IT-Based Knowledge Capability and Commercialization of Innovations: Modeling the Impacts of Ambidexterity and Absorptive Capacity

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ABSTRACT
The author provides a framework comprising of propositions for further research explicating the relations between IT-based knowledge capabilities (IT-KC) and Commercialization of Innovations (CI). They posit that a firm's absorptive capacity and ambidexterity (ability to explore and exploit) affect CI. Further, absorptive capacity too can be an antecedent to ambidexterity. IT-based knowledge capability (which is an instantiation of IT capability) is found to positively moderate the relationship between ambidexterity and commercialization of innovations, and also is an antecedent to potential and realized absorptive capacity. The author ties the seemingly isolated bits of literature together into an integrative theoretical model for testing.

Keywords: Absorptive Capacity, Ambidexterity, Commercialization of Innovations (CI), Exploitation, Exploration, Information Technology (IT) Capability, Knowledge Capabilities, Potential Absorptive Capacity, Realized Absorptive Capacity

INTRODUCTION
In order to extract strategic value from information technologies (IT), firms have to apply IT capabilities to harness and exploit their knowledge capabilities to continually innovate their business products, services, and processes. Knowledge management researchers have been trying to link investments on information technology for knowledge management with firm performance. The current knowledge management literature shows mixed results in establishing a relationship between IT investment on firm performance, which has been attributed to factors such as sample size, data sources, and industry type (Devaraj & Kohli, 2003; Kohli & Devaraj, 2003). However, we argue that central problem is that the relationship has not been conceptualized through the lens of three aspects of firm innovations: IT-Based Knowledge Capabilities (IT-KC), Absorptive Capacity, Ambidexterity and Commercialization of Innovations (CI).
In this study, we examine the knowledge capabilities that are supported and/or enabled by information technology (IT) and posit a theoretical model that establishes a link between IT and innovation derived through IT-based knowledge capabilities. We draw on knowledge-based view of the firm and argue that IT-KC better enable firm innovation by enabling new idea generation and facilitating the conversion of these ideas into new products and services that can be introduced into the market. In addition we argue that link between IT-KC and CI are mediated by Ambidexterity and Absorptive Capacity.

In this study, we examine the knowledge capabilities that are supported and/or enabled by information technology (IT) and posit a theoretical model that establishes a link between IT and commercialization derived through IT-based knowledge capabilities. This study is motivated by two major reasons. First, IT has become critical for supporting knowledge management initiatives and nurturing innovation (Alavi & Leidner, 2001). IT enables to better manage the creation, dissemination, and usage of knowledge and makes firms more productive and competitive (Davenport et al., 2008). IT-based knowledge capabilities are thus consequential to firm strategy (Joshi et al., 2010) and value creation (Joshi, Chi, Datta, & Han, 2010; Piccoli & Ives, 2005). However, an extensive survey of the existing literature on IT and management reveals that there is a conspicuous gap in the literature between IT and innovation. IT’s contribution and assistance in supporting, building, and strengthening a firm’s knowledge capabilities has been increasingly recognized (Alavi & Leidner, 2001; Sambamurthy & Subramani, 2005; Tanriverdi, 2005). The link between knowledge capabilities and firm innovation has also been emphasized (Cohen & Levinthal, 1990; Leonard-Barton, 1992; Leonard-Barton, 1995). Yet, limited research has been done to systematically examine the link between IT-based knowledge capabilities and innovation. A few conceptual and anecdotal studies have examined the relationships between IT-based knowledge capabilities and innovation (Davenport, 1993; Davenport, Prusak, & Strong, 2008; Holsapple & Singh, 2003). Even fewer studies have empirically investigated the aforementioned (Joshi, Chi, Datta, & Han, 2010; Sabherwal & Sabherwal, 2005; Tippins & Sohi, 2003). As more companies turn to IT in an attempt to enhance firm competitiveness, this gap must be systematically addressed by empirically examining specific innovation outcomes and processes from idea generation to new product introduction that may benefit from IT investment and practice. By doing so, an in-depth understanding of the relationship between IT-based knowledge capabilities and firm innovation becomes critical. Second, mixed results have been found in the literature in establishing a positive relationship between IT investment and its effect on firm performance, which may be attributable to a number of factors such as sample size, data sources, and industry characteristics (Kohli & Devaraj, 2003). However, emerging empirical evidence has shown that IT does not necessarily create a competitive advantage and there is no significant direct relationship between IT investment and firm performance (Hitt et al., 1996; Kohli & Devaraj, 2003; Mahmood & Soon, 1991; Powell & Dent-Micaleff, 1997; Tippins & Sohi, 2003; Zahra & Covin, 1993). Here, we postulate that firm innovation may be an important intermediate factor between IT investment and firm performance outcomes and an investment in IT itself is less likely to drive competitive advantage for firms. Instead, to extract strategic value from IT, firms have to use IT to exploit IT-based knowledge capabilities to continuously innovate their products, services, and business processes. To our knowledge this relationships has not be systematically examined in the IT literature.

To bridge the gap in the existing literature, we draw on knowledge-based view of the firm to examine the link between IT and commercialization of innovations. We argue that IT-based knowledge capabilities better enable firm innovation by enabling new idea generation and facilitating the conversion of these ideas into new products and services that can be introduced into the market.
The rest of this paper is organized as follows. In the next section we discuss our theoretical model alongside the testable hypothesis and theoretical underpinnings. It begins a description of the knowledge-based view of the firm, followed with the dependent variable of this study - Commercialization of innovation. Then, we concentrate on a discussion of antecedents and mediators to commercialization, including ambidexterity, and absorptive capacity. We also discuss how IT based knowledge capability moderate the influence of ambidexterity and absorptive capacity on commercialization of innovations. We conclude the paper by interpreting our results and discussing the implications and contributions of our study.

THEORETICAL MODEL AND HYPOTHESIS DEVELOPMENT

Our theoretical model is shown in Figure 1 to provide an easier assimilation of the discussion.

Knowledge Based View of the Firm

Knowledge-based View (KBV) considers knowledge as the most strategically significant resource of the firm. A valuable resource that allows firm's to act to its competitive environment innovatively. Its proponents argue that because knowledge resources are usually difficult to imitate and socially complex, heterogeneous knowledge bases and capabilities among firms are the major determinants of sustained competitive advantage and superior firm performance. A firm's knowledge is embedded and carried through multiple entities including organizational culture and identity, policies, routines, documents, systems, and employees (Holsapple & Joshi, 2002; Joshi, Chi, Datta, & Han, 2010). Based on KBV, IT is critical to firm innovation when IT is used to support, synthesize, and enhance large-scale knowledge management efforts (Alavi & Leidner, 2001; Datta, 2011a, 2011b).

In the knowledge-based economy, the urgency of continuous innovation with the help of tools used to manage the critical knowledge resource has been at the forefront (Davenport, Prusak, & Strong, 2008; Tippins & Sohi, 2003). Although existing IT literature that applies RBV has responded to this urgency by recognizing the important role of knowledge in gaining and sustaining firm competitiveness, proponents of KBV argue that RBV does not go far enough (Pavlou et al., 2005; Tanriverdi, 2005, 2006; Teigland & Wasko, 2003; Wasko & Faraj, 2005). The models developed using Resource-Based View (RBV) treat knowledge as a generic resource, rather than having special characteristics (Datta, 2009; Joshi, Chi, Datta, & Han, 2010). This literature thus does not dis-
tistinguish between different types of knowledge capabilities that can be supported through IT. Specifically, most IT studies have modeled the role of knowledge capabilities and innovation in an indirect and implicit manner. The traditional view of KBV is typically characterized as an instantiation of RBV. However, we argue that such a reductionist perspective of KBV fails to recognize that a positive relationship between IT and firm performance is an artifact of the outcomes of innovative activities achieved through knowledge capabilities. Therefore, it is imperative to examine how knowledge capabilities enabled or enhanced through IT impact commercialization of innovation. In this study, we draw upon KBV and argue that IT-based knowledge capabilities enable a firm to innovate and remain competitive in the market.

### Ability to Commercialize Innovations

Commercialization of innovation has been defined as the act or activities required for introducing an innovation to market (Andrew & Sirkin, 2003; Kelm et al., 1995; Kwak, 2002; Nambisan & Sawhney, 2007; Narayanan et al., 2000; Nerkar & Shane, 2007). It has been operationalized as the first sale of the target product or service (Nerkar & Shane, 2007). Converting technical innovations to products and services entails the development of manufacturing and marketing capabilities, and assets such as manufacturing facilities and service and distribution networks (Ahuja, 2000; Mitchell, 1989; Teece, 1986; Teece et al., 1997).

Our definition of commercialization of innovations has three aspects - (a) recognizes a market for an innovation (b) develops and manufacture it into a product and (c) sell/distribute the product through distribution channels. Of these, while the last two can be outsourced, the first one is of fundamental importance. Thus, the ability to commercialize innovations primarily lies in an organization's ability to recognize current and emerging markets for technological innovations and secondarily on its ability to manufacture and sell the product either buy itself or by subcontracting.

### IT-Based Knowledge Capabilities (IT-KC)

We define IT-based knowledge capabilities as the firm capabilities enabled or supported by IT that enhances organizational capabilities to acquire, internalize, create, share, and apply existing knowledge to conduct organizational knowledge activities (Alavi & Leidner, 2001; Davenport et al., 2008). The value of IT is visible and magnified when firms use it to better manage and exploit the knowledge resources for competitive advantage (Meta et al., 1996; Malhotra & Segars, 2001; Tippins & Sohi, 2003; Davenport et al., 2008). Thus, IT-based knowledge capabilities are dynamic capabilities that can enhance firm performance.

IT is central to a firm's efforts toward managing knowledge (Sambamurthy & Subramani, 2005; Griffith, 2003). IT supports business processes, flows of information, as well as sources of knowledge to be integrated and synergies from such combinations to be realized. Examples include searchable document repositories to support the digital capture, storage, integration, retrieval, and distribution of a firm's explicitly documented knowledge, creation of databases of experts, the development of decision aids and expert systems, and the hardwiring of social networks to aid access to resources of non-collocated individuals (Alavi & Leidner, 2001; Sambamurthy & Subramani, 2005). Based on a review of over 300 articles in the IT and management literature, we characterize IT-based knowledge capabilities into five specific dimensions: knowledge acquisition, knowledge internalization, knowledge generation, knowledge sharing, and knowledge application.

### Ambidexterity

A common thread that runs through all the seemingly varied views on ambidexterity is that instead of choosing between the two extreme ends of a spectrum, ambidexterity is about strik-
ing a 'balance' (Bodwell & Chermack, 2009; Collin & Porras, 1997; Eisenhardt, 2000; Lewis, 2000). In other words, it is about balancing seemingly contradictory tensions be it exploration & exploitation, adaptability & agility, initiation & implementation, emergent & deliberate, radical & incremental innovations and so forth. While exploration, adaptability, initiation, radical and emergent are explorative ends of the spectrum; exploitation, agility, implementation, incremental and deliberate are exploitative ends of the spectrum. Concentrating only on one aspect would help us address the core of ambidexterity: balance between opposing forces. For the purpose of this paper we chose exploration and exploitation. We thus define and restrict our definition of ambidexterity as the property of an organization to balance the two activities of exploration and exploitation. Exploration requires significant investments with uncertain payoffs (Bodwell & Chermack, 2009; Siggelew & Levinthal, 2003). Exploitation focuses on incremental change to create value through existing competencies, and thus poses less risk to the organization. Exploration is an orientation to the short-term whereas exploration has a more future-based, or long-term focus (Bodwell & Chermack, 2009; He & Wong, 2004). Exploitation activities may be directed toward gaining efficiency while exploration activities promote flexibility in the organization. The exploration versus exploitation construct has been used in a "wide range of management research areas, including strategic management, organization theory, and managerial economics (Bodwell & Chermack, 2009; He & Wong, 2004).

Past research has positively linked a balance between exploration and exploitation with organizational self-renewal through constant innovations in volatile business environment (Hamel & Getz, 2004; Handy, 1990; Huber & Glick, 1993; Levinthal, 1997; Levinthal & March, 1993; Lewin & Volberda, 1999; March, 1991; Nahapet & Ghoshal, 1998; Volberda, 1998; Volberda & Lewin, 2003). In addition, a number of studies have posited that a balance between exploration and exploitation leads not only to organizational renewal but also, helps firms to become more innovative and, as a result, such firms are more long-lived (Dess & Beard, 1984; Hamel & Getz, 2004; Hamel & Prahalad, 2002; Levinthal, 1997; Levinthal & March, 1993; Lewin & Volberda, 1999; March, 1991; Volberda, 1998; Volberda & Lewin, 2003). The precise amount of exploitation or exploration a company needs is, however, not specified in the existing literature. While too much time spent on exploration can drive out exploitation, the more common situation in organizations is that "exploitation tends to drive out exploration", due to focus on daily operations (Levinthal & March, 1993).

Ambidexterity and Commercialization of Innovations

Technologically oriented organizations that engage in successive or cyclic rounds of exploitation and exploration are best equipped to pursue product innovations (Simsek, 2009; Simsek et al., 2009; Tushman & O'Reilly, 1996). Ambidextrous firms have been observed to be successful in launching breakthrough products and services and in ensuring the continued high performance of existing products (O'Reilly & Tushman, 2004). Large corporations, such as Johnson and Johnson, and Asea Brown Boveri (ABB), have been able to compete in mature market segments through incremental innovation, and in emerging market segments through discontinuous innovation (Tushman & O'Reilly, 1996, 2002). They reconcile conflicting demands from their task environment and synchronize and balance concurrent exploration of new opportunities and exploitation of existing ones (Birkinshaw & Gibson, 2004; Duncan, 1976; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008; Tushman & O'Reilly, 1996). Thus, ambidextrous organizations can renew themselves through the creation of breakthrough products, services and processes without destroying or hampering traditional businesses (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008; Tushman & O'Reilly, 1996; Volberda & Lewin, 2003).
For instance, the ability of Hewlett Packard to balance its mainstream computing and printing market with emerging IT service markets led to leading products in computers, printers and IT services, like HP open view. Thus, being ambidextrous leads a firm to combine current opportunities with future vision, which, per our definition of ability to commercialize innovations, includes being able to recognize current and emerging markets. Further, we have argued that the ability to balance exploration and exploitation leads to an organization's being cognizant of existing and emerging markets, and capitalize on both types of market opportunities. In our definition of ability to commercialize innovations, we included an organization's ability to recognize current and emerging markets as a fundamental component. The ability to balance exploration and exploitation leads to an organization's being cognizant of existing and emerging markets. Thus, we can propose that being ambidextrous leads a firm to be better at commercialization of innovations. This leads us to propose:

Proposition 1a: A firm that can create a balance between exploitation and exploration is better able to commercialize innovation.

Ambidexterity, IT-KC, and CI

In the IS Literature the term ambidexterity received lukewarm treatment with some exceptions (Gold et al., 2001; Joshi, Chi, Datta, & Han, 2010; Tarafdar & Gordon, 2007). Tarafdar and Gordon (2007) conceptualized ambidexterity as an attribute to IS competency and as a property to achieve and balance strategic vision and operational excellence. Exploration entails knowledge creation and analysis of emerging and future opportunities (Wieland, 2003; Zack, 1999, 2003), while exploitation is defined as making use of the existing knowledge to leverage current opportunities. Gold et al. (2001), had items such as (a) identify business opportunities (exploration), (b) come out with new products (exploitation and commercialization), which collectively translate into ambidexterity. Yet they don't specify the term. Further, Kwon and Watts (2006), in evaluating the performance based impacts of two types of IT value practices: traditional efficiency based and knowledge and knowledge based had item (KM5: "has increased cross functional efforts to explore business opportunities", p.351) in their questionnaire that measures the link between internal knowledge network and exploration stage in ambidexterity. Despite the recognition of the construct in both the papers (Gold, Malhotra, & Segars, 2001; Kwon & Watts, 2006) there is no mention of the term ambidexterity. While linking IT with organizational capability, Gold et al (2005), measured how IT helps in collaborate employees across and between organizations to explore new opportunities and on how IT capability is used to commercialize newer products. For instance, the use of Computer aided Design/manufacturing (CAD/CAM) technologies, Content Management systems not only help collaborating but also reduce the time to commercialize innovations. Such technologies potentially reduce the cycle time from patent or conceptualization to production. IT-based knowledge capabilities results in social integration mechanisms that affects a firm's ability to translate exploitation to commercialized innovations. Social Integration Mechanisms enhance firms' ability to connect and integrate understanding of market needs and technical expertise in designing and manufacturing new products and services. This shared understanding increases firms' conversion of inventions to new products and services in the market (Joshi, Chi, Datta, & Han, 2010). Therefore, we postulate that a high level of IT-KC is likely to increase firms' conversion rate from exploration/exploitation cycle to new products and services introduced to the market (Joshi, Chi, Datta, & Han, 2010). Hence, IT based knowledge capability affects the relation ambidexterity has with commercialization of innovations.

Proposition1b: IT-based knowledge capability positively moderates the relationship
Absorptive Capacity (Potential and Realized)

Absorptive capacity is the limit to the rate at which a firm can absorb scientific or technological information and/or a limit to the quantity of such information that can be absorbed (Cohen & Levinthal, 1990; Jansen et al., 2005b). It underlies a firm's knowledge capabilities by which the firm acquires, assimilates, transforms, and exploits knowledge resources to produce dynamic capabilities such as innovativeness (Zahra & George, 2002). It is critical to developing competitive advantage and often leads to significant innovations (Powell et al., 1996). The theory was extended by specifying four distinct dimensions to absorptive capacity: acquisition, assimilation, transformation and exploitation (Zahra & George, 2002). The primary precursors to absorptive capacity are structure of communication between the organization and entities within its external environment (termed outward absorptive capacity), structure of communication within subunits in the organization (termed inward absorptive capacity), and structure of communication between subunits in the organization (termed cross functional absorptive capacity) (Cohen & Levinthal, 1990).

In studying the organizational antecedents to absorptive capacity (Jansen, Vanden Bosch, & Volberda, 2005b), distinguished between potential and realized absorptive capacity using work of Zahra and George (2002). Potential absorptive capacity, which includes knowledge acquisition and assimilation, captures efforts expended in identifying and acquiring new external knowledge and in assimilating knowledge obtained from external sources (Zahra & George, 2002). Realized absorptive capacity, which includes knowledge transformation and exploitation, encompasses deriving new insights and consequences from the combination of existing and newly acquired knowledge, and incorporating transformed knowledge into operations (Zahra & George, 2002).

Absorptive Capacity and Ambidexterity

According to Zahra and George (2002) firms focusing on acquisition and assimilation of new external knowledge (i.e., potential absorptive capacity) are able to continually renew their knowledge stock, but they may suffer from the costs of acquisition without gaining benefits from exploitation. Conversely, firms focusing on transformation and exploitation (realized absorptive capacity) may achieve short-term profits through exploitation but fall into a competence trap (Ahuja & Lampert, 2001) and may not be able to respond to environmental changes. Zahra and George (2002) and Jansen (2005) posited that realized absorptive capacity is likely to influence performance through product and process innovation. Transformation, for instance, facilitates the combination of knowledge and the development of new perceptual schemas and proposals for changes to existing products, processes, and technologies (Jansen et al., 2005a; Jansen, Vanden Bosch, & Volberda, 2005b). In addition, exploitation underlying a unit's realized absorptive capacity converts knowledge into products, services, and technologies. In this way, a firm's realized absorptive capacity is vital to a unit's innovation process and contributes to both exploratory and exploitative innovations, as posited by Jansen (2005).

Transformation and exploitation processes may be aimed at deepening existing knowledge and skills, and improving efficiency (Jansen, Vanden Bosch, & Volberda, 2005b; Zahra & George, 2002). In this way, realized absorptive capacity helps organizational units to create refinements to existing processes (Zahra & George, 2002) and to reduce associated costs (Jansen, Vanden Bosch, & Volberda, 2005b, Zahra and George, 2002). Additionally, realized absorptive capacity may also be aimed at developing and applying newly acquired external knowledge to pursue exploratory innovations (Jansen, Vanden Bosch, & Volberda, 2005b). Exploratory innovations originate from combining and interpreting existing and newly
acquired external knowledge in a different manner (Henderson & Clark, 1990; Kogut & Zander, 1992). Thus one can argue that realized absorptive capacity is positively associated with its exploitative as well as exploratory innovation. As we mentioned earlier that the balance between exploration and exploitation is ambidexterity which leads us to posit that realized absorptive capacity leads to ambidexterity.

Proposition 2a: Realized absorptive capacity, through its ability to transformation and exploitation of external knowledge positively affects ambidexterity

Apart from the contribution of realized absorptive capacity toward explorative innovation (exploration segment of ambidexterity), Jansen (2005) argued that potential absorptive capacity becomes critical to renew a firm's knowledge stock, and develop innovative outcomes that differ substantially from existing products, services, and technologies. Explorative innovations are radical innovations place a sizeable premium on assimilative ability of new external knowledge (Henderson & Clark, 1990; Jansen, Vanden Bosch, & Volberda, 2005b; Jansen et al., 2006). Assimilative ability of external knowledge is an attribute of potential absorptive capacity (Zahra & George, 2002). Because exploratory innovations require new knowledge or departure from existing knowledge (Levinthal & March, 1993; McGrath, 2001), the acquisition and assimilation of new external knowledge contributes to a firm's ability to pursue exploratory innovations (Jansen, 2005). Conversely, without applying newly acquired and assimilated new external knowledge, organizational units are not able to pursue exploratory innovations successfully, as posited by Jansen (2005). Thus a firm's potential absorptive capacity positively moderates the impact of realized absorptive capacity on exploratory innovations. Although, potential absorptive capacity may increase newly acquired external knowledge, Jansen (2005) argued that exploitative innovations build on existing knowledge and are outcomes of deepening and broadening existing knowledge and skills. The development of a firms' potential absorptive capacity, therefore, may hinder the efficient transformation and exploitation of knowledge (Jansen, 2005). Speaking differently, organizations when increase their potential absorptive capacity, decrease the impact of realized absorptive capacity on exploitative innovations. From an intraorganizational standpoint the several aspects of coordination, system and socialization capability that increases potential absorptive capacity, runs counter to realized-absorptive capacity. Also, to increase potential absorptive capacity organization needs low formalization and high diverse networks, with moderate centrality, whereas for realized absorptive capacity one needs diverse networks under the lens of high formalization with high centrality. Resources for acquisition and assimilation of new knowledge (for exploration) are different for exploitative innovations where one needs resources for with improvements to existing products, services, and technologies. In this sense, Jansen (2005) argued that organizations that increase their potential absorptive capacity may hinder organizational tasks or operations to efficiently develop exploitative innovations. Therefore, potential absorptive capacity negatively moderates the relationship between realized absorptive capacity and a unit's exploitative innovations. Combining the moderation effect of potential absorptive capacity on the effect of realized absorptive capacity on exploration and exploitation we get:

Proposition 2b: Potential absorptive capacity moderates the relationship between realized absorptive capacity and ambidexterity. Such that, potential absorptive capacity positively moderates and negatively moderates the relation between realized absorptive capacity on exploration and exploitation respectively.
Absorptive Capacity, and IT Based Knowledge Capability

Malhotra et al. (2005) have identified two types of information systems that can enhance absorptive capacity: one that enhances the ability of a firm to absorb (through capture and retention such as organizational memory systems, databases, knowledge repositories) and another that enables a firm to digest (through processing) information received from supply chain partners to create new knowledge (such as interpretation systems, data/text mining tools) (Malhotra et al., 2005). Such systems compare incoming information with existing insights, and help in the generation of new insights by integrating or synthesizing information (Alavi & Leidner, 2001; Scott, 2000). Putting Malhotra's work in terms of Zahra and George (2002) we can posit that, type of ability that helps firm to absorb helps in enhancing potential absorptive capacity, while the ones that helps in digesting helps in realized absorptive capacity.

Malhotra et al. (2005) also provide support for interpreting information based on task characteristics (Becerra-Fernandez & Sabherwal, 2001) and individual cognitive styles (Markus, 2001), resulting in an increase in the absorptive capacity of a firm. Therefore, IT can help enhance a firm's absorptive capacity not only by lowering the barriers of bounded rationality, but also by facilitating organizational learning of both tacit and explicit knowledge. IT can play an important role in building a firm's absorptive capacity by providing skills and processing abilities that can support acquisition, assimilation, transformation, and exploitation of knowledge to create innovation (Alavi & Leidner, 2001; Dehning et al., 2003; Holsapple & Joshi, 2000, 2002). While, acquisition and assimilation are elements of potential absorptive capacity, transformation and exploitation are surrogates of realized absorptive capacity.

Further, according to Boynton, Zmud, and Jacobs (1994), absorptive capacity can be measured with (a) managerial IT knowledge of business process, and value of IT, (b) Managerial IT process effectiveness. Now managerial IT knowledge and IT process effectiveness are both functions of IT capabilities (Boynton et al., 1994). Thus, IT based knowledge capability is an antecedent to absorptive capacity.

Thus we propose,

Proposition 2c: IT-based knowledge capability positively affects a firms potential absorptive capacity
Proposition 2d: IT-based knowledge capability positively affects a firm's realized absorptive capacity

Absorptive Capacity and Commercialization of Innovations

Absorptive capacity enables firms to predict more accurately the mature and commercial potential of technological advances (Cohen & Levinthal, 1990). In other words, a higher absorptive capacity and/or efforts to increase absorptive capacity can both promote innovation within a firm as well as a firm's ability to manage innovation effectively. Realized absorptive capacity converts knowledge into products, services, and technologies (Jansen, Vanden Bosch, & Volberda, 2005b). By the combination of potential and realized absorptive capacity firms increase the distinctiveness of their innovations (Yli-Renko et al., 2001) and are able to develop new innovations that differ substantially from existing products, services, and processes. Both inward and outward absorptive capacity can increase the ability to commercialize innovations. Overlapping interfaces between design, manufacturing, sales and marketing in Japanese firms led to increased absorptive capacity leading to movement of the product from design, sales to market (Clark & Fujimoto, 1987; Cohen & Levinthal, 1990). In sense of outer absorptive capacity, networks between firms and innovation engines, increase the ability to commercialize, as innovators can view their innovations as finished products and firms can sense business value of fundamental research. Nokia has done exactly that with its networks with the academia (Birkinshaw & Gibson, 2004).
In our definition of ability to commercialization of innovations, we included organization's ability to recognize current and emerging markets as a fundamental component. Absorptive capacity is the limit to the rate at which a firm can absorb scientific or technological information. Without being cognizant on absorbing scientific or technological innovations, it is impossible to visualize a market for such innovations. Thus, without absorptive capacity the fundamental requirement to commercialize innovation will not be reached.

Looking at some examples of increasing absorptive capacities enabled by IT on its impact on commercialization of innovations. For instance we can see how product engineering through information technologies such as CAD and CAM (computer-aided design and manufacturing), virtual reality, and other simulation and visualization tools. This capability could allow firms to create virtual mock-ups by recombining or refining existing products and services and by incorporating customers’ feedback into new products and services before they are released. Virtual mock-ups using computer simulations could help eliminate the time required to make numerous product models and reduce the need to conduct extensive product testing, cutting launch costs and time while increasing product marketability and sales. For instance, DaimlerChrysler uses simulation and graphical planning tools such as Dassault Systemes' Catia 3-D CAD and CAM software to digitally design vehicles and test them in a virtual world. The company can digitally create a passenger, watch that passenger enter and exit the vehicle, and gather data that can be used to improve comfort of new vehicle models (Joshi, Chi, Datta, & Han, 2010).

In another example, Kimberly-Clark's Customer Immersion and Design Center provides 3-D virtual reality technology to retailers such as Kroger, Target, and Wal-Mart, enabling retailers to interact with Kimberly-Clark's new products and displays in their stores in the same way retailers would, and thus facilitating retailers to release its new products more effectively. Kimberly-Clark's internal researchers also use this design center by bringing new product models developed using 3-D design software to the immersion room, where they can better visualize and sense the product design for market introduction (Joshi, Chi, Datta, & Han, 2010; McGee, 2007). Taken together, we posit a positive relationship between Absorptive Capacity and CI.

This leads us to propose:

Proposition 2e: Higher absorptive capacity increases a firm's ability to commercialize innovations.

**IMPLICATIONS AND FUTURE RESEARCH**

This work has the potential to make a significant contribution to Knowledge Management Researchers who are trying to link technological investments on information technology with firm performance. It extends the theory and our understanding of the relationship between IT and firm performance by using knowledge based view of the firm, highlighting the importance of IT-based knowledge capabilities, commercialization of innovation mediated through absorptive capacity, ambidexterity. These links have been overlooked or underrepresented in the existing IS literature. This framework is also valuable to knowledge management researchers, who try to link the impact of IT on creating knowledge based system, but struggle to link in to firm performance. Absorptive Capacity, ambidexterity, and commercialization of innovations show a great way to establish such causality. In addition we believe that this work can also add lens to literature on management, strategy and innovation where these constructs were studied but not in the light of strengths and opportunities brought by IT- based knowledge capabilities.

The knowledge-based integrative perspective used in this study is much needed in today's environment where competition becomes a learning race while knowledge base is increasingly complex and wide-spanning across many organizations in the industry. Our model will not
only provide a more nuanced understanding of the role IT plays in impacting firm performance, but it might also provide a better explanation for the mixed results regarding the aforementioned relationship between IT investment and firm performance.

From the standpoint of the knowledge management practitioner this paper compels to ask few key questions. Organizations must ask whether the IT resources can create and enhance a firm’s absorptive capacity, which increases a firm’s ability to realize market opportunities of innovations within and outside the firm. Increasing absorptive capacity leads to balancing creation of new markets without hampering the existing ones. Such a balance, alongside absorptive capacity leads to commercialization of innovations.

One of the biggest limitations of this paper is we are treating ambidexterity and absorptive capacity as two distinct constructs with no overlap. Although we have identified the causal relationships between the two constructs, but for matter of theoretical simplicity we are treating them as distinct. Also for theoretical simplicity, we have treated networks as one whole entity, while discussing its contributions on commercialization of innovations. Further, in this model we are not considering the impact of environmental turbulence, environmental complexity and industry maturity on commercialization of innovations. No matter how integrated IT resources are, the impact of absorptive capacity and ambidexterity in commercializing innovations is through these macro economic variables. So organizations must align its resources to get the best fit considering the environmental turbulence, and industry maturity.

Before these or any other lessons can be acted on with confidence, much research remains and we hope that this paper sets forth a useful path for research in this area. We hope that from the academic standpoint this paper sets a path for research in this area. Each of the proposition posited in this paper is would open doors for future research. This paper opens opportunity for research in both positivist and interpretivist paradigms. Surveys or secondary data could be used to do positivist research, while detailed case studies may aid in attaining interpretivist style of research. Future research must break the constructs into more testable variables and breaking the proposition into hypotheses and test them. Detailed studies could be made in studying specific relations between constructs and brief snapshots on the entirety of the theory. Attempt should be made to integrate all the studies and see how it fits within the bigger picture.

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