities has been documented at an abstract level using anecdotal evidence, no study has attempted to theoretically specify, operationalize, and empirically measure a particular set of dynamic capabilities. Drawing upon the challenge of resource reconfiguration[1] as a critical success factor, this study aims to identify a set of specific and identifiable dynamic capabilities, and describe the item measures and underlying factors that constitute the measurement model of the 'resource reconfigurability' concept. Resource reconfigurability suggests that competitive advantage stems from the complex capability to recombine resources in innovative ways, faster and better than the competition. This logic involves learning (Pisano 1994), coordinating diverse skills (Iansiti and Clark 1994), and integrating multiple streams of knowledge (Prahalad and Hamel 1990). Success in turbulent environments involves expecting the unexpected, reinventing new competencies, discovering new opportunities, and competing in uncertain conditions (Kirzner 1973; Sambamurthy 2000).

Drawing upon the resource-based view, knowledge has been widely touted as a primary strategic resource for organizations (Grant 1996a; Grant and Baden-Fuller 1995; Kogut and Zander 1992; Leonard-Barton 1992; Leonard-Barton 1995; Pisano 1994). The concept of "knowledge as a resource" suggests that knowledge can be transferred, recombined, and used to create value (Grant 1996a). Hence, competitive advantage can arise from effectively creating and transferring knowledge (Alavi 2000), especially collective tacit knowledge that is not stored in any given individual, and it is also difficult to convey to others (Brown and Eisenhardt 1997; Orlikowski 2002). The concept of resource reconfigurability essentially captures the dynamic ability to coordinate, expand, and reconfigure knowledge resources to build new functional competencies (Eisenhardt and Brown 1999; Iansiti and Clark 1994; Pisano 1994; Teece and Pisano 1994).

[1] It is not possible to enumerate all types of dynamic capabilities, such as strategic decision-making, acquisition strategy, and alliance formation (Eisenhardt and Martin 2000). This study focuses on a specific set of dynamic capabilities that address the challenge of reconfiguring existing resources, excluding additional resources from mergers or acquisitions. It is important to note that reconfiguration and its underlying factors occur in a collective fashion (Brown and Eisenhardt 1997; Orlikowski 2002).

Theory Development (Chapter 3)

This study proposes a capability-based framework for delineating how different organizational resources and abilities interrelate to create differential performance outcomes, drawing from Grant's (Grant 1995) architecture of resources and capabilities,. The proposed model is shown in Figure 1.

Figure 1: Proposed Dissertation Model and Research Hypotheses

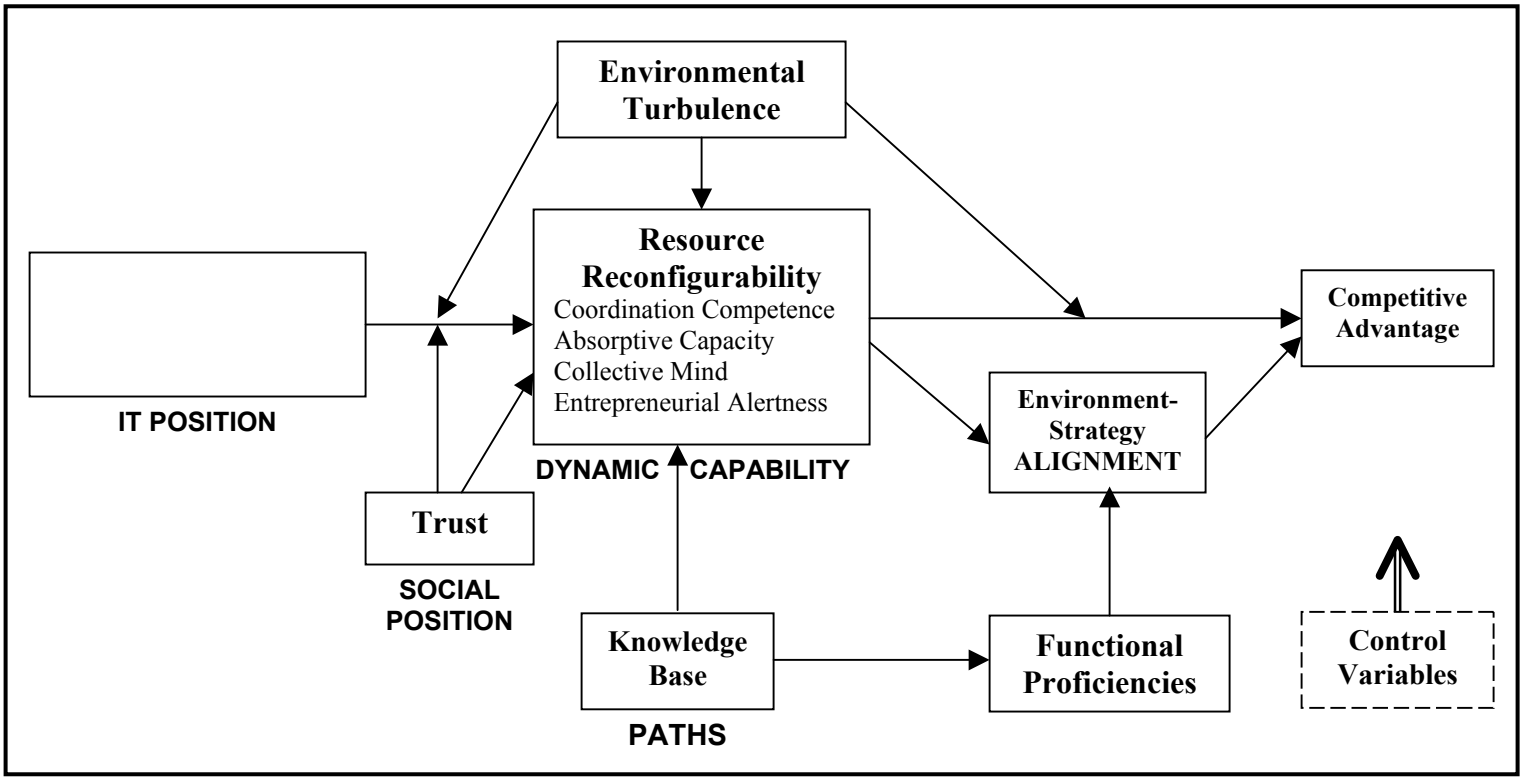


Figure 1 presents the proposed research model and basic hypotheses. The resource reconfigurability construct is posited as the key mediating variable, which is essentially a formative higher-order dynamic capability. This study describes four underlying factors that form this construct, namely coordination competence, absorptive capacity, collective mind, and entrepreneurial alertness, in addition to their own underlying dimensions. Drawing upon (Teece et al. 1997), dynamic capabilities are formed by existing positions and paths. Two positions are posited - IT and social position – and a knowledge path. IT competence is proposed as a critical antecedent of resource reconfigurability,

acting as the enabling platform upon which this dynamic capability is built. IT competence is also a higher order formative structure, formed by the effective use of project management systems, knowledge management systems, and cooperative work systems.

Trust is proposed to have a dual effect on resource reconfigurability; a direct effect through its ability to build a collaborative context, and an interactive with IT competence. Environmental turbulence has a direct positive effect on resource reconfigurability, and also an indirect one in conjunction with IT competence. Two consequences of the proposed dynamic capability are examined; a direct effect on competitive advantage, and an indirect effect through the alignment between functional proficiencies and environmental turbulence. While several other constructs and underlying dimensions could have been included in the model, a major goal was to balance the model's parsimony with comprehensiveness in describing key factors describing the nomological network by which IT influences sustainable competitive advantage. The existence of higher order factors further contributes to the model's parsimony by allowing the specification and testing of the relationships among abstract, higher-order concepts, such as competitive advantage, resource reconfigurability, alignment, and IT competence, without scrutinizing the interrelationships among their underlying components.

(Bakos and Treacy 1986) describe three reasons by which IT can influence competitive advantage – efficiency, market power, and sustainability. The proposed IT competence is expected to influence competitive advantage through *sustainability* (Feeny and Ives 1990), which captures the existence of strategic resources that can be uniquely leveraged by IT. We view dynamic capabilities, namely resource reconfigurability, as the strategic resource that can utilize IT positions to preserve sustained configurations of competencies in order to create superior process efficiencies and product attributes (e.g., product quality and innovation). Such combination is hard to replicate by potential competitors because it is complex, causing causal ambiguity and uncertain inimitability (Lippman and Rumelt

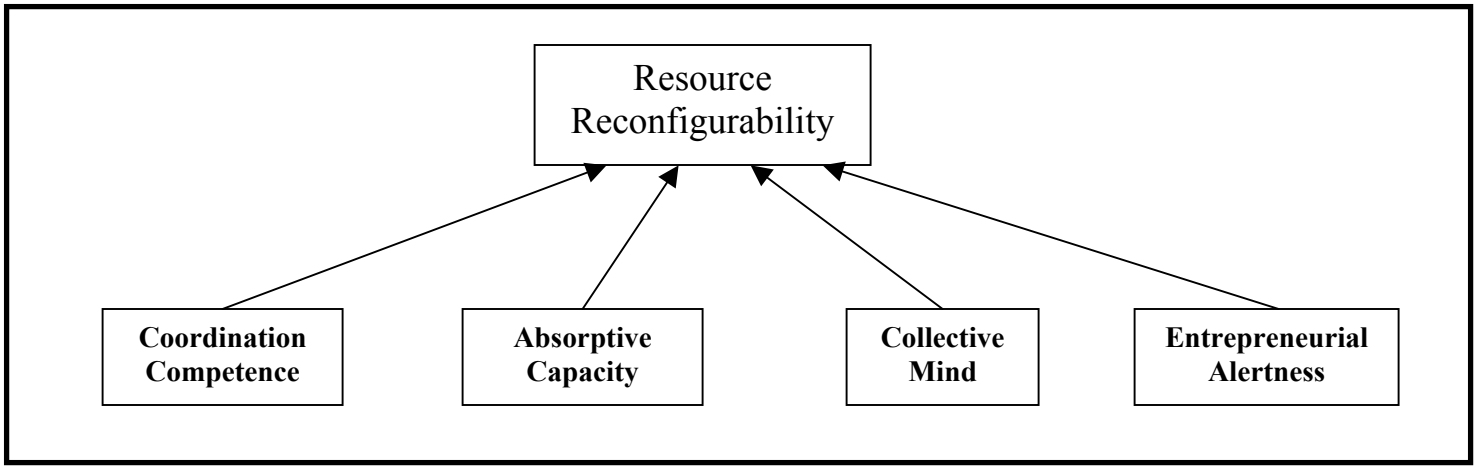
1982). This combination is further leveraged by social positions, such as trust, and paths, such as the existing knowledge base. This scarce and valuable combination is unlikely to be replicated, imitated, or substituted by the competition, thus forming the basis for sustained competitive advantage.

3.1 Nature of Resource Reconfigurability

Drawing from an extensive literature review, four interrelated factors were identified, which cumulatively form the proposed resource reconfigurability construct. First, 'coordination competence' is described as the dynamic process of managing knowledge resources to achieve synchronization, resource allocation, and task assignment (Crowston 1997; Malone and Crowston 1994). Second, 'absorptive capacity' (Cohen and Levinthal 1990; Zahra and George 2002a) is described as the dynamic learning process of acquiring, assimilating, transforming, and exploiting knowledge. Third, following (Weick and Roberts 1993), 'collective mind' is conceptualized as the dynamic ability to heedfully contribute to the group outcome, represent the collective input, and interrelate activities to adapt and improvise to situational demands and rapidly-evolving conditions, drawing upon the 'sense and respond' paradigm (Bradley and Nolan 1998; Haeckel and Slywotzky 1999). Finally, 'entrepreneurial alertness' is the dynamic ability to discover new opportunities and be oriented to market conditions (Brown and Eisenhardt 1997; Kirzner 1973; Kohli and Jaworski 1990; Weick 1995). These four distinct, yet related, mutually reinforcing capabilities are conceptualized as 'best practices' in reconfiguring resources to adapt to rapidly changing environments. These capabilities are consistent with the factors identified by (Prahalad and Hamel 1990; Sambamurthy, Bharadwaj and Grover 2002; Segars and Dean 2000; Teece et al. 1997) to adapt to radical change and hyper-competitive environments. While this set is not exhaustive, we posit that these capabilities are fundamental in forming the higher-order resource reconfigurability concept. These capabilities, in turn, also have underlying lower-level dimensions, which are essentially actionable processes that managers can directly influence to form the ability to effectively reconfigure resources.

Resource reconfigurability is proposed as a higher-order phenomenon that is evidenced through high effectiveness across the four proposed lower-order capabilities (coordination competence, absorptive capacity, collective mind, entrepreneurial alertness), which are expected to be highly related to each other. A higher-order structure captures these relationships (Barki and Hartwick 2001; Segars and Grover 1998), explaining how these interrelations constitute an integrative latent construct, which is more likely to directly relate to other variables compared to any set of lower-order dimensions. Resource reconfigurability is posited as a formative (as opposed to a reflective) construct in order to clarify that the lower-order constructs are not driven by a the higher-order factor, but the underlying correlations cause the existence of a latent overarching structure. Despite the fact that the four underlying factors are highly correlated, change in any factor does not necessarily cause change in another, further suggesting that the four lower-order constructs do not 'reflect' but rather 'form' the proposed resource reconfigurability (Chin 1998), as shown in Figure 2.

Figure 2. Proposed Higher-Order Structure of Resource Reconfigurability



3.2 IT and Dynamic Capabilities

From the outset, IS researchers have strongly advocated tight linkages between IT and strategy (Bakos and Treacy 1986; Sabherwal and Chan 2001). IT is at the forefront of strategy formulation, preceding or driving business initiatives by creating new opportunities, new markets, and value propositions (Zahra and George 2002b). Drawing upon the resource-based view (RBV) (Penrose 1959), there has been an upsurge of interest on IT resources and competencies (Grant 1991; Mata, Fuerst and Barney 1995; Powell and Dent-Micallef 1997). While conceptually organizations can implement strategy without the use of IT, a growing body of literature arguably suggests that IT can have a dramatic effect on business strategy (Cash and Konsynski 1985; Ching, Holsapple and Whinston 1996; Clemons and Row 1992; Porter and Millar 1985). IT has evolved from traditionally supporting day-to-day operations towards a transformation role (Venkatraman and Henderson 1999). In fact, IT can enable organizations to do things they could not do before and thus develop superior new capabilities (Day 1994; Dewett and Jones 2001). A particular emphasis is paid on the role of IT in enhancing strategic flexibility in rapidly changing environments (Sambamurthy 2000). Our emphasis lies on utilizing IT to produce dynamic capabilities that are scarce, heterogeneous, and inimitable (Lippman and Rumelt 1982; Peteraf 1993). The proposed dynamic resource reconfigurability is essentially a knowledge management process, and it is likely to be significantly supported by IT competence. In particular, this study sheds light on how IT competence facilitate the development of dynamic capabilities, and particularly resource reconfigurability.

In order to better understand the role of IT and its impact on organizational capabilities, this study proposes the concept of 'IT competence', which is broadly described as the ability to acquire, deploy, and leverage IT functionality in combination or copresence with other resources to shape and support business processes' (Bharadwaj 2000). While the deployment of IT competence is not always

necessary for reconfiguring and adapting resources to changing conditions, there are is an emerging insight (Sambamurthy 2000; Sambamurthy et al. 2002; Sampler 2000; Venkatraman and Henderson 1998) and managerial intuition (D'Aveni 1994; Goldman, Nagel and Preiss 1995) that IT can be a powerful enabler. For example, (Sambamurthy et al. 2002) argue that IT serves as the enabling platform on which agility – an instance of a dynamic capability - is built. (Dewett and Jones 2001) argue that IT improves boundary-spanning capabilities, enhancing the ability to codify knowledge, improve coordination, and enhance collaboration.

This study examines how organizations can leverage IT competence to reconfigure their resources toward building a sustainable competitive advantage. While the potential benefits of IT may be intuitive, the exact process by which IT competence result in differential performance outcomes is not well understood. Even if there is evidence that IT leads to higher performance (Bharadwaj 2000; Bharadwaj, Bharadwaj and Konsynski 1999), the purpose of this study is to explicate the mediating variables, which are posited as an IT-enabled dynamic capability or resource reconfigurability. Hence, this study aims to uncover the delineate the exact was by which organizations can leverage IT to support resource reconfigurability, build new functional proficiencies, and generate a competitive advantages in environments of continuous change.

There has been a recent focus on building dynamic capabilities by taking advantage of IT to enhance dynamic processes (Wheeler 2002; Zahra and George 2002b). There are at least four theoretical perspectives that explain the impact of IT competence on resource reconfigurability. First, the knowledge-based view suggests that knowledge driven capabilities can enhance through efficiency, scope, and flexibility (Grant 1995; Grant 1996b). There is much evidence to suggest that IT competence can enhance all three attributes. Second, resource reconfigurability is essentially an information processing routine (Galbraith 1977), creating the opportunity for IT competence to

enhance the actors' ability to process information. In other words, IT competence extends the limits of bounded rationality (Bakos and Treacy 1986), and reduces its negative effects on decision making. Third, (Sambamurthy et al. 2002) draw upon digital economics to suggest that IT competence creates digital options that help intertwine IT with organizational processes to leverage digital economics (Shapiro and Varian 1999). Finally, the ability to reconfigure resources is enhanced if resources are modular (Galunic and Eisenhardt 2001). IT competence increases resource modularization, thus resource reconfigurability. In sum, the knowledge sharing and information processing capabilities of IT enable rapid information flows and resource reconfiguration and facilitate organizations to successfully keep up with rapidly changing environments.

In sum, this study examines the nomological framework by which strategic IT competence influences differential performance outcomes in conditions of rapid change. I argue that a prominent impact of IT competence is through its ability to facilitate dynamic capabilities to effectively reconfigure existing resources into new functional competencies. In other words, IT competence is not expected to be a direct antecedent of superior performance, but it is valuable by supporting flexible strategic processes, such as resource reconfigurability. Given the enabling role of IT on dynamic capabilities, this study essentially focuses on resource reconfigurability, an instance of an IT-enabled dynamic capability, and examines its nature, antecedents, and consequences.

3.3 Resource Reconfigurability and Competitive Advantage

Resource reconfigurability is difficult to substitute and imitate because of its complexity that creates causal ambiguity (Lippman and Rumelt 1982). Resource reconfigurability is essentially based on collective tacit knowledge, and given the nature of its underlying factors, its overal complexity, and the evolutionary way it develops, it is difficult to describe, explain, transfer, or replicate. This makes it a fundamental source of sustainable competitive advantage. This is consistent with Henderson and

Iansiti and their collegues who show that dynamic capabilities can be important sources of enduring competitive advantage in product development processes (Henderson and Clark 1990; Henderson and Cockburn 1994; Iansiti and Clark 1994; Iansiti and West 1997). This study focuses on an economic reasoning toward optimizing the technical fit between the environment and functional competencies toward a competitive advantage. Resource reconfigurability is proposed to result in a competitive advantage by creating better matches between functional competencies and evolving environmental contingencies. Failure to align functional competencies with external needs may transform valuable proficiencies into rigidities (Leonard-Barton 1992). Resource reconfigurability is expected to shape, deepen, and configure resources to increase their alignment with changing product-market areas (Teece et al. 1997) and directly and indirectly influence performance for competitive advantage (Doty, Glick and Huber 1993; Venkatraman 1989).

3.4 Environmental Turbulence

Dynamic capabilities are particularly valuable in high-velocity industries that regularly need to adapt to changing conditions and meet varying market demand (Brown and Eisenhardt 1997). Environmental turbulence is proposed as a higher-order construct formed by frequent technological breakthroughs, changes in customer demand, competitors' moves, and internal changes. Environmental turbulence reduces the value potential of existing competencies and existing competitive positions (Leonard-Barton 1992; Sambamurthy 2000; Tushman and Anderson 1986). Therefore, turbulent environmetns cause organizations to engage in frequent resource reconfigurations to introduce new configurations that better adapt to the new environment. Environmental turbulence also increases the knowledge intensity of business processes, escalating the importance and emphasis on knowledge (Hitt et al. 1998; Leonard-Barton 1995), necessitating the effective use of IT to support knowledge driven dynamic capabilities. Environmental turbulence also increases the intensity of the competitive landscape; thus, the impact of resource reconfigurability on competitive advantage is contingent on the presence of

environmental turbulence; higher turbulence is likely to facilitate the positive impact of dynamic capabilities on competitive advantage.

3.5 The Role of Trust

Drawing upon the RBV, another critical organizational resource is trust, which captures the climate and social context in which business processes occur. Trust has been touted as the 'magic ingredient' or 'social lubricant' of collaborative activities (Koza and Lewin 1998). Resource reconfigurability is a complex, socially embedded process that can be supported by trust. In fact, (Galunic and Eisenhardt 2001) show that a trusting social culture favors the group's ability to build dynamic capabilities. There is also evidence that luck of a trusting environment contributes to low use of IT for collaboration, information sharing, and knowledge dissemination (Fulk 1993). Hence, interactive effect of IT competence and trust on resource reconfiburability is hypothesized.

3.6 Interorganizational and Intra-organizational Relationships

Recent advances in information and communication technologies enable geographically dispersed teams within and across organizational boundaries to collaboratively conduct work. In fact, greater use of IT favors dispersed cross-functional work groups (DeSanctis and Monge 1999; Jarvenpaa and Leidner 1998; Maznevski and Chudoba 2000). This trend is facilitated by the advent of low-cost, Internet-based IT that facilitates better management of complementary knowledge resources across geographical boundaries. In a world of ubiquitous Internet technologies, traditional organizational boundaries are blurring, at least as far as technology is concerned. The role of IT on supporting value-added interorganizational relationships by effectively managing complementary knowledge resources is increasingly gaining attention (Bensaou 1997; Liberatore and Stylianou 1995; Rayport and Sviokla 1995), even in traditional intra-organizational areas, such as product development (Sobrero and Roberts 2001). In other words, advanced technologies make it equally easy to exchange information

and collaborate, despite geographical boundaries. In practice, (Argyres 1999) describes a well-coordinated partnership among four firms that act as a virtual organization by effectively using IT. Knowledge integration typically takes place in groups (Okhuysen and Eisenhardt 2002), which can be formed by more than one organization. An example is virtual teams that enable organizations to accumulate and integrate knowledge from multiple geographically-dispersed locations within and beyond organizational boundaries (Saunders 2000).

In terms of non-IT distinctions, there is a growing recognition that collaborative interorganizational relationships offer significant opportunities for strategic advantages. This is particularly true in highly turbulent environments where organizations urgently need new technologies and knowledge outside their traditional organizational boundaries (Henderson and Cockburn 1994). Organizations are gradually adopting a 'cooperative logic' and move toward strategic alliances and value-adding partnerships (Bensaou 1997; Dyer 1997; Moss-Kanter 1994). There is increased evidence for the value of combining complementary resources that reside outside traditional firm boundaries (D'Adderio 2001; Dyer and Singh 1998). While the RBV focuses on firm-specific capabilities, the relational view (Dyer and Singh 1998) focuses on interorganizational relationships as the unit of analysis, examining how organizations develop joint capabilities and 'collaborative' advantage (D'Adderio 2001; Dyer 2000; Jap 2001). Many authors argued that competition occurs among networks of organizations (Dyer 2000; Dyer and Singh 1998), supply chain versus supply chain (Segars and Dean 2000).

Similar to organizations, interorganizational partnerships also need to periodically alter their stock of knowledge-based resources in response to changing environmental conditions and market needs (Stuart 1998). The theoretical examination of dynamic capabilities from an interorganizational perspective draws from the relational view (Dyer and Singh 1998), which posits the relationship as the unit of analysis and interfirm processes as the focal activities. This is consistent with (De Boer, Van de

Bosch and Volberda 1999) who explain that capabilities can be both of an intra- or interorganizational nature. The practical utility of studying inter-organizational versus intra-organizational capabilities is supported by managerial empiricism (Grant and Baden-Fuller 1995; Konicki 2002).

This study explores IT-enabled dynamic capabilities by focusing on strategic group-level processes by which strategic groups dynamically reconfigure their resources to build superior new competencies in turbulent markets. 21st century organizations depend on creating value through the expertise and value of its members as they interact with each other and with individuals from other organizations (Zmud 2000). With the advent of sophisticated information technologies, strategic groups are becoming the primary vehicle through which productive activity is orchestrated (Moss-Kanter 1994; Sambamurthy and Zmud 2000). While most studies on dynamic capabilities have focused on organizational-level characteristics, this study focuses on the group level, drawing upon (Leonard-Barton 1992) (p. 122-123) who proposed a focus on enlarging the boundaries of 'middle range' theory and place groups under a magnifying glass to examine their strategic implications. The proposed unit of analysis is thus the processes of a 'strategic group', which may contain several related divisions and product dimensions (Galunic and Eisenhardt 2001), and may be formed by several departments or organizations. This is consistent with (Bakos and Treacy 1986), (Cash and Konsynski 1985), and (Dyer and Singh 1998) in the sense that the unit of analysis might be two or more organizations, instead of just one. In addition, the literature on interorganizational relationships is increasingly challenging the traditional centrality of the single organization as the main focus of research (Koza and Lewin 1998).

Research Methodology (Chapter 4)

This study uses a combination of field interviews and large-scale survey methodology. The goal was to triangulate theory development with both qualitative evidence and also quantitative confirmation from large-scale empirical studies. Given the newness of the principal constructs and their underlying complexity, qualitative evidence was deemed necessary before statistical validation. The context on which the role of IT-enabled dynamic capabilities is examined is product development, which has long been viewed as the locus of innovation and reconfiguration (Galunic and Eisenhardt 2001; Iansiti and Clark 1994; Kusunoki, Nonaka and Nagata 1998; Leonard-Barton 1992; Marsh and Stock 2002).

4.1 Research Context: New Product Development Context

New Product Development (NPD) has long been touted as a domain that organizations can develop a strategic advantage (Leonard-Barton 1992; Verona 1999; Wheelwright and Clark 1992). Dynamic capabilities are evident in specific strategic, knowledge-intensive, problem-solving processes, such as NPD processes (Eisenhardt and Martin 2000){Madhaven, 1998 #285}. The need to adapt to change to match evolving market and technical conditions is particularly evident in NPD processes; long-term success is associated with a superior stream of new products, not any single product (Rosenthal 1992). After all, the most prominent examples of generating 'new' knowledge are NPD or R&D groups (Alavi 2000) (p.21). The proposed research model readily applies to strategic groups that engage in NPD processes in which complex interactions are required to integrate and exploit diverse knowledge-based resources into new products. The iterative problem-solving context of NPD helps propel the development of new proficiencies (Henderson and Cockburn 1994; Iansiti and Clark 1994), making dynamic capabilities fundamental in this context. In fact, NPD is a critical function by which organizations diversify, adapt, and even reinvent their resources to match evolving market and technical conditions (Schoonhoven, Eisenhardt and Lyman 1990). NPD processes in complex-product industries are prime examples of such collaborative, knowledge-intensive relationships, especially in

fast-paced markets. Cross-functional teams have been considered the method of choice for NPD processes (Brown and Eisenhardt 1995; Song, Michael, Montoya-Weiss and Schmidt 1997), stressing the need to draw on, coordinate, and utilize dispersed (e.g., technical, marketing, managerial) knowledge. By focusing on the NPD area, resource reconfigurability is proposed as the fundamental process to aggregate, coordinate, expand, and recombine knowledge-based resources to build new NPD proficiencies. Hence, NPD is examined as an ongoing strategic process that may influence long-term competitive advantage by managing favorable adaptation to changing environmental conditions.

Beyond the concept of dynamic capabilities in collaborative relationships, the interorganizational NPD process is becoming an important area for IS research on its own right. The NPD process is an information-intensive process that is likely to be facilitated by IT. Despite the existence of powerful, web-based innovative IT tools for facilitating NPD processes (Rangaswamy and Lilien 1997), we know little about whether, how, and why these innovations can be translated into viable strategic options to improve NPD performance outcomes. Most work in NPD has focused on project staffing and structure, external influences, and cross-functional teams; thus, the role of IT-enabled dynamic capabilities is relatively under-researched (Marsh and Stock 2002). Therefore, examining how IT competence can influence dynamic capabilities to achieve NPD performance outcomes for competitive advantage is a promising context for IS researchers. Therefore, this study focuses on a NPD context aiming to address the following research question: What is the strategic role of IT in NPD processes?

Given technological and associated cost limitations, practical NPD processes and related theoretical work have been predominantly examined within traditional organizational boundaries (Brown and Eisenhardt 1995; Krishnan and Ulrich 2001). However, the low cost and sophisticated functionality of Internet-based IT tools enable strong interorganizational NPD collaboration, R&D alliances, and supplier involvement in NPD (Primo and Amundson 2002). This study aims to integrate the

interorganizational literature with the dynamic capabilities perspective, under the aegis of the relational view (Dyer and Singh 1998) and apply this new perspective into a NPD context[2]. Interorganizational NPD is a formalized collaborative arrangement among two or more organizations to co-develop a new product, and may often take the form of strategic alliances or joint ventures (Gulati, Nohria and Zaheer 2000). In general, this study aims to test the proposed model both to an interorganizational and intra-organizational (e.g. interdepartmental) level.

4.2 Field Interviews

Parallel to theory development, we conducted 33 in-depth interviews with a wide range of individuals involved in NPD initiatives. These included NPD managers and group leaders, R&D executives and vice presidents, and managers supporting IT initiatives in NPD. Interviewees were also managers of companies developing software tools for NPD, such as SAP, EDS, Sopheon, Imaginatik, among others. These semi-structured interviews were conducted either on site, on the phone, or during practitioner conferences, such as the Product Development and Management Association (PDMA) annual meetings. The purpose of these interviews was threefold. First, we sought to get an initial feel for the relevance, importance, and face validity of our theoretical framework. Interview findings are not viewed as validation of the research model, simply a confirmation that the theory-based hypotheses were in line with managerial experiences and expectations. Interviews also aimed at guiding further theory development, especially identifying and understanding factors that were not initially included in the research model. Second, these interviews attempted to uncover specific best business practices in integrating, expanding, and reconfiguring knowledge-based resources, utilizing IT competencies, and building cross-functional proficiencies that align with environmental contingencies. This was to ensure that the final theoretical model would readily apply to practice. Third, part of the final interviews was

[2] The unit of analysis of in NPD processes is often the work unit (Brown and Eisenhardt 1995) since the focus of much NPD research is the project team.

to pretest the measurement instrument for subsequent empirical studies. According to (Churchill 1979), in addition to defining the theoretical domain of proposed constructs, it is useful to get insight from experts, especially when dealing with ambiguous scale operationalization. Given that the principal constructs required several new scales applied into a NPD context, special care was taken to ensure that measure operationalization was guided by managerial empiricism.

4.3 Empirical Studies

Two empirical studies were conducted in order to provide statistical evidence for the proposed structural model and testable hypotheses. Following key informant methodology, data were collected through online surveys from managers of collaborative NPD partnerships who had a global understanding of the partnership's cross-functional activities. The selected NPD managers were asked to self-select a specific NPD partnership that they recently managed. The instructions provided to the respondents are shown in the cover letter of the survey instrument (Appendix A). To encourage participants to respond, NPD manager were offered a customized report of the research findings that would compare the respondent's partnership with the overall characteristics of the respondent sample.

Measurement Development. Measurement items were adapted from the literature wherever possible. New measures where the construct measure required significant deviations were developed following standard psychometric scale development procedures (Bagozzi and Phillips 1982; Boudreau, Gefen and Straub 2001). The domain of the relevant construct was initially specified, and the items were subsequently developed based on the conceptual definition. Measures for resource reconfigurability and its underlying dimensions were based on related theoretical and empirical studies, such as (Malone and Crowston 1994), (Cohen and Levinthal 1990), (Weick and Roberts 1993), (Kohli and Jaworski 1990). The construct of IT competence was operationalized following the recommendations of (Lind and Zmud 1995), trying to link IT functionality with specific business processes. The procedure

included detailed analysis of over 20 NPD-specific software packages and identification of frequently used functionalities under theoretically driven categories. The procedure for operationalizing and calculating strategy-environment alignment is shown in Appendix B. Competitive advantage is operationalized as high achievement in both process efficiency and product quality and innovation (Sobrero and Roberts 2001). The preliminary instrument was initially reviewed by faculty and doctoral students for clearness and comprehensiveness. The revised instrument was then pretested by personally administering to eight NPD managers. The items were further modified on the basis of a major statistical pretest of the survey instrument with a sample of 70 NPD managers in the automotive industry, based on the procedure recommended by (Churchill 1979). Following these extensive pretests, no problems were found with the final measurement instrument. All items were measured on five-point Likert-type scales, as shown in Appendix A.

Study 1. An exploratory study was first conducted to provide initial support for the proposed model, and identify the relative effectiveness of a large number of variables.

Survey Administration. E-mail addresses of potential key respondents were selected from the participants of the annual PDMA conference (www.pdma.org/2002/). Out of the 493 registered attendees, 386 were selected based on their job description (e.g., product development manager, NPD leader, etc.). Invitation e-mails were sent to the selected managers, explaining the purpose of the study and requesting their participation. The respondents were asked to click on the URL link provided in the e-mail message, which linked to the web-based survey instrument (www-scf.usc.edu/~pavlou/NPD/). The respondents were offered incentives in the form of a report that summarized the results of the survey; 95% of the respondents requested this report. The invitees were assured that the results would be reported in aggregate to guarantee their anonymity. Two subsequent e-mail reminders were sent to the non-respondents, two and five weeks after the initial contact.

Key informant quality. Although some preliminary steps were taken to ensure proper selection of key informants, a formal check was administered as part of the questionnaire (Kumar, Stern, and Anderson 1993). Specifically, one item assessed the informant's familiarity with the self-selected NPD partnership. Only respondents specifying '4' or '5' on the five-point familiarity scale were retained for data analysis.

Dyadic Data. Given that the respondents could also specify an interorganizational partnership, an attempt was made to collect dyadic responses from their counter parties in the partner organization. One entry allowed respondents to indicate an appropriate NPD manager from their partner firm and provide contact information. Seven out of 48 respondents provided such contact information, and following three e-mail invitations, four dyadic responses (8%) were obtained. Despite the small sample size, the inter-rater reliability among these dyadic responses was high (r=0.81), suggesting a consensus within the inter-organizational NPD partnerships.

Response Rate and Nonresponse Bias. Out of the 386 invitees, 48 e-mails were undeliverable, and 103 responses were obtained. Seven responses were deemed inappropriate given extensive missing items. Three responses were removed since the respondents indicated that their level of familiarity was extremely low. Finally, 93 responses were received for an effective response rate of 28%. The low response rate may be because of (a) company policy not to permit employees to participate in surveys, (b) lack of experience with collaborative NPD partnerships or use of IT tools, (c) lack of time, and (d) possible e-mail filtering. Non-response bias was assessed by comparing between the early and late respondents (Armstrong and Overton 1976). Early respondents were identified by selecting those that responded during the first e-mail contact (44%), against those responding following the two subsequent reminders (56%). The two groups were compared based on their NPD group's and company's sample

characteristics, such as group age, number of functional areas, percentage of activities conducted electronically or collaboratively, and company size (revenues and number of employees). All t-test comparisons between the means of the two groups showed insignificant differences ($p<0.1$ level).

Descriptive Statistics. Appendix C provides detailed information on the nature of the principal and secondary constructs, including descriptive statistics, and reliability estimates.

Study 2 (in progress). A second study is being conducted to provide confirmatory evidence of the significant relationships observed in Study 1. The goal of the second study is to capitalize on the findings of the first study and focus on a more specialized set of variables. Special care was taken to more comprehensively capture the key variables, such as resource reconfigurability and IT competence, by allowing a more extensive set of their lower-order factors and underlying dimensions. This would allow better specification and testing of the nature of the higher-order factors, and provide empirical support to the existence of higher order latent structures.

Survey Administration. Similar to Study 1, e-mail addresses of potential respondents were selected from the participants of the Management Roundtable (www.roundtable.com) conference on collaborative product development (www.codevpd.org). Out of the 160 registered attendees, only appropriate respondents were selected based on their job description (e.g., product development manager, NPD leader, etc.). Invitation e-mails are sent to the selected managers, explaining the purpose of the study and requesting their participation. The respondents are asked to click on the URL link (www-scf.usc.edu/~pavlou/CoDev/) provided in the e-mail message, which links to the online survey instrument The respondents are offered a customized report that summarized the results of the survey, and are assured that the results would be reported in aggregate to guarantee their anonymity.

Results (Chapter 5)

For both studies, the research model was analyzed with PLS[3] (PLS-Graph Version 3.0), as shown in Figure 3 (Study 1). PLS is considered better suited for explaining complex relationships (Fornell and Bookstein 1982; Fornell, Lorange and Roos 1990). As stated by (Wold 1990)(p. 589), "PLS comes to the fore in larger models, when the importance shifts from individual variables and parameters to packages of variables and aggregate parameters." Wold states later (p. 590), "In large, complex models with latent variables PLS is virtually without competition." PLS allows specifying the relationships among the principal constructs and their underlying items, resulting in a simultaneous analysis of both whether the hypothesized relationships at the theoretical level are empirically true and also how well measures relate to each construct (Chin 1998). Furthermore, due to the nature of some of the measures used and the small sample size, LISREL analysis was not deemed appropriate (Chin and Gopal 1995)[4].

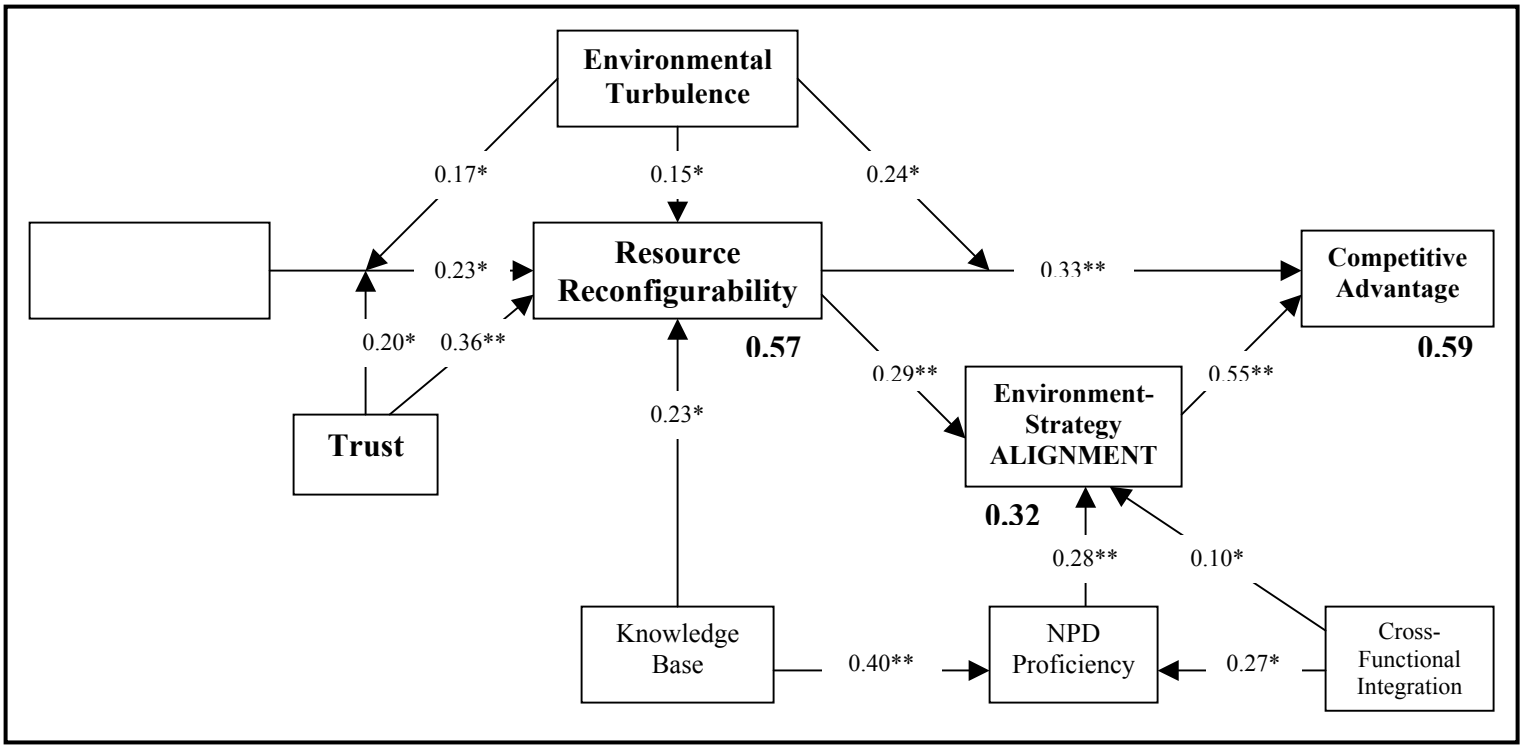
5.1 Study 1

Measure Validation. Measure validation was initially examined for reliability analysis by computing Cronbach's alpha coefficient for each construct. As shown in Appendix C, all measures have high levels of reliability, all above the recommended 0.7 levels. Discriminant and convergent validity of the principal constructs was examined with factor analysis procedure in Partial Least Squares (PLS). Discriminant validity is shown when the PLS indicators (a) load much higher on their hypothesized factor than on other factors, and (b) when the square root of each construct's Average Variance Extracted (AVE) is larger than its correlations with other constructs (Chin 1998). As shown in Appendix B (Table 1), the square root of the AVE is much larger than all other cross-correlations. In addition, the own factor loadings are much higher than cross loadings, reinforcing the claim that the instrument demonstrates convergent and discriminant validity (Appendix C).

[3] In addition to the main PLS analysis, multiple regression analysis was also conducted for verification purposes, as shown in Appendix D. The results from both statistical analysis techniques are broadly consistent.

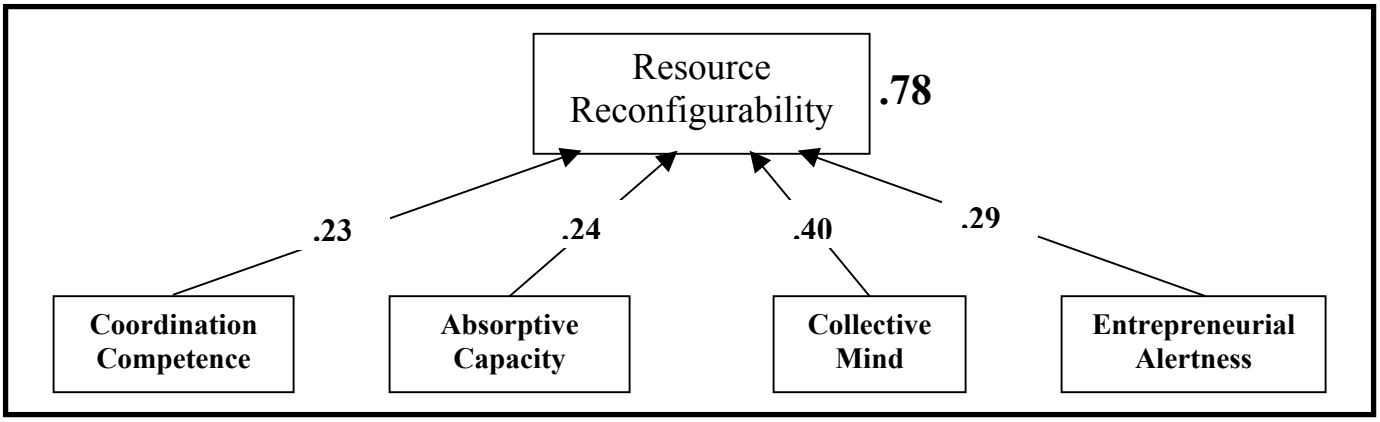
[4] To provide additional support for the higher-order structures, LISREL was also used for validation purposes, even if LISREL does not allow for examining formative structures (Chin 1998), and the structures were modeled as reflective.

Figure 3. Results of PLS Data Analysis (Study 1)



Higher Order Structures. PLS was also used to assess the structure of resource reconfigurability as a higher-order structure formed by the proposed four underlying factors (Figure 4).

Figure 4. Results of PLS Data Analysis for Resource Reconfigurability (Study 1)



Brief Interpretation of Results. In general, the results from Study 1 provide broad support for the proposed structural model and research hypotheses, delineating the process by which IT competence results in competitive advantage and stressing the key mediating role of resource reconfigurability.

Dissertation Contribution (Chapter 6)

This dissertation study makes a set of theoretical and empirical contributions to research and practice:

6.1 Theoretical Implications

While IT has been regarded as a 'strategic necessity' (Clemons, Reddi and Row 1993; Clemons and Row 1992; Clemons 1991) and an 'economic imperative' (Benjamin, Rockart, Scott Morton and Wyman 1984), this study argues that the effective use of IT can have differential performance outcomes, especially if directly applied to the development of dynamic capabilities. In other words, this study stresses the fundamental role of IT competence as an essential platform for building dynamic capabilities. Resource reconfigurability is posited as a key mediating variable that enables organizations to leverage existing resources to build more effective functional competencies that better match changing environmental contingencies. This IT-enabled mediating effect complements existing research on the effects of IT that focused predominantly on improving functional competencies, as opposed to dynamic capabilities. The proposed view provides a theory-driven perspective on understanding the role of IT on sustainable competitive advantage through influencing a set of transformation processes. This dissertation study theorizes IT as the enabler of strategic flexibility, laying the groundwork for redefining the role of IT in contemporary organizations and knowledge-driven competition. By adding granularity to the nomological network by which IT resources lead to competitive advantage, this study calls for reconceptualization of the role of IT from supporting static operational processes to strategic dynamic processes.

By proposing a set of mediating capabilities and competencies, this study clarifies that IT does not have a direct impact on performance, but an indirect impact through a set of other factors. This finding partially accounts for the infamous 'IT productivity paradox'. First, there are several intermediate factors mediating the role of IT on performance outcomes. Organizations should focus on building

dynamic capabilities and other functional competencies with the aid of IT rather than expect a linear relationships. Second, the role of IT is contingent on social (e.g., trust) and external (environmental turbulence) factors in the sense that there are interactive effects. Finally, IT competence is a superior measure than investments in IT because it captures the effective utilization of investments in IT functionality, not merely IT-related cost expenditures. In sum, by 'cobbling together' several critical factors in a structural model, this study helps explain why IT investments may not necessarily translate to superior performance.

The extant literature on dynamic capabilities has focused primarily on purely theoretical or qualitative, case-study methodology at an abstract level. To the best of my knowledge, a comprehensive theoretical framework that conceptualizes, operationalizes, and measures a coherent set of dynamic capabilities has not yet been developed nor been empirically examined. The proposed resource reconfigurability construct is perhaps the first attempt to capture a crucial dynamic capability. In addition to the proposed higher-order structure, a representative set of specific underlying factors of resource reconfigurability are described, in addition to a set of actionable dimensions of each variable. This approach not only provides a comprehensive description of a dynamic capability that can be used as a bluepring for capturing other dynamic processes, but it also presents a parsimonious view of resource reconfigurability that can relate to other abstract concepts in a structural model, such as competitive advantage and IT competence.

While the proposed model readily applies to rapidly changing environments, this does not preclude its generalizability to more stable environments. Our results suggest that the proposed dynamic capability is a key mediating variable, even in less rapidly changing situations. This is explained by the fact that effectively reconfiguring resources can create superior 'services' and earn higher 'rents' (Penrose 1959), even if adequate configurations may be present. In other words, even if stable environments,

there are potentially opportunities for yet improved resource reconfigurations that may result in even higher performance. Therefore, the proposed model may be viewed as a superior representation of how various competencies and capabilities result in competitive advantages, irrespective of environmental dynamism. This does not suggest that the model may be superior in completely stable environments.

This study also extends the dynamic capabilities view to an interorganizational level of analysis by focusing on the value chain process as the unit of analysis, as opposed to intra-organizational processes. This collaborative perspective on dynamic capabilities suggests that interorganizational relationships can develop their own dynamic processes to guide their evolution and transformation over time. While the extant literature precluded dynamic capabilities beyond organizational boundaries (Teece et al. 1997), this study makes a modest argument that long-term collaborative relationships can reconfigure their resources and transform themselves in response to changing environments. This finding has implications for the viability of long-term interorganizational partnerships. This study then contributes to the relational view (Dyer and Singh 1998) in the sense that processes and capabilities can extend beyond traditional organizational boundaries.

Similar to the RBV, dynamic capabilities have also been accused of their tautological relationship to competitive advantage (Eisenhardt and Martin 2000). to overcome this potential limitation as it applies to resource reconfigurability, a specific mediating variables was proposed and validated. The proposed strategy-environment alignment factor essentially captures the extent to which some critical functional competencies form favorable configurations with certain environmental profiles. By showing the resource reconfigurability indirectly influences performance outcomes through alignment, it empirically validates that dynamic capabilities impact competitive advantage by creating favorable resource configurations, not through tautological means.

This study examines strategic group level phenomena, such as the ability of strategic groups to build a firmwide competitive advantage. While strategy has been viewed as a top management decision making, this study calls for examining the strategic implications of group level phenomena, such as the ability to effectively and efficiently managing resources. After all, (Galbraith 1977) argued that perhaps the only source of sustainable competitive advantage is efficient and effective management.

Finally, it aims to describe the role of IT-enabled dynamic capabilities in a NPD context, a strategic, yet under-researched area of the IS literature. This study aims to entice future research on understanding the role of IT and its potential outcomes in NPD. Whereas NPD processes are becoming heavily supported by customized, NPD-specific IT tools, the IS literature has done very little to inform theory and practice as to the potential benefits from effectively using IT in NPD processes.

6.2 Implications for Research

From an empirical perspective, this study aims to contribute to the empirical measurement and assessment of the nature of a specific dynamic capability, namely resource reconfigurability, its antecedent variables, and their consequences. In terms of measure operationalization, it aims to capture an abstract concept with a higher-order structure, its underlying factors, and their respective actionable dimensions. In doing so, it aims to provide empirical support to Grant's (1995) theoretical propositions for different types of organizational resources and capabilities. From a research point of view, it aims to entice future research on operationalizing and measuring other dynamic capabilities, further improving the proposed resource reconfigurability construct, and examining the interaction of IT with dynamic capabilities and other variables. Another important empirical contribution of this study is the examination of dynamic capabilities to an interorganizational group level, as opposed to the traditional organizational level.

6.3 Implications for Practice

From a practical perspective, this study aims to describe specific and identifiable factors that affect success and performance outcomes in collaborative product development relationships, and particularly in interorganizational NPD processes. Since this study aims to prescribe variables that can be readily influenced by managerial practices, the findings of this study could provide useful recommendations for building a competitive advantage. The proposed model that delineates the role of IT toward a competitive advantage provides a useful guide to managerial thinking in terms of where to focus their attention. More important, it aims to prescribe how IT functionality can be effectively utilized to support critical transformation processes, particularly in an NPD context. This study suggests that there is a need for a fundamental change in managerial thinking about the enabling role of IT, not simply on operational processes, but on transformation processes and strategic flexibility (Henderson and Venkatraman 1993).

By neglecting the existence of interorganizational dynamic capabilities, executives might have been tempted to dissolve partnerships whose competencies did not adequately match external conditions. However, interfirm dynamic capabilities can potentially transform existing relationships to better match changing environments. By focusing on building collaborative dynamic capabilities, managers can sustain and enhance existing partnerships and avoid having to continually search for new partners.

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Appendix A. Measurement Items of Principal Constructs

Resource Reconfigurability
1. Coordination Competence (Crowston 1991; Mohr and Spekman 1994; Malone and Crowston 1994; Hinds and Mortensen 2002)
a. Synchronization
We ensure that the output of our work is synchronized with the work of others.
We ensure that the output of our work is of a form useful to others when needed (the right thing at the right time).
b. Resource Allocation
We ensure an appropriate allocation of resources (e.g. information, time, reports) within the partnership.
Group members ensure a fair sharing of resources.
c. Task Assignment
Group members are assigned to tasks commensurate with their task-relevant knowledge and skills.
We ensure that there is compatibility between group members expertise and work processes.
d. Coordination Competence Indicator
We ensure that our work tasks (activities, designs, reports) fit together very well.
Overall, our group is well coordinated.
2. Absorptive Capacity (Cohen and Levinthal 1990; Zahra and George 2002; Huber 1991)
a. Acquisition
We are able to identify and acquire internal (e.g. within the partnership) and external (e.g. market) knowledge.
We have effective routines to identify, value, and import new information and knowledge.
b. Assimilation
We have adequate routines to analyze the information and knowledge obtained.
We have adequate routines to assimilate new information and knowledge.
c. Transformation
We can successfully integrate our existing knowledge with the new information and knowledge acquired.
We are effective in transforming existing information into new knowledge.
d. Exploitation
We can successfully exploit internal and external information and knowledge into concrete applications
We are effective in utilizing knowledge into new products.
e. Absorptive Capacity Indicator (Sobrero and Roberts 2001; Huber 1991)
We are successful in learning new things within this partnership.
We are effective in developing new knowledge or insights that have the potential to influence product development.
3. Collective Mind (Weick and Roberts 1993; Crowston and Kammerer 1998)
a. Contribution
We promptly make our contributions to the partnership with attention and care.
We are forthcoming in contributing our individual input to the group.
b. Representation
We have a global understanding of each other's tasks and responsibilities.
We are fully aware who in the partnership has specialized skills and knowledge relevant to our work.
c. Interrelation
We carefully interrelate our actions to each other to meet changing conditions.
Group members manage to successfully interconnect their activities.
d. Improvisation (Moorman and Miner 1997)
Our actions are figured out as we go along.
We frequently improvise in carrying out our activities.
Our activities are done by careful planning (r)
Collective Mind Indicator
We effectively interrelate our activities to manage rapidly changing conditions.
We collectively manage our tasks to address situational demands.

4. Entrepreneurial Alertness (Kirzner 1973; 1979; 1982)
a. Opportunity Recognition (Zahra and George 2002)
We frequently scan the environment to identify new business opportunities.
We are effective in recognizing new product ideas.
b. Market Orientation (Kohli and Jaworski 1993)
We detect changes in our customers' product preferences.
We often review our product development efforts to ensure they are in line with what the customers want.
We are quick to respond to significant changes in our competitors' pricing structures.
We periodically review the likely effect of changes in our business environment on customers.
Entrepreneurial Alertness Indicator (Busenitz 1996)
We spend considerable time reading trade publications and magazines.
We devote a lot of time to thinking about ideas for new products and improving our products.
Resource Reconfigurability Indicator (Galunic and Eisenhardt 2001)
We can successfully reconfigure the partnership's resources to come up with new productive assets.
We can effectively integrate and combine existing resources into 'novel' combinations.
We often engage in resource recombinations to better match our product-market areas and our partnership's assets.
IT Competence (Bharadwaj 2000; Sambamurty and Zmud 2000)
1. Project Management Systems (Pinto 2002; Rangaswamy and Lilien 1997)
Effectiveness of IT tools to analyze and measure work, tasks, and resources.
Representing the true availability of people, skills, and resources to enable appropriate task assignment.
Accurately providing real-time information on resource availability, usage, and cost.
Adequacy of IT tools to visualize and monitor project status, task lists, and progress of workflows.
Efficiency of IT tools to create parallel workflows so that multiple tasks can be worked on simultaneously.
Quickly prioritizing tasks and keeping deliverables on track to ensure realistic schedules.
Effectively tracking rapidly-changing information to update project deliverables in real-time.
2. **Knowledge Management Systems** (Alavi and Leidner 2001)
Effectiveness of IT tools for capturing, compiling, and coding relevant information (e.g., product/engineering data).
Project history (e.g., discussions, insights, work data, documents) is readily accessible for reuse.
Consistency of IT tools (e.g., databases, content repositories) to permanently store accurate information over time.
Leveraging IT tools for storing, archiving, retrieving, sharing, and reusing project information and best practices.
Creating online knowledge communities (e.g., virtual discussion forums) focused on new ideas and products.
Sufficiency of IT tools (e.g., knowledge networks) for locating relevant expertise.
3. Cooperative Work Systems (Wheeler, Dennis, and Press1998)
Effectiveness of IT tools to describe and redefine product structures, configurations, and routines.
Adequacy of IT tools (e.g., whiteboards, presentation features) to manipulate the format of our contributions.
Adequately using IT tools (e.g., multi-threaded discussions) to add new meaning to existing knowledge.
Effectiveness of IT tools (e.g., transformation functions) to create meaning to information by changing its form.
Adequacy of IT tools (e.g. application and desktop sharing) for simultaneously working together in real-time.
Effectiveness of IT tools (e.g. collaborative design tools) for seamless virtual product design reviews.
IT Competence Indicator (New scale)
Effectiveness of using IT functionality in the NPD process.
Adequateness of utilizing IT tools in the NPD partnership.

Competitive Advantage (Bakos and Treacy 1986; Feeny and Ives 1990; Jap 2001)
Process Efficiency (Kusunoki et al. 1998)
Overall Development Costs.
Overall Efficiencies of NPD Process.
Accelerated Time-to-Market.
Product Effectiveness (Kusunoki et al. 1998)
Improvements in Product Quality/Functionality.
Major Innovations in Products as a whole.
Creation of New Product Concepts.
Competitive Advantage Indicator (Jap 2001)
Gain strategic advantages in the marketplace.
Gain a competitive advantage.
NPD Proficiency
Technical Proficiency (Song and Parry 1997)
Evaluating the technical feasibility of developing new products with continuously changing features.
Recurrently evaluating tests to determine basic performance against shifting technical specifications.
Frequently executing prototypes or sample product testing.
Marketing Proficiency (Song and Parry 1997)
Frequently determining market characteristics and trends.
Regularly appraising competitors and their products – both existing and potential.
Executing several test marketing programs in line with commercialization plans.
Managerial Proficiency (Sethi 2000)
Management effectively monitors the progress of this partnership.
Management is actively involved in activities at the working level.
Management effectively administers relevant tasks and functions.
NPD Proficiency Indicator (Vorhies and Harker 2000)
We do a remarkable job of developing new products.
This product development partnership gives us an edge in the market.
Environmental Turbulence
Technological Turbulence (Kohli and Jaworksi 1993)
In our kind of business, customers' product preferences change a lot over time.
Marketing practices in our product area are constantly changing.
Marketing Turbulence (Kohli and Jaworksi 1993)
The technology in this product area is changing rapidly.
Technological breakthroughs provide big opportunities in this product area.
Partnership Turbulence (Bensaou 1997)
There are many changes taking place within this partnership.
There are no established practices and procedures to follow in doing our jobs.
Competitive Intensity (Song and Parry 1997)
New product introductions are very frequent in this market.
There are many competitors in this market.
Environmental Turbulence Indicator (New Scale)
The environment in our product area is continuously changing.
Environmental changes in our industry are very difficult to forecast.
Interorganizational Trust (Pavlou 2002)
All members of the partnership are capable of doing their own part.
Our promises to each other are reliable.
We are very honest with each other.
We trust that all members will act to the partnership's best interests.

IT Customization (New Scale)
The IT tools we use in this partnership adapt to our business processes, rules, and practices.
Our IT functionalities are customized to our specific needs.
Knowledge Base (Song and Parry 1996)
Technical Knowledge
Our R&D, engineering, and technical skills, knowledge, and expertise were more than adequate.
Marketing Knowledge
Our marketing research skills, knowledge, and expertise were more than adequate.
Managerial Knowledge
Our managerial skills, experience, and resources were more than adequate.
Knowledge Base Indicator (New Scale)
The overall skills, knowledge, and resources available in this partnership were more than adequate.
Cross Functional Integration (Song and Parry 1997)
There are frequent interactions between our cross-functional NPD partnership.
The NPD process is truly a cross functional effort.
Partnership Purpose (Sethi 2000)
Basic research that lays the basic foundations for future product development effort.
Applied work to develop specific, clearly defined products to fulfill immediate goals and strategic directions.
Routine engineering for continuous improvement of existing products and processes.
Control Variables
Our NPD partner is a (please circle one): a) supplier, b) customer, c) internal unit, d) other (please specify): _____
What percent of the overall product development work in this NPD partnership is collaboratively conducted? ____%
What percentage of this collaboration is conducted over electronic means (e.g., e-mail, online data, Internet tools, virtual teams) as opposed to personal, face-to-face interactions? _____%
How many functional areas (e.g., R&D, marketing) are represented in this NPD partnership? _____
How many employees are fully involved in this NPD partnership? _____
How long has this NPD partnership been in place? _____ years.
Estimated total annual revenues (2001): _____
Proportion of Sales spent on R&D (2001)_____%
Number of Employees: _____
Industry Segment: _____

Appendix B. Empirical Computation of Strategy-Environment Alignment

Following the deductive conceptualization of strategy-environment alignment, the goal is to have a rigorous empirical test to assess the proposed strategy-environment alignment. The basic premise of 'alignment' is that there are multiple potential successful configurations of functional competencies, given different observed environment conditions. Hence, alignment requires not only examination of distinct theoretical meanings, but also a thorough empirical investigation of analytical requirements (Venkatraman 1989). As conceptualized, the objective was to empirically examine the degree of adherence to environmental variables and the resource deployment of proficiencies that is likely to influence performance.

While alignment can also be computed with interaction terms between capabilities and environmental variables, such approach is problematic given the number of variables that makes such computation cumbersome and unreliable. Alignment can also be understood in terms of a pair-wise alignment or interaction among the individual dimensions that represent the two basic constructs. However, a more holistic approach was chosen in this study (Venkatraman and Prescott 1990), which aims to reflect the simultaneous pattern of interlinkages between strategy (functional competencies) and the environment (environmental turbulence).

Following (Venkatraman and Prescott 1990), calculating alignment involves (a) the identification of distinct environmental variables, (b) the specification of an 'ideal' competence deployment for each environment, (c) testing the performance effects of environment-strategy alignment using differential weights, and (d) comparing the ideal profile to a baseline measure. The multivariate deviation of the resource deployment from the 'ideal' profile examines the degree of misalignment. Based on the procedure outlined by (Venkatraman and Prescott 1990) and (Sabherwal and Kirs 1994), the following steps were followed:

1. Distinct Environmental Patterns. The alignment perspective encompasses the basic idea of the contingency view that there is no one best profile of cross-functional competence, but the optimal strategy profile depends on the contextual environmental turbulence. Given on the different environmental turbulence levels (e.g., technical, market, partnership), cluster and discriminant analysis was performed, which resulted in three distinct patterns. Even if these patterns may not be theoretically driven, empirical evidence suggests clearly distinct patterns.

2. Ideal Profile. The proposed 'alignment' computation is dependent on the development and justification of the 'ideal' profile, which is empirically derived based on theoretical rationale. In other words, deviations from the 'ideal' profile would suggest a negative correlation between such misalignment and a performance measure. For any given environmental pattern, there is a specific competence deployment needed for maximum performance given a specific set of environmental turbulence. Deviation from this 'ideal' profile should be negatively related to performance. The ideal profile was calculated using the highest performing organizations, specifically the top 10% of the organizations based on the perceptual performance outcomes measures. Since the top 10% was removed from the study sample to calculate the ideal profile, the removal of the bottom 10% was deemed appropriate to avoid a biased sample.

3. Differential Weights. In developing the multi-dimensional 'ideal' profile that reflects differential weights for the underlying functional competencies. This is an acceptable assumption given that having equal weight across all competencies is generally invalid (Venkatraman and Prescott 1990). The weights are derived from the beta weights of the regression equation of NPD competencies on

performance outcomes. The proximity of the ideal competence profile was computed using differential weights for the three functional competencies. The differential weights were obtained by the normalized and standardized beta values of the NPD competence-competitive advantage regression (Sabherwal and Chan 2001).

Alignment was calculated as the weighted Euclidean distance of the capability variables from the ideal profile for the group to which the organization belongs using the following equation:

$$\textbf{Alignment} = 1 - \sqrt{\left(\sum Wj\left(Xsj - Cj\right)^2\right)}$$

Where:

W_j = Weighted beta coefficients of competence effect
X_{sj} = Standardized score of each organization
C_j = Mean of Standardized Score of Ideal Profile

4. Baseline Measure. The development of a baseline model for more reliable hypotheses testing is deemed appropriate {Sabherwal, 1994 #364}. The predictive power of the calculated alignment measure should to a baseline measure (Venkatraman 1989); hence, a baseline measure was alo created and tested, which was inferior to the calculated 'ideal' profile.

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Appendix C. Statistical Analysis Results (Study 1)

Table 1. Descriptive Statistics for Principal Multi-Item Constructs

Construct	Mean	Variance	Cronbach's alpha	Internal Consistency Coefficient	Average Variance Extracted
Resource Reconfigurability	**3.56**	**0.80**	**0.89**	**0.92**	**0.83**
Coordination Competence	3.73	0.74	0.80	0.81	0.77
Absorptive Capacity	3.58	0.75	0.71	0.73	0.75
Collective Mind	3.52	0.85	0.76	0.78	0.80
Entrepreneurial Alertness	3.15	0.93	0.75	0.76	0.77
IT Competence	**2.54**	**1.26**	**0.94**	**0.95**	**0.94**
Project/Resource Management Systems	2.57	1.11	0.89	0.90	0.90
Knowledge Management Systems	2.68	1.42	0.88	0.90	0.85
Cooperative Work Systems	2.43	1.26	0.90	0.92	0.79
Competitive Advantage	**3.44**	**0.78**	**0.88**	**0.91**	**0.92**
Process Efficiency	3.29	0.74	0.77	0.80	0.81
Product Effectiveness	3.51	0.80	0.89	0.93	0.90
Cross-Functional Proficiency	**3.17**	**0.98**	**0.81**	**0.83**	**0.79**
Technical Proficiency	3.31	1.02	0.79	0.80	0.78
Marketing Proficiency	3.05	0.89	0.81	0.83	0.85
Managerial Proficiency	3.15	1.03	0.84	0.86	0.87
Environmental Turbulence	**3.12**	**1.29**	**0.73**	**0.75**	**0.80**
Technological Turbulence	3.19	1.36	0.81	0.83	0.80
Marketing Turbulence	2.94	1.25	0.80	0.82	0.84
Partnership Turbulence	3.24	1.26	0.85	0.87	0.86
Knowledge Resources	**3.50**	**0.94**	**0.81**	**0.83**	**0.86**
Technical Resources	3.18	1.24	0.84	0.86	0.84
Marketing Resources	3.84	0.87	0.87	0.90	0.94
Managerial Resources	3.49	0.81	0.87	0.88	0.90
Trust	3.64	1.00	0.83	0.86	0.91
Resource Complementarity	3.99	0.71	0.81	0.84	0.85
IT Customization	3.02	1.19	0.87	0.89	0.88
Cross-Functional Integration	3.78	0.91	0.86	0.88	0.90
Constructs in bold represent higher-order factors, formed by their underlying first-order factors shown below them.					

Table 2. Descriptive Statistics for Secondary Variables

Variable	Mean	STD
Partnership Age	4.08	4.29
Partnership's Purpose of Product Development[+]	1.98	0.98
Partnership's Number of Functional Areas	3.92	2.74
Organizational Size (Employees)	2,270	3,550
Organizational Size (Revenues)	$2.5B	$4.93B
Organizational R&D/Sales	10.6%	14.1%
Work Collaboratively Conducted	52.2%	29.2%
Work Electronically Conducted	50.7%	29.5%
Respondent's Familiarity	4.31	0.80
Respondent's Profile (Supplier=32%; Customer=19%; Internal Unit=45%; Alliance=4%)		
[+] 1=Basic Research; 2=Applied Development; 3=Routine Engineering		

Table 3. Factor Analysis of Principal Constructs for Convergent and Discriminant Validity

CONSTRUCT	CC1	CC2	CC3	CC4	CC5	AC1	AC2	AC3	AC4	CM1	CM2	CM3	CA1	CA2
Coordination Competence	.51	.45	.60	.75	.52									
Absorptive Capacity						.40	.44	.64	.79					
Collective Mind										.56	.77	.66		
Collective Alertness													.67	.47

CONSTRUCT	PM1	PM2	PM3	PM4	PM5	PM6	PM7	KM1	KM2	KM3	KM4	KM5	KM6	CW1	CW2	CW3	CW4	CW5	CW6
Project Management Systems	.57	.67	.79	.68	.71	.65	.61												
Knowledge Management Systems								.67	.76	.81	.79	.60	.40						
Cooperative Work Systems														.82	.70	.75	.68	.55	.58

CONSTRUCT	PE1	PE2	PE3	PE4	PE5	PE6	EF1	EF2	EF3	TC1	TC2	TC3	MC1	MC2	MC3	GC1	GC2	GC3	TT1	TT2	MT1	MT2	IT2	IT3
Product Effectiveness	.55	.68	.46	.87	.88	.78																		
Process Efficiency							.79	.50	.61															
Technical Proficiency										.69	.80	.61												
Marketing Proficiency													.76	.75	.68									
Managerial Proficiency																.66	.83	.70						
Technological Turbulence																			.66	.74				
Marketing Turbulence																					.68	.86		
Internal Turbulence																							.81	.77

CONSTRUCT	TR2	TR3	TR4	CF1	CF2	CF3	KC2	KC3	ITC1	ITC2	ITC3	MC2	MC3	GC1	GC2	GC3	TT1
Trust	.74	.88	.81														
Cross-Functional Integration				.74	.65	.72											
Knowledge Complementarity							.74	.79									
IT Customization									.64	.72	.66						
Technical Knowledge												.82	.85				
Marketing Knowledge														.76	.75		
Managerial Knowledge																.63	.66

Appendix D. Multiple Regression Analysis Results (Study 1)

Table 4. Multiple Regression Analysis Results for Competitive Advantage

Predictor Variables	Construct	Competitive Advantage	t-value
Independent	**Resource Reconfigurability**	**0.50**	**3.958*****
	Alignment	**0.32**	**2.96****
	NPD Competence	0.06	0.75
Indirect/Control	IT Competence	-0.09	0.93
	Work Electronically Conducted	0.19	2.20*
	Partnership Age	0.13	1.38
	R-squared	**0.65**	**0.63(adjusted)**
	F ratio	**$F_{6,84}$ = 31.01*****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 5. Multiple Regression Analysis Results for Alignment

Predictor Variables	Construct	Alignment	t-value
Independent	**Resource Reconfigurability**	**0.25**	**2.61****
	NPD Competence	**0.47**	**4.83*****
Indirect/Control	IT Competence	0.11	1.36
	Knowledge Resources	0.09	0.95
	Partnership Age	0.14	1.32
	Number of Functional Areas	0.20	2.60*
	R-squared	**0.50**	**0.49(adjusted)**
	F ratio	**$F_{6,84}$ = 28.16*****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 6. Multiple Regression Analysis Results for Resource Reconfigurability

Predictor Variables	Construct	Resource Reconfigurability	t-value
Independent	**IT Competence**	**0.22**	**2.68****
	Trust	**0.38**	**4.02*****
	Knowledge Resources	**0.17**	**2.12***
Moderators	IT Competence * Trust	**0.23**	**2.34***
Indirect/Control	Cross-Functional Integration	0.13	1.91^{+}
	Work Collaboratively Conducted	0.18	2.14*
	Knowledge Complementarity	0.02	0.28
	R-squared	**0.49**	**0.45(adjusted)**
	F ratio	**$F_{7,83}$ = 17.08*****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 7. Test for Mediation for Resource Reconfigurability as Higher-Order Construct

	Predictor Variables	Competitive Advantage	t-value
Regression 1	**Resource Reconfigurability**	**0.372**	**3.78*****
	R-squared	0.131 (adjusted)	
	F ratio	$F_{1,89}$ = 14.28***	
Regression 2	Coordination Competence	**0.214**	**2.55****
	Absorptive Capacity	**0.233**	**2.69****
	Collective Mind	**0.156**	**1.99***
	Collective Alertness		
	R-squared	0.121(adjusted)	
	F ratio	$F_{3,87}$ = 6.51**	
Regression 3	**Resource Reconfigurability**	**0.419**	**3.86*****
	Coordination Competence	-0.045	-.67
	Absorptive Capacity	0.056	-.71
	Collective Mind	-0.023	-.43
	Collective Alertness		
	R-squared	**0.112 (adjusted)**	
	F ratio	**$F_{4,86}$ = 3.94****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 8. Test for Mediation for IT Competence as Higher-Order Construct

	Predictor Variables	Resource Reconfigurability	t-value
Regression 1	**IT Competence**	**0.356**	**3.58*****
	R-squared	**0.117 (adjusted)**	
	F ratio	$F_{1,89}$ = 12.8***	
Regression 2	Project/Resource Management Systems	**0.18**	**1.78^{+}**
	Knowledge Management Systems	**0.22**	**1.98***
	Cooperative Work Systems	**0.10**	**1.34**
	R-squared	**0.105(adjusted)**	
	F ratio	$F_{3,87}$ = 4.47**	
Regression 3	**IT Competence**	**3.78**	**3.55*****
	Project/Resource Management Systems	-0.11	-.97
	Knowledge Management Systems	0.056	.34
	Cooperative Work Systems	-0.04	-.29
	R-squared	**0.112 (adjusted)**	
	F ratio	**$F_{4,86}$ = 3.75****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 9. Test for Mediation for Resource Reconfigurability in Nomological Network

	Predictor Variables	Alignment	t-value
Regression 1	**Resource Reconfigurability**	**0.551**	**5.56*****
	R-squared	0.251 (adjusted)	
	F ratio	$F_{1,89}$ = 30.87***	
Regression 2	IT Competence	**0.221**	**2.14***
	Trust	**0.30**	**2.92****
	Knowledge Resources	**0.255**	**2.56***
	Knowledge Complementarity	**0.16**	**1.38**
	Cross-Functional Integration	**0.05**	**0.36**
	Partnership Age	**0.20**	**1.61**$^{+}$**
	R-squared	0.26(adjusted)	
	F ratio	$F_{6,84}$ = 6.14***	
Regression 3	**Resource Reconfigurability**	**4.186**	**3.86*****
	IT Competence	0.172	1.71^{+}
	Trust	-0.043	-0.38
	Knowledge Resources	0.14	1.34
	Knowledge Complementarity	0.03	0.26
	Cross-Functional Integration	0.02	0.18
	Partnership Age	0.18	2.00^{+}
	R-squared	**0.29 (adjusted)**	
	F ratio	**$F_{7,83}$ = 3.94****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 10. Test for Mediation for Alignment in Nomological Network

	Predictor Variables	Competitive Advantage	t-value
Regression 1	**Alignment**	**0.60**	**6.95*****
	R-squared	0.35 (adjusted)	
	F ratio	$F_{1,89}$ = 48.23***	
Regression 2	Resource Reconfiguration	**0.392**	**3.67*****
	NPD Competence	**0.300**	**2.85****
	IT Competence	**0.03**	**0.27**
	R-squared	0.343 (adjusted)	
	F ratio	$F_{3,87}$ = 16.51**	
Regression 3	**Alignment**	**0.39**	**3.56*****
	Resource Reconfiguration	0.32	3.17***
	NPD Competence	0.10	0.87
	IT Competence	-0.08	-.83
	R-squared	**0.42 (adjusted)**	
	F ratio	**$F_{4,86}$ = 17.19*****	
***Significant at p<0.001 level **Significant at p<0.01 level, *Significant at p<0.05 level.			

Table 11. Multiple Regression Analysis Results for NPD Competence

Predictor Variables	Construct	NPD Competence	t-value
Independent	**Cross-Functional Integration**	**0.38**	**3.68*****
	Knowledge Resources	**0.32**	**3.94*****
Indirect/Control	Turbulence	0.18	2.46**
	IT Competence	0.01	0.13
	Trust	0.06	0.62
	R-squared	**0.56**	**0.54 (adjusted)**
	F ratio	**$F_{6,84}$ = 21.70*****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 12. Multiple Regression Analysis Results for Product Effectiveness

Predictor Variables	Construct	Competitive Advantage	t-value
Independent	**Resource Reconfigurability**	**0.34**	**2.34***
	NPD Competence	0.17	1.45
	Alignment	**0.30**	**2.00***
Indirect/Control	Partnership Purpose	0.08	0.71
	Cross-Functional Integration	0.01	0.22
	Partnership Age	0.10	1.76^{+}
	R-squared	**0.44**	**0.40(adjusted)**
	F ratio	**$F_{6,84}$ = 11.01*****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			

Table 13. Multiple Regression Analysis Results for Process Efficiency

Predictor Variables	Construct	Process Efficiency	t-value
Independent	**Resource Reconfigurability**	**0.67**	**6.11*****
	NPD Competence	**-0.35**	**-2.50****
	Alignment	**0.32**	**2.32***
Indirect/Control	Partnership Purpose	0.20	1.96*
	Cross-Functional Integration	0.02	0.30
	Partnership Age	0.02	0.13
	R-squared	**0.49**	**0.45(adjusted)**
	F ratio	**$F_{6,84}$ = 10.65*****	
***Significant at p<0.001 level ** p<0.01 level, * p<0.05 level; $^{+}$ p<0.1 level.			