JUGGLING PARADOXICAL STRATEGIES: THE EMERGENT ROLE OF IT CAPABILITIES

Completed Research Paper

Abhishek Kathuria
The University of Hong Kong
School of Business
Pokfulam, Hong Kong
kathuria@hku.hk

Benn Konsynski
Emory University
1300 Clifton Road
Atlanta, GA 30322
benn_konsysnki@bus.emory.edu

Abstract

The simultaneous pursuit of paradoxical strategies is an emergent means of attaining competitive advantage. By nature, exploration and exploitation are fundamentally different, inconsistent and contradictory, thus reflecting an instance of organizational ambidexterity. We assert that IT capabilities act through different mechanisms to influence ambidexterity. To test our model, we selected to gather data from 352 manufacturing firms in high growth sectors in India – a setting that provides an exemplar for the world's enterprises undergoing rapid changes in the 21st century. Through OLS analysis we find strong support for our assertion that an organization's IT capabilities individually and jointly influence organizational ambidexterity, hitherto a challenging competitive possibility. We are thus also able to account for previously unexplained variance in IT payoffs in the emerging economy and small and medium enterprise contexts. Overall, through this research, we validate the emergent role of IT capabilities in juggling paradoxical strategies in the 21st century.

Keywords: Business Value of IT, IT Capabilities, Innovation, Ambidexterity

Introduction

Information Technology (IT) permits new strategic possibilities. The ability to tolerate and thrive in complex organizational settings resulting from the pursuit of paradoxical strategic objectives is one such opportunity. In the past, it has been the aspiration of many firms to tolerate complexities arising from managing conflicting principle practices at the same time. In the 21st century, IT uniquely enables organizations to not just seek operational efficiencies, but leverage the simultaneous pursuit of seemingly conflicting strategies. Such an ability to indulge in two paradoxical strategies simultaneously has been termed *organizational ambidexterity* by researchers in the area of strategic management (Tushman and O'Reilly 1996). The metaphor of a juggler has been evoked to describe ambidextrous organizations, which can juggle two conflicting strategies (O'Reilly and Tushman 2004; Tushman and O'Reilly 1996). Organizational ambidexterity is a critical means to attain competitive advantage and superior firm performance, and a growing cause for firm success or failure. While pursuit of paradoxical strategies is the source of many tensions, IT may be a key enabler to firms that follow this path.

IT is a critical investment for firms in today's knowledge-driven, hypercompetitive environment, with worldwide IT spending by enterprises reaching $2.6 trillion in 2011 and forecast to reach $2.7 trillion in 2012 (Gartner 2010; Gartner 2011). Consequently, the performance implications of IT are a major managerial concern and an enduring question in the area of Information Systems (IS). The tangible and intangible benefits of IT have been recognized by examining the impact of IT on operational and accounting based measures of firm performance (e.g. Banker et al. 2006; Hitt et al. 2002) and forward looking measures of firm performance (e.g. Bharadwaj et al. 1999) respectively. Researchers have conceptualized IT capability as a firm's ability to mobilize and deploy IT resources in combination with other capabilities or resources, and demonstrated its positive influence on competitive advantage and performance (Bharadwaj 2000; Santhanam and Hartono 2003). As the threads connecting IT to competitive performance become clearer, it is becoming apparent that IT capabilities endow both direct and indirect benefits to firms through the effect of intermediate constructs, many of which are intangible in nature. Organizational ambidexterity is one such unexamined construct and emergent competitive possibility.

The dichotomy between exploration of new possibilities and the exploitation of old certainties is well established and reflects an instance of organizational ambidexterity. By nature, exploration and exploitation strategies require fundamentally different, inconsistent and contradictory organizational settings. While prior research in IS has considered exploitation and exploration strategies as mutually exclusive (e.g. Subramani 2004), strategic management scholars have established the simultaneous pursuit of exploration and exploitation strategies as a means of realizing a competitive advantage and enhancing firm performance. This research argues that simultaneous exploration and exploitation enables firms to be efficient in managing the business demands of today while simultaneously being adaptive to the changes and demands of tomorrow (Gibson and Birkinshaw 2004). Simultaneous exploration and exploitation is positively related to sales growth (He and Wong 2004), long-run profitability, and successful product development and innovation (Sheremata 2000).

There is emerging consensus that ambidextrous firms reconcile and manage internal tensions and conflicting demands through a variety of organizational factors, such as structural forms, and situational factors, such as organizational flexibility (Raisch and Birkinshaw 2008). Though most established antecedents of ambidexterity are facilitated by IT, systems have only been mentioned as a construct of interest in the ambidexterity debate (Gibson and Birkinshaw 2004). Few initial studies of IT and organizational ambidexterity have appeared in IS scholarship, wherein IS scholars have extended the ambidexterity concept to the areas of software development, IT management and green IT (e.g. Im and Rai 2008; Lee et al. 2007; Prieto et al. 2007).

In this paper, we seek to address these gaps in the IS and strategic management literatures by examining the role of IT in facilitating organizational ambidexterity. For this purpose, we focus on the research question "How do IT capabilities enable organizational ambidexterity?" Through this study, we assert the antecedent relationship of IT capabilities with organizational ambidexterity.

We adopt the IT strategy categorization and view IT capabilities as falling into automate, informate, and transform categories (Dehning et al. 2003; Schein 1992; Zuboff 1988). We assert that these IT capabilities

act through different mechanisms to individually and jointly influence ambidexterity. To test our theory, we selected to gather data from a novel empirical setting. India is undergoing a period of accelerated growth, with rapidly evolving organizational challenges and opportunities - an exemplar for the world's enterprises undergoing rapid structural changes in the 21st century. India's manufacturing sector is characterized by high turbulence and hyper-competition. Firms in this environment juggle the paradoxical strategies of exploitation and exploration to simultaneously address the needs of existing and emerging customers. While this results in competitive advantage in stable, low growth markets, such behavior is essential for survival of organizations in faster growing markets. Consequently, we gathered data from 352 manufacturing firms located in India.

Through our analysis, we find strong support for our core assertion that an organization's IT capabilities influence organizational ambidexterity, hitherto a challenging competitive possibility. We find that an organization's Transform IT capability has a strong positive effect on its ability to pursue ambidextrous strategies. We also observe that Automate and Informate IT capabilities impede ambidexterity; however, the negative relationship of Informate IT capability is lessened in magnitude by Transform IT capability. We posit that this reflects the ossification of processes and lower flexibility due to automation. Finally, we find that simultaneous exploration and exploitation is best enabled by pursuing a strategy of balancing IT Automate, Informate and Transform capabilities. Overall, our results support the reasoning that while the simultaneous pursuit of paradoxical strategies leads to multiple and conflicting demands being placed upon an organization, the tolerance of these resultant tensions enables organizations to achieve superior competitive performance in the 21st century.

This study contributes towards the dialogue on intangible business value of IT by asserting the role of IT in enabling organizational ambidexterity, and thereby attaining superior competitive performance. Our findings strengthen the understanding of IT impacts on a key strategic construct that lies on the path from IT to competitive advantage. We provide insights into the first-order effects of IT on intermediate variables and present ambidexterity as an IT-enabled capacity that be produced under high turbulence. Our study also contributes towards the mixed findings of currently scant research that addresses IT payoff questions in emerging economy or small and medium enterprise contexts. Finally, this research contributes towards the strategic management and ebusiness literatures by establishing IT capabilities as key antecedents to organizational ambidexterity. Overall, we showcase the emergent role of IT capabilities in tolerating the complexity inherent in effectively resolving strategic tensions arising from juggling paradoxical strategies.

Theory and Hypotheses

Organizational Ambidexterity

Firms face several paradoxical challenges due to the simultaneous pursuit of contradictory activities, including the challenges of efficiency versus flexibility (Konsynski and Tiwana 2004), stability versus transformation, and internal versus external sourcing (Rothaermel and Alexandre 2009). While all these refer to forms of organizational ambidexterity, a key and recently oft studied instance of ambidexterity is the pursuit of exploration and exploitation strategies.

James March (1991) conceptualized exploration as a set of those firm behaviors that exemplify search, discovery, variation and experimentation, and exploitation as those firm behaviors that exemplify refinement, implementation, selection and efficiency. Exploration is associated with risk taking, new routines, and divergent thinking, while exploitation is associated with existing routines and focus (Baum et al. 2000; March 1991). There are several fundamental differences in organizational behavior due to the distinction between the exploration of new possibilities and exploitation of old certainties and this conceptual distinction has been used across a wide range of management research, including information systems (e.g. Kane and Alavi 2007; Prieto et al. 2007; Subramani 2004).

Exploration and exploitation require fundamentally different and inconsistent architectures and competencies, thereby creating paradoxical challenges (Jansen et al. 2009). For example, exploitation requires a short-term efficiency and control focus, which contradicts the long-term experimental focus and decentralized architecture of exploratory units (Floyd and Lane 2000). Thus most research in the 20th

century conceptualized these as two strategies at opposite ends of a continuum. March (1991) asserted a contrarian view, which was supported by latter studies that demonstrated the perils of a solitary focus on either self-reinforcing process (Levinthal and March 1993). Specifically, an exploitation only strategy results in competency traps and organizational inertia (Leonard-Barton 1992), while an exploration only strategy results in endless cycles of search. On the other hand, a strategy of juggling exploration and exploitation not only avoids these perils, but also generates complementary resources and synergistic effects (Cao et al. 2009; Katila and Ahuja 2002). Consequently, empirical research studies conducted in the past decade (e.g. Cao et al. 2009; He and Wong 2004; Lubatkin et al. 2006) assert that the long term success and survival of firms is contingent upon their ability to juggle both paradoxical strategies of exploration and exploitation, an approach increasingly possible in the 21st century.

Organizations juggle between exploration and exploitation by either interspersing long spells of exploitation with short bursts of exploration (Siggelkow and Levinthal 2003) or simultaneously pursuing both strategies within different parts of the firm (Benner and Tushman 2003; Raisch et al. 2009). Both approaches are facilitated by three types of mechanisms – organizational structures, contexts, and leadership processes (Tushman and O'Reilly 1996). Different organizational structures facilitate organizational differentiation and integration (Raisch and Birkinshaw 2008), which allow firms to maintain conflicting competencies (Gilbert 2005) and combine exploration and exploitation efforts to achieve ambidexterity (Smith and Tushman 2005). Context, consisting of a combination of meta-routines, shared vision, discipline, and trust also facilitates ambidexterity (Gibson and Birkinshaw 2004). Heterogeneous teams, consisting of ambidextrous senior or middle managers who link and integrate old and new knowledge, can also enable ambidexterity (Mom et al. 2009; Taylor and Helfat 2009).

The common effect of these structural, organizational and managerial antecedents is that they allow ambidextrous organizations to manage conflicting tensions and demands through acts of separation and reconciliation. However, several of the critical processes underlying these antecedents, are enabled or facilitated by IT. This assertion is reflected theoretically in the IS research literature and anecdotally in the majority of empirical ambidexterity studies being conducted in the IT intensive era. Though systems are mentioned as part of an organization's context, none of these studies have explicitly addressed the relationship of IT with ambidexterity. Thus, to the best of our knowledge, no previous study in the ambidexterity literature has conceptualized IT as an antecedent to ambidexterity. This paper represents the first effort to fill this gap.

Performance Implications of IT

The performance implications of IT have intrigued scholars for the past four decades and continue to be a significant question in IS research. Utilizing a variety of accounting and operational measures, many studies have reported a positive effect of IT on firm performance. Other work has acknowledged the contribution of IT towards firm intangibles by examining the effect of IT on market based measures of performance such as Tobin's Q (e.g. Bharadwaj et al. 1999). Over the past decade, researchers have applied the resource based view (Barney 1991) and postulated that to create and sustain competitive advantage, firms must acquire unique IT resource bundles and capabilities (Santhanam and Hartono 2003). Overall, research shows that IT is linked to firm performance in the presence of specific complementary organizational characteristics (Bharadwaj et al. 2007; Chari et al. 2008) and by way of several intermediate processes, including manufacturing processes, superior customer services, and new product development (Banker et al. 2006; Ray et al. 2005). IT also has positive impacts on exploration, exploitation, knowledge creation and innovation output (Kane and Alavi 2007; Kleis et al. 2012). While several intermediate constructs and processes have been identified, this work is yet incomplete, ongoing and emergent. We identify organizational ambidexterity as one such intermediate construct, which lies on the path from IT to competitive advantage and thereby, firm performance.

Data availability constraints have restricted the majority of these studies to large sized, U.S. based organizations. The scant use of international data has found mixed results (e.g. Lal 2001; Lal 2002). Research that examines the digital business strategy of small and medium enterprises, which have different structures, and business environments from larger firms, has also found mixed payoffs. This paper addresses these gaps by examining small, medium and large enterprises in a non-US setting.

Organizational Ambidexterity and IT

As aforementioned, antecedents to the development of organizational ambidexterity and the management of resultant conflicting demands and tensions have been established in the extant literature. Many of these antecedents may be enabled by IT in differing ways. We assert four underlying causal mechanisms through which an organization's IT capabilities facilitate its simultaneous pursuit of seemingly conflicting exploration and exploitation strategies. First, a greater flow of knowledge within an organization enables cross-leverage of existing knowledge, thereby increasing ambidexterity (Mom et al. 2007). Second, connectedness is a direct antecedent to ambidexterity due to its facilitation of knowledge exchange and integration (Jansen et al. 2009). Third, integration of dispersed explorative and exploitative efforts is another means to achieve ambidexterity (Gilbert 2005; Smith and Tushman 2005). Fourth, organizational flexibility enables management of the exploration and exploitation paradox on a continuous basis (Andriopoulos and Lewis 2009; He and Wong 2004).

Bharadwaj (2000) defines IT capability as a firm's ability to mobilize and deploy IT resources in combination with other capabilities or resources. IT capability is considered as a higher order capability, comprising of lower order IT capabilities. Our conceptualization of IT capabilities is consistent with this treatment, which provides a basis for our orientation and theorizing. We suggest that IT capabilities facilitate the organization to mobilize, integrate, and deploy operational capabilities and resources across spatially and temporally dispersed exploratory and exploitative efforts – a critical requirement in achieving ambidexterity (Jansen et al. 2009). While prior literature has classified IT capabilities in many ways, in this examination, we adopt the IT strategy categorization and view IT capabilities as falling into the categories of Automate, Informate, and Transform (Dehning et al. 2003; Schein 1992; Zuboff 1988). Prior research has viewed these categorizations as part of the IT strategic role applied at both the firm and industry level (Dehning et al. 2003).

Different types of IT, which act as proxies for different types of IT capabilities, lead to differing effects on firms and their performance (Barua et al. 1995). Thus, we posit that different types of IT capabilities that comprise a firm's IT capability lead to differing impacts on the ability of the firm to manage the demands arising from juggling paradoxical strategies. Figure 1 illustrates our proposed model. The supporting rationale and hypothesis are presented below.

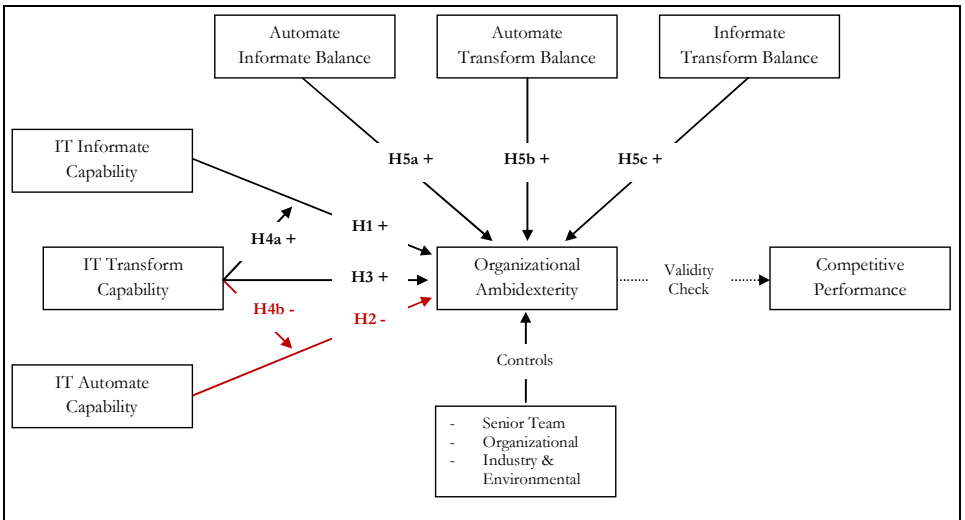

Figure 1. Impact of IT Capabilities on Ambidexterity

Influence of IT Informate Capability

We define IT Informate Capability as *a firm's ability to mobilize and deploy IT resources in combination with other capabilities or resources that leads to greater access of information across the organization*. IT Informate capability facilitates the sharing, reach, richness, accessibility and availability of knowledge (Alavi and Leidner 2001; Zahra and George 2002), thereby enabling the rapid transformations required to address conflicting demands. Informate IT also improves the accuracy and timeliness of information regarding changing and conflicting internal and external demands which results in improved resource allocation decisions. For example, the implementation of EDI at various organizations, including Chrysler, in the last decade of the 20th century was credited with enhancing Informate IT capability, resulting in improved information accuracy and timeliness (Lucas 1999; Mukhopadhyay et al. 1995; O'Callaghan et al. 1992). IT Informate capability facilitates enhanced decision making and coordination processes and thus improved responsiveness and resource utilization (Mooney et al. 1996). It also enhances communication, coordination, information search, processing and realignment of a firm's resources (Bharadwaj et al. 1999). Thus, we expect that organizations with a high Informate IT capability possess high connectedness and are also able to actively transmit knowledge. For example, Merck witnessed improved drug discovery due to an increase in knowledge flows and connectivity following the enhancement of its IT Informate capability through the implementation of a knowledge management system (Ravichandran and Lertwongsatien 2005). Finally, the role of Informate capability in enhancing organizational integration has been established (Ranganathan and Brown 2006).

Hypothesis 1 (H1): IT Informate capability is positively related to organizational ambidexterity.

Influence of IT Automate Capability

We define IT Automate Capability as *a firm's ability to mobilize and deploy IT resources in combination with other capabilities or resources to facilitate an automation of its existing business processes*. Automate IT capability directly improves exploitation through efficiency gains, due to cost reductions and productivity enhancements through automation. Amazon and Netflix are two oft cited examples of organizations that have reaped several cost and productivity benefits from their Automate IT capability. Automate IT simplifies, accelerates and coalesces repetitive business processes, enabling firms to speed up and improve existing processes, products and services. For example, by automating its design processes, Boeing was able to speed up its exploitation efforts during the development of the 777 model (Ravichandran and Lertwongsatien 2005). Additionally, automation of existing processes reduces organizational flexibility and the ability to respond to paradoxical external stimuli in a flexible and improvisational manner. Thus we expect that IT Automate capability is detrimental to ambidexterity.

Hypothesis 2 (H2): IT Automate capability is negatively related to organizational ambidexterity.

Influence of IT Transform Capability

IT Transform Capability is defined as *a firm's ability to mobilize and deploy IT resources in combination with other capabilities or resources that leads to the redefining of business practices*. An organization's IT Transform capability endows it with the ability to instill radical changes to processes, routines and the firm's business model. IT Transform capability and its resultant radical innovations lead to better, flexibility, responsiveness and agility, as evidenced by the success of Oticon in creating a flexible organization (Lucas 1999). IT Transform capability also supports enterprise-wide integration, collaboration and communication through changes to processes and routines. Thus, a strong Transform IT capability may lead to an improvement in a firm's ambidexterity. Transform IT capability also enhances the effects of IT Automate and IT Informate capabilities due to the agility it lends to the processes of integration. The resultant greater responsiveness also increases the effect and speed of knowledge flows, thereby improving the effectiveness of IT Informate and Automate capabilities. IT Transform capabilities also lead to fundamental changes to business processes, which augment the efficiency of automated processes. Thus we expect that IT Transform capability will enhance the effect of

IT Informate capability on organizational ambidexterity. We also expect that this capability will reduce the ambidexterity impeding effects of IT Automate capability due to gains in organizational flexibility.

Hypothesis 3 (H3): IT Transform capability is positively related to organizational ambidexterity.

Hypothesis 4a (H4a): IT Transform capability strengthens the influence of IT Informate capability on organizational ambidexterity.

Hypothesis 4b (H4b): IT Transform capability weakens the influence of IT Automate capability on organizational ambidexterity.

Joint Influence

As aforementioned, IT Automate capability has direct positive impacts on an organization's pursuit of exploitation activities. IT Informate capability enhances the richness of information available in the organization. This includes information regarding environmental changes, market and innovation opportunities, and competitive moves. Thus IT Informate capability has a direct positive effect on an organization's exploration activities. Therefore, overall, a balance in an organization's Automate and Informate IT capabilities is expected to lead to improvements in existing processes and routines and in the quality, correctness and timeliness of environmental information. Similarly, since Automate and Transform IT directly impact exploitation and exploration respectively, a balance of these capabilities is expected to directly influence ambidexterity. However, richer information regarding market opportunities due to IT Informate capability also results in a direct positive effect on an organization's exploitation activities. Thus, we expect a balance of Informate IT and Transform IT capabilities to positively facilitate organizational ambidexterity. As per this conceptualization, the relative balance of two IT capabilities pertains to their *relative magnitude*. Thus, for example, an organization with a balance of Automate and Informate IT capabilities will have an equal emphasis towards both capabilities. As a result, such an organization will witness a similar magnitude of ability to automate its existing business processes and enhance information access across the organization. Overall, we expect that relative balance of capabilities will facilitate ambidexterity.

Hypothesis 5a (H5a): The relative balance of Automate and Informate IT capability is positively related to organizational ambidexterity.

Hypothesis 5b (H5b): The relative balance of Automate and Transform IT capability is positively related to organizational ambidexterity.

Hypothesis 5c (H5c): The relative balance of Informate and Transform IT capability is positively related to organizational ambidexterity.

Methods

Setting

The context for this study is an important empirical setting. Despite several business challenges and infrastructural constraints, India has been the world's second fastest growing major economy in the past decade, with more than 9% growth per year for most of the 2000's (Cappelli et al. 2010). Increased globalization and digitization calls for a study of organizations hailing from developing economies, such as

India. On one hand, fast growth of emerging economies offers market opportunities for ambidextrous organizations hailing from developed countries. On the other hand, ambidextrous firms from emerging economies pose potential competitive threats in developed economies. Most importantly, the constantly evolving market challenges and opportunities witnessed by organizations in emerging economies are an exemplar for the rest of the world's enterprises undergoing rapid changes in the 21st century.

India's manufacturing sector, in particular, is characterized by high turbulence and hyper-competition. Firms indulge in the concurrent pursuit of the paradoxical strategies of exploitation and exploration to simultaneously address needs of existing and emerging customers. We have collected data regarding innovation and IT from manufacturing firms located in India, which hail from five sectors that have witnessed the double digit growth rates over the past three years - Auto Ancillaries, Home Appliances, Air Conditioners & Refrigeration, Hand Tools and Telecom Equipment.

Firms from these selected sectors provide a rich, diverse and interesting setting for this study. There is little IS research based in an emerging economy context or which examines small and medium sized firms. Therefore, this choice of setting fills important gaps in extant literature. Also, the high degree of institutional uncertainty of a transitional economy, coupled with the high degree of technological uncertainty of a high-growth sector, result in a high variance in strategic choices by firms and thus their levels of ambidexterity (Cao et al. 2009). Due this reason, several prior ambidexterity studies have been situated in similar contexts (e.g. Cao et al. 2009; He and Wong 2004).

Data Collection

For the purpose of data collection, we employed two survey instruments that were developed by borrowing questions from existing scales after a thorough review of relevant bodies of literature. The first questionnaire was designed to collect dependent variables and control variables from the top ranking executive responsible for strategy formulation (CEO or equivalent) and the second questionnaire was designed to collect the independent variables regarding IT capabilities from the top ranking IT executive (CIO or equivalent). The initial questionnaires were refined through a pre-test and pilot test conducted in India. These tests ensured content validity, appearance, terminology, clarity of instructions, organization and response format. Since English usage in India differs from English usage elsewhere, these interviews also helped in localizing the questionnaires.

We engaged the services of an India-based management consulting firm, which has considerable experience and expertise in similar data collection efforts for academic research purposes. Due to the absence of a single, consolidated national level database for industry sector-wise manufacturing organizations, a list of potential participating organizations was developed by consolidating information from seventeen different sources - membership directories of three national level, eight industry level and six state/city level business associations. We refined the original list by removing duplicate entries through verification of the information via the company website, different secondary news sources and the Registrar of Companies website maintained by the Government of India.

We solicited responses from organizations through an introduction letter. Since the membership directories are unverified sources, telephone calls were made to each organization to determine their eligibility for our study. While several organizations were not manufacturing firms, the existence of others could not be verified as they did not respond to letters sent to their physical address, answer multiple telephone calls and did not have a website. This resulted in a verified sample pool of 1359 organizations, out of which 628 refused to participate in the study. The remaining organizations were asked to nominate a key contact person, who was sent a packet containing two separate sealed envelopes addressed to the respondents, instructions and a pre-addressed envelope. Further follow-up telephone calls were made to organizations and agents from the local partner offered to collect the filled in questionnaires.

As an incentive to participate, organizations were offered a copy of an executive summary of the findings after completion of the research. They were assured of the confidentiality and privacy of their individual responses and the local partner offered to be available to meet with potential respondents to clarify any doubts and to alleviate concerns.

The data collection process lasted from April to September 2011. We received 352 usable responses, representing a response rate of 25.9% (352/1359). The majority of the respondents were from the auto

ancillaries sector (76%). Nearly 70% of respondents were privately held, 72% had 500 or lesser employees and a third of the firms had a workforce of 100 or less. Overall, the firms in the study have an average age of 26.1 years (s.d. = 17.9, minimum = 1, maximum = 161) and have an average of 752.5 full-time employees (s.d. = 2083.9, minimum = 7, maximum = 20,000).

Alleviating Bias Concerns

We took several steps to mitigate the potential for non-response bias, common method bias and measurement error. We assessed response bias by finding no significant differences between early and late responses or responses collected after telephonic follow-ups and those requiring field visits (Kanuk and Berenson 1975). We contacted non-respondents and found no underlying issue indicating non-response bias. Common method bias was mitigated by the use of the following procedures. First, independent and dependent variables were collected from different respondents. Second, different types of scales were used to measure different constructs. Scales were also reverse-ordered across different constructs. Third, a control variable collected from both respondents showed high inter-rater reliability. Fourth, we conducted Harmon's one-factor test (Podsakoff and Organ 1986) and the absence of a single factor that accounts for the majority of covariance in the unrotated factor solution enabled us to rule out common source issues. Fifth, we conducted a marker variable test, using an unrelated variable, which had almost zero correlations with the primary constructs (Lindell and Whitney 2001).

Measures

IT Capabilities

To measure Automate, Informate and Transform capabilities, we captured details of organizations' IT portfolio. Based on extensive analysis of prior literature, initial interviews with industry practitioners, and feedback from pre-test and pilot study participants, we developed a list of IT systems that are most commonly used in the manufacturing sector in India. From this list, respondents were asked to select the IT systems that are *used* in their firm and name any other IT applications that fall outside the list.

To operationalize the measures of Automate, Informate and Transform capabilities, we use the approach followed in prior literature (e.g. Chi et al. 2010; Joshi et al. 2010). First, each IT application was categorized into one of the three capabilities by four coders, who consisted of three academics and an industry expert. While it is possible for a particular IT application to accomplish more than one of the IT capabilities, we followed the methodology and criterion used in prior studies and assessed the *main business benefits* of the IT application (e.g. Dehning et al. 2003). Each coder independently assessed each system and any differences in the coding were resolved through discussions. The reliability of the coding process and inter rater agreement were ascertained by a kappa value of 0.77, which exceeded the suggested 0.75 threshold value (Landis and Koch 1977). Table 1 provides representative examples of IT applications for each capability.

Table 1. Representative Examples of IT Application Categorization

Automate IT Capability	**Informate IT Capability**	**Transform IT Capability**
Production Scheduling System	Market share monitoring system	Supply chain management system
Ledgers & Statements System	Sales management system	Cost-price analyzing system
Document Management System	Visualization tools	Business intelligence
Structural Design System	Video conferencing	Groupware
Tool Design System	Intra-company instant messaging	Cloud computing services

Second, we calculate the total number of applications for each capability and convert this into a 7 point scale, where 1 was the scale anchor for lowest capability and 7 for highest capability (e.g. Oh and Pinsonneault 2007). This provided measures for Automate, Informate and Transform IT capabilities. Finally, we construct the measures of relative balance of IT capabilities by calculating the absolute difference of different pairs of IT capabilities. Such measures reflect the relative magnitude of IT capabilities and a similar approach of using difference scores has been used by several recent studies in other contexts (e.g. Cao et al. 2009; Hogan et al. 2007; Milton and Westphal 2005). This value was reversed on a scale of 7 to facilitate ease of analysis and interpretation.

Organizational Ambidexterity

We conceptualize ambidexterity as a higher-level construct comprising of exploration and exploitation (e.g. Gibson and Birkinshaw 2004; Gupta et al. 2006; Jansen et al. 2009). We operationalize organizational ambidexterity as an organization's innovation orientation or intent. An organization's intent is not a dynamic construct and is path dependent upon past resource deployments and processes (Cao et al. 2009; Leonard-Barton 1992). Exploration and exploitation intent are stable over time and thus, ambidexterity does not change over a period of three years (e.g. Cao et al. 2009; He and Wong 2004).

In a two-step approach, first, we measure exploration and exploitation independently. Exploration is a five-item measure adapted from prior literature (He and Wong 2004; Jansen et al. 2009). This measure captures the extent to which an organization pursues explorative innovations for emerging customers, markets or product-market domains and departs from existing knowledge (Benner and Tushman 2003; He and Wong 2004; Smith and Tushman 2005). Similarly, we construct a five-item measure for exploitation that captures the extent to which an organization pursues exploitative innovations for current customers, improves current product-market positions and builds on existing knowledge (Benner and Tushman 2003; He and Wong 2004; Smith and Tushman 2005). The reliability of this scale, originally developed by He and Wong (2004), and used by subsequent studies (e.g. Cao et al. 2009; Lubatkin et al. 2006), is well established.

In the second step, we construct the measure for ambidexterity. Since previous research has followed different approaches, we incorporated these operationalizations into our analysis by following the procedures suggested by Edwards (1994) that have been used in several previous ambidexterity studies (e.g. Gibson and Birkinshaw 2004; He and Wong 2004; Lubatkin et al. 2006). We compared regression models of the different formulations of ambidexterity (sum, product, and absolute difference of exploration and exploitation) to identify the appropriate measure. We use competitive advantage as the dependent variable for this analysis (Gibson and Birkinshaw 2004; He and Wong 2004), which is operationalized as a five-item measure of competitive performance that "reflects a firm's ability to capture market share, remain profitable, keep growing, and be innovative and cost-efficient in comparison to its major competitors" (Rai and Tang 2010). As predicted by earlier studies, we find that the different operationalizations of organizational ambidexterity have significant, albeit differing, positive effects on competitive performance. This analysis also validates our overall research model. The reversed absolute difference of exploration and exploitation was chosen as the measure of ambidexterity as it provided maximum explanatory power (adjusted $R^2 = 0.154$; $p < 0.05$) and performed the best when using the F-test ($p < 0.05$).

Controls

We measured and controlled for a number of other antecedents to organizational ambidexterity. We account for founding team and senior team heterogeneity by capturing senior team size and founding team size (Jansen et al. 2009). We control for firm size, measured as the natural logarithm of number of full-time employees (Cao et al. 2009), firm age, measured as the natural logarithm of number of years from the firm's founding, and ownership structure. We include industry sector dummies and measures for environmental dynamism and environmental competitiveness. Environmental dynamism is a four-item measure and captures the rate of change and turbulence of the environment (Jansen et al. 2006). Environmental competitiveness is captured through a five-item measure which assesses the competitive pressures that a firm has to deal with (Jansen et al. 2006). Finally, we control for the state in India where the firm is located to account for clustering effects and uneven economic development.

Table 2. Descriptive Statistics and Correlations

	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Automate IT Capability (1)	3.86	1.28	1										
Informate IT Capability (2)	3.21	1.55	0.723 ***	1									
Transform IT Capability (3)	1.83	1.18	0.645 ***	0.854 ***	1								
Ambidexterity (4)	7.04	2.34	-0.235 ***	-0.198 ***	-0.029	1							
Senior Team Size (5)	10.04	17.12	0.154 ***	0.133 **	0.151 ***	0.08	1						
Founding Team Size (6)	4.71	11.48	0.168 ***	0.13 **	0.164 ***	-0.053	0.526 ***	1					
ln(Firm Age) (7)	3.01	0.79	0.052	0.094 *	0.102 *	-0.009	0.095 *	0.007	1				
ln(Firm Size) (8)	5.36	1.52	0.312 ***	0.381 ***	0.435 ***	0.097 *	0.381 ***	0.229 ***	0.276 ***	1			
Env. Comp. (9)	15.5	2.71	-0.147 ***	-0.17 ***	-0.079	0.11 **	0.001	-0.071	-0.076	-0.062	1		
Env. Dyna.(10)	17.53	2.63	0.023	0.101 *	0.126 **	0.108 **	0.127 **	-0.013	-0.035	0.158 ***	0.359 ***	1	
Comp. Perf. (11)	1.51	0.7	-0.057	-0.062	0.022	0.364 ***	0.056	-0.02	0.047	0.204 ***	-0.002	0.153 ***	1

Pairwise correlations. *** p<0.01, ** p<0.05, * p<0.1

Measure Construction

We conducted a principal components factor analysis with varimax rotation and pairwise deletion to establish the item loadings and create individual measures. We dropped items that had low loadings and high cross-loadings. We also employed Cronbach's alpha on all the measures. Thus we assessed convergent validity, discriminant validity and internal consistency / reliability. As noted earlier, all items were adapted from prior research and thus had prior established reliability and theoretical consistency. All Cronbach's alpha values were above or just slightly below the suggested threshold of 0.70 (Nunnally 1967). Our analysis clearly replicated the intended factor structure, with all five factors having eigenvalues greater than 1, factor loadings above 0.50 and cross-loadings below 0.38. Interfactor correlations (> 0.65) and variance inflation factor values (<10) for all variables were assessed to confirm the absence of multicollinearity problems. Descriptive statistics and correlations for the main constructs are presented in table 2.

Table 3. Abbreviated OLS Results for Hypothesized Model

Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Senior Team Size	0.010	0.012*	0.012*	0.011*
	(0.007)	(0.007)	(0.007)	(0.007)
Founding Team Size	-0.009	-0.012	-0.011	-0.009
	(0.008)	(0.009)	(0.008)	(0.008)
ln (Firm Age)	-0.047	-0.032	-0.044	-0.001
	(0.168)	(0.169)	(0.168)	(0.162)
ln (Firm Size)	0.136	0.128	0.135	0.107
	(0.102)	(0.109)	(0.102)	(0.104)
Environmental Competitiveness	-0.010	-0.035	-0.038	-0.037
	(0.047)	(0.048)	(0.047)	(0.048)
Environmental Dynamism	0.042	0.044	0.046	0.048
	(0.049)	(0.050)	(0.049)	(0.050)
IT Automate Capability		-0.283*		-0.348**
		(0.145)		(0.163)
IT Informate Capability		-0.395**		-0.353**
		(0.156)		(0.157)
IT Transform Capability		0.664***		0.816***
		(0.188)		(0.209)
Balance of IT Transform & Informate			0.512***	
			(0.165)	
Balance of IT Transform & Automate			0.224^	
			(0.154)	
Balance of IT Automate & Informate			0.269^	
			(0.189)	
IT Transform x IT Informate Capability				-0.192**
				(0.092)
IT Transform x IT Automate Capability				0.138
				(0.134)
Constant	3.908***	5.635***	-1.017	5.676***
	(1.116)	(1.195)	(1.823)	(1.209)
Observations	323	323	323	323
R-squared	0.336	0.373	0.380	0.385
Adj. R-squared	0.277	0.310	0.319	0.320

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1 for two-tailed test; ^ p<0.1 for one-tailed test

Analysis and Results

We employ ordinary least squares and follow a hierarchical moderated regression analysis approach to evaluate the hypotheses. In the base model, we regress the measure of organizational ambidexterity on the three sets of control variables. In the second model, we introduce IT automate, informate and transform capabilities into the base model. In the third model, we introduce the three balance terms. In the fourth model, we add the interaction terms to the prior main effects model. Table 3 reports abbreviated results for these regressions. To reduce multicollinearity concerns and ease interpretation of the results, we mean centered and multiplied the main variables to form the interaction terms (Aiken and West 1991; Edwards and Lambert 2007). Since a Breusch-Pagan test could not rule out the presence of heteroskedasticity (Breusch and Pagan 1979), we used Huber/White standard errors across our analysis (Huber 1967; White 1982), which also corrected for any potential clustering of the data (Williams 2000).

Estimation of the base model indicates that there are differences in ambidexterity due to geographical location and industry, as evidenced by significant coefficients for dummy variables. In the interests of brevity, these dummy variables (twelve corresponding to the state in India where the firm is located and four corresponding to the main industry of the firm) are not reported in Table 3. Model 2 evaluates the main effects of Automate, Informate and Transform IT capabilities. These results indicate that as predicted, Transform IT capability has a strong positive effect on ambidexterity ($b = 0.664$, $p < 0.01$). Similarly, as hypothesized, Automate IT capability has a significant negative main effect on ambidexterity ($b = -0.283$, $p < 0.10$). However, contrary to the hypothesized positive relationship, Informate IT capability has a significant negative effect ($b = -0.395$, $p < 0.05$) on organizational ambidexterity. Overall, results from Model 2 provide strong support for hypothesis 2 and 3, but no support for hypothesis 1.

To ease interpretation of results and to decrease multicollinearity concerns, as per procedures suggested in prior studies (e.g. Cao et al. 2009; Edwards 1994), the balance relationships are tested separately in Model 3. Results from this analysis indicate that the balance of Transform IT and Informate IT capabilities has a strongly significant positive effect on organizational ambidexterity ($b = 0.512$, $p < 0.01$). The balance of Transform IT and Automate IT capabilities is observed to be weakly significant at a 10% level for a one-sided test ($b = 0.224$, $p < 0.10$, one-sided test). Similarly, the balance of Automate IT and Informate IT capabilities is weakly significant using a one-sided test ($b = 0.269$, $p < 0.10$, one-sided test). However, both these relationships follow the hypothesized directionality. Thus Model 3 suggests strong support for hypothesis 5a and weak support for hypotheses 5b and 5c.

Model 4 includes the two hypothesized interaction terms along with the main effects of Automate, Informate and Transform IT capabilities. The results from this model do not provide support for neither hypothesis 4a nor for hypothesis 4b. We find that the interaction of Transform and Informate IT capability is negative and significant ($b = -0.192$, $p < 0.05$). In contrast, the interaction of Transform and Automate IT capabilities is not significant ($b = -0.138$, $p > 0.30$, not significant). The results illustrate a negative influence of Transform IT capability on the relationship between IT Informate capability and organizational ambidexterity. These results are consistent irrespective of whether the interactions are entered individually or as a block in the analysis.

Robustness Tests

We conducted four types of post-hoc robustness checks. First, we used procedures laid out by Landis and Dunlap (2000) to assess reverse causality by setting organizational ambidexterity and interaction of ambidexterity and Transform IT capability as independent variables and assessed Automate IT as the dependent variable in a regression analysis. The absence of significant reverse interaction terms ($p > 0.4$) suggests that reverse causality is not a concern. Second, we replicated our analysis using an alternative measure of performance which assesses the real performance of the firm over the past financial year on four indicators measuring growth in sales, returns on sales, returns of assets and growth in returns on assets. Third, we repeated our analysis by using alternative constructions of our dependent variables. Specifically, we used the product of exploration and exploitation as the measure of ambidexterity. Fourth, we also compared our model results across the auto ancillaries versus non-auto sub-samples. Our results qualitatively hold across these alternative specifications. Overall, our post-hoc analysis provides strong support for our research findings.

In summary, we have found strong empirical support for three of the hypotheses (i.e. H2, H3, and H5a) and weak support towards two of the hypotheses (i.e. H5b, H5c). These results strongly indicate that IT capabilities distinctly contribute towards the juggling of paradoxical strategies.

Discussion

In this paper, we described how organizational ambidexterity, or the juggling of paradoxical strategies, is an emergent means to attain competitive advantage in the 21st century. The concurrent pursuit of exploration and exploitation, hitherto conceptualized as ends of a continuum, is an instance of ambidexterity. We noted the absence of IT among the various antecedents to ambidexterity established in the extant literature. We also noted several gaps in the IS literature. IT capabilities endow competitive advantage to firms through the impact of intermediate, value-creating processes. We have presented organizational ambidexterity is one such intermediate construct.

Towards this purpose, we have found support for our primary thesis that different IT capabilities act in differing ways to influence (support and hinder) ambidexterity. We have uncovered support for the hypothesized positive effect of Transform IT capability on ambidexterity. We had asserted that Transform IT capability facilitates organizational ambidexterity due to enhanced inter and intra organizational integration and improved organizational responsiveness and flexibility. We have also demonstrated the positive influence of balancing IT capabilities. We have found that organizations that maintain a balance of Automate and Informate IT capability, Automate and Transform IT capability, and Informate and Transform IT capability, are more ambidextrous. This supports the reasoning that a balance of capabilities not only balances their direct impacts on exploration and exploitation, but also leads to improvements in organizational information exchange and flexibility. On a similar note, we have found support for the assertion that Automate IT capability will hamper organizational ambidexterity due to its strong direct influence on exploitation. Overall, these findings help to advance the literature that speaks towards the indirect effects of IT on competitive advantage. This also leads us to suggest that previously asserted antecedents to ambidexterity are actually intermediate effects enabled by IT (Jansen et al. 2009).

We had asserted that Informate IT capability positively influences ambidexterity due to the enhancing of knowledge flows and connectedness. Interestingly, we have found a significant, negative effect of Informate IT capability on organizational ambidexterity, which can be explained as follows. Our analysis identified ambidexterity as a true balance between exploration and exploitation. This requires the concurrent operation of two similar sized and conflicting resource setups and orientations, which would benefit more from integration and flexibility, rather than knowledge flows and connectedness (Cao et al. 2009). Further, organizational flexibility and responsiveness play a key role in enabling this process. Informate (and Automate) IT capability reflects an ossification of existing business processes, thereby impeding organizational flexibility. For example, Mrs. Fields Cookies was a much celebrated example of a firm that utilized its Informate IT capability for centralized control of a highly successful chain of cookie stores in the 20th century. However, the gains in control were offset by reduced flexibility, which lead to an inability to react to changes in its environment and business strategy (Lucas 1999). Similarly, while mere automation of existing processes without any transformative benefits may encourage the replication and transfer of best practices within and across firms (Frei et al. 1999; Galunic and Rodan 1998), this eventually results in ossification of existing processes and reduction in organizational flexibility. This explanation also suggests that when the magnitudes of IT capabilities are equal relative to one another, there will be gain of benefits from all capabilities and adverse effects will be diminished. This is supported by our finding that while both Automate IT and Informate IT capabilities alone are detrimental to organizational ambidexterity, they have a positive effect when balanced with IT Transform capability, or with one another. These observations are also reinforced by our finding that IT Transform capability weakens the negative influence of IT Informate capability.

This paper makes several critical contributions to research. First, it is one of the early studies to conceptualize organizational ambidexterity in the context of IS research. Thus our results have strong implications for prior IS research that considers exploration and exploitation as two ends of a continuum. For example, our results suggest that a balance of explorative and exploitative supply chain technologies may be more beneficial than either alone (Subramani 2004). Second, we showcase a key ebusiness challenge in the context of small and medium enterprises from an emerging economy. Our results explain

some of the previously unaccounted for variance in IT payoffs in such contexts. For example, the mixed IT payoffs reported from India (Lal 2001; Lal 2002) may be due its effects on specific strategic necessities. An alternative explanation may be that IT impacts are subsumed at intermediate levels. Thus we also further the debate that the business value of IT is not only reflected in measures of firm performance, but also reflected by improvements in firm intangibles. Third, we advance the literature on IT-enabled organizational innovation (Kleis et al. 2012). While this literature suggests that IT does not directly impact breakthrough innovation, our research suggests that IT helps organizations to balance their exploitative and explorative (or breakthrough) innovation, thereby helping them survive in the long run. Finally, our explicit conceptualization of constructs relating to the relative magnitude of IT capabilities provides a basis for future theorizing that may explain previously unaccounted variance in the performance impacts of IT and discern the practical implications of the co-development of IT capabilities in firms. Thus our insights also speak towards the theoretical perspective that the first-order effects of IT are expected to be felt at the level of intermediate variables that mediate or moderate the overall relationship of IT with firm performance (Barua et al. 1995; Subramani 2004).

The implications of this research for managerial practice are immense. In the 21st century, managers have to contend with constant and accelerating waves of change, much of which are driven by advances in information technology and ebusiness strategy. IT also provides managers with the tools to deal with these challenges. Organizational ambidexterity is one such possibility that is emergent in the current century. Our findings indicate that in highly turbulent and competitive environments, managers should concentrate upon balancing seemingly contradictory strategies. Our findings indicate that this balance should percolate across all aspects of firm strategy, including the strategic choice of developing IT capabilities. Further, managers should prioritize their investments in transformative IT to maximize their potential benefits from electing to pursue this approach. Furthermore, our results specifically highlight the importance of IT in enabling a balanced innovation outlook, which is critical for survival in the rapidly changing competitive environment of today.

Limitations and Avenues for Future Research

Like all research, this study suffers from limitations that may stimulate further research. First, the choice of industry setting for this study, and the fact that a majority of our respondents hail from the auto ancillaries sector, may restrict its generalization to some other contexts. While we have conducted robustness tests to illustrate that our results are not driven by the sample composition, future research can examine the influence of IT capabilities on organizational ambidexterity in the context of service organizations, larger firms, or across other countries. Second, unlike many other studies that gather primary data, we do not use subjective measures of IT capabilities. By measuring IT applications that are in use, we hope to avoid personal biases that may be present in a subjective assessment (Collopy 1996; Oh and Pinsonneault 2007). Future research may consider alternative measures for these constructs. Third, the cross-sectional nature of this study results in some limitations. Though we have taken several steps to mitigate bias and reverse causality, we are unable to answer questions regarding the exact temporal causal nature of the relationship between IT capabilities and ambidexterity. A future longitudinal study may help to establish how IT facilitates development of ambidexterity over time and how this affects firm survival.

Conclusion

In this paper, we build upon and contribute towards research on ebusiness strategy, IT business value and organizational ambidexterity. We explicitly theorize the different causal mechanisms through which a firm's IT capabilities influence ambidexterity. This research addresses calls to consider SMEs and emerging economy contexts around the ambidexterity and IT capability concepts. We use primary data collected from high growth manufacturing sectors in India to test our model. Our results support our key assertions. The findings of this study imply that organizational ambidexterity and other intangible strategic assets are key pieces that should be considered while conceptualizing the payoffs of IT as the strategic implications of IT include enhanced firm intangibles.

Overall, through this research, we validate the emergent role of IT capabilities in juggling paradoxical strategies in the 21st century.

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Appendix: Measures for Key Constructs

Exploration

Please indicate the extent to which you agree or disagree with the following statements about your organization's strategic outlook and intent. (Scale anchors are 1: Strongly agree—7: Strongly disagree).

We accept demands that go beyond existing products and services. *

We frequently utilize new opportunities in new markets. *

We regularly use new sales / distribution channels.

We innovate to enter new technology fields.

We commercialize products and services that are completely new to our organization.

Exploitation

Please indicate the extent to which you agree or disagree with the following statements about your organization's strategic outlook and intent. (Scale anchors are 1: Strongly agree—7: Strongly disagree).

We frequently make small adjustments to our existing products and services (extend existing product & service range). *

We improve efficiency of our products and services.

We increase economies of scale in existing markets (improve yield, reduce material consumption or reduce production cost).

We expand services for our existing clients.

We improve production flexibility.

Competitive Performance

Please compare the performance of your organization with that of your competitors on the following aspects.

(11-point Scale with Percentage Anchors (0% · · · · · · 50% · · · · · · 100%))

Market share (Much lower market share · · · · · · Equal share · · · · · · Much higher market share)

Profitability (Much less profitable · · · · · · Equally profitable · · · · · · Much more profitable)

Growth (Growing much slower · · · · · · The same · · · · · · Growing much faster)

Innovativeness (Much less innovative · · · · · · The same · · · · · · Much more innovative)

Cost leadership (Much less efficient · · · · · · The same · · · · · · Much more efficient)

* = Dropped item; ® = reversed item

References

Aiken, L., and West, S. 1991. *Multiple Regression: Testing and Interpreting Interactions*. Thousand Oaks, CA: Sage Publications.

Alavi, M., and Leidner, D.E. 2001. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly* (25:1), pp. 107-136.

Andriopoulos, C., and Lewis, M. 2009. "Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation," *Organization Science* (20:4), pp. 696-717.

Banker, R., Bardhan, I., Chang, H., and Lin, S. 2006. "Plant Information Systems, Manufacturing Capabilities and Plant Performance," *MIS Quarterly* (30:2), pp. 315-337.

Barney, J.B. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99-120.

Barua, A., Kriebel, C., and Mukhopadhyay, T. 1995. "Information Technologies and Business Value: An Analytic and Empirical Investigation," *Information Systems Research* (6:1), pp. 3-23.

Baum, J., Li, S., and Usher, J. 2000. "Making the Next Move: How Experiential and Vicarious Learning Shape the Locations of Chains' Acquisitions," *Administrative Science Quarterly* (45:4), pp. 766-801.

Benner, M., and Tushman, M. 2003. "Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited," *Academy of Management Review* (28:2), pp. 238-256.

Bharadwaj, A. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), pp. 169-196.

Bharadwaj, A.S., Bharadwaj, S.G., and Konsynski, B.R. 1999. "Information Technology Effects on Firm Performance as Measured by Tobin's Q," *Management Science* (45:7), pp. 1008-1024.

Bharadwaj, S., Bharadwaj, A., and Bendoly, E. 2007. "The Performance Effects of Complementarities between Information Systems, Marketing, Manufacturing, and Supply Chain Processes," *Information Systems Research* (18:4), pp. 437-453.

Breusch, T.S., and Pagan, A.R. 1979. "A Simple Test for Heteroscedasticity and Random Coefficient Variation," *Econometrica: Journal of the Econometric Society* (47:5), pp. 1287-1294.

Cao, Q., Gedajlovic, E., and Zhang, H. 2009. "Unpacking Organizational Ambidexterity: Dimensions, Contingencies, and Synergistic Effects," *Organization Science* (20:4), pp. 781-796.

Cappelli, P., Singh, H., Singh, J., and Useem, M. 2010. "The India Way: Lessons for the US," *Academy of Management Perspectives* (24:2), pp. 6-24.

Chari, M.D.R., Devaraj, S., and David, P. 2008. "The Impact of Information Technology Investments and Diversification Strategies on Firm Performance," *Management Science* (54:1), pp. 224-234.

Chi, L., Ravichandran, T., and Andrevski, G. 2010. "Information Technology, Network Structure, and Competitive Action," *Information Systems Research* (21:3), pp. 543-570.

Collopy, F. 1996. "Biases in Retrospective Self-Reports of Time Use: An Empirical Study of Computer Users," *Management Science* (42:5), pp. 758-767.

Dehning, B., Richardson, V., and Zmud, R. 2003. "The Value Relevance of Announcements of Transformational Information Technology Investments," *MIS Quarterly* (27:4), pp. 637-656.

Edwards, J. 1994. "The Study of Congruence in Organizational Behavior Research: Critique and a Proposed Alternative," *Organizational Behavior and Human Decision Processes* (58:1), pp. 51-100.

Edwards, J., and Lambert, L. 2007. "Methods for Integrating Moderation and Mediation: A General Analytical Framework Using Moderated Path Analysis," *Psychological Methods* (12:1), pp. 1-22.

Floyd, S., and Lane, P. 2000. "Strategizing Throughout the Organization: Managing Role Conflict in Strategic Renewal," *Academy of Management Review* (25:1), pp. 154-177.

Frei, F., Kalakota, R., Leone, A., and Marx, L. 1999. "Process Variation as a Determinant of Bank Performance: Evidence from the Retail Banking Study," *Management Science* (45:9), pp. 1210-1220.

Galunic, C., and Rodan, S. 1998. "Resource Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation," *Strategic Management Journal* (19:12), pp. 1193-1201.

Gartner. 2010. "Worldwide Enterprise IT Spending to Reach $2.5 Trillion in 2011, Says Gartner." Retrieved June 28, 2011, from http://wtnnews.com/articles/7895/

Gartner. 2011. "Gartner Says Worldwide Enterprise IT Spending to Reach $2.7 Trillion in 2012." *Business*

Wire Retrieved 30 April, 2012, from http://www.businesswire.com/news/home/20111017006470/en/Gartner-Worldwide-Enterprise-Spending-Reach-2.7-Trillion

Gibson, C., and Birkinshaw, J. 2004. "The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity," *Academy of Management Journal* (47:2), pp. 209-226.

Gilbert, C. 2005. "Unbundling the Structure of Inertia: Resource Versus Routine Rigidity," *Academy of Management Journal* (48:5), pp. 741-763.

Gupta, A., Smith, K., and Shalley, C. 2006. "The Interplay between Exploration and Exploitation," *Academy of Management Journal* (49:4), pp. 693-706.

He, Z., and Wong, P. 2004. "Exploration Vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis," *Organization Science* (15:4), pp. 481-494.

Hitt, L.M., Wu, D., and Zhou, X. 2002. "Investment in Enterprise Resource Planning: Business Impact and Productivity Measures," *Journal of Management Information Systems* (19:1), pp. 71-98.

Hogan, J., Barrett, P., and Hogan, R. 2007. "Personality Measurement, Faking, and Employment Selection," *Journal of Applied Psychology* (92:5), pp. 1270-1285.

Huber, P.J. 1967. "The Behavior of Maximum Likelihood Estimates under Nonstandard Conditions," *Proceedings of the Fifth Berkeley Symposium in Mathematical Statistics,* L.M.L. Cam and J. Neyman (eds.), Berkeley: University of California Press, pp. 221–233.

Im, G., and Rai, A. 2008. "Knowledge Sharing Ambidexterity in Long-Term Interorganizational Relationships," *Management Science* (54:7), pp. 1281-1296.

Jansen, J., Tempelaar, M., Van den Bosch, F., and Volberda, H. 2009. "Structural Differentiation and Ambidexterity: The Mediating Role of Integration Mechanisms," *Organization Science* (20:4), pp. 797-811.

Jansen, J.J.P., Van Den Bosch, F.A.J., and Volberda, H.W. 2006. "Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators," *Management Science* (52:11), pp. 1661-1674.

Joshi, K.D., Chi, L., Datta, A., and Han, S. 2010. "Changing the Competitive Landscape: Continuous Innovation through IT-Enabled Knowledge Capabilities," *Information Systems Research* (21:3), pp. 472-495.

Kane, G.C., and Alavi, M. 2007. "Information Technology and Organizational Learning: An Investigation of Exploration and Exploitation Processes," *Organization Science* (18:5), pp. 796-812.

Kanuk, L., and Berenson, C. 1975. "Mail Surveys and Response Rates: A Literature Review," *Journal of Marketing Research* (12:4), pp. 440-453.

Katila, R., and Ahuja, G. 2002. "Something Old, Something New: A Longitudinal Study of Search Behavior and New Product Introduction," *Academy of Management Journal* (45:6), pp. 1183-1194.

Kleis, L., Chwelos, P., Ramirez, R.V., and Cockburn, I. 2012. "Information Technology and Intangible Output: The Impact of IT Investment on Innovation Productivity," *Information Systems Research* (23:1), pp. 42-59.

Konsynski, B., and Tiwana, A. 2004. "The Improvisation-Efficiency Paradox in Inter-Firm Electronic Networks: Governance and Architecture Considerations," *Journal of Information Technology* (19:4), pp. 234-243.

Lal, K. 2001. "The Determinants of the Adoption of Information Technology: A Case Study of the Indian Garments Industry," in *Information Technology, Productivity, and Economic Growth: International Evidence and Implications for Economic Development,* M. Pohkola (ed.). Cambridge, United Kingdom: Oxford University Press, pp. 149-174.

Lal, K. 2002. "E-Business and Manufacturing Sector: A Study of Small and Medium-Sized Enterprises in India," *Research Policy* (31:7), pp. 1199-1211.

Landis, J.R., and Koch, G.G. 1977. "The Measurement of Observer Agreement for Categorical Data," *Biometrics* (33:1), pp. 159-174.

Landis, R., and Dunlap, W. 2000. "Moderated Multiple Regression Tests Are Criterion Specific," *Organizational Research Methods* (3:3), pp. 254-266.

Lee, G., DeLone, W., and Espinosa, J. 2007. "Ambidexterity and Global IS Project Success: A Theoretical Model," *Proceedings of the 40th Annual Hawaii International Conference on System Sciences (HICSS)*, Waikoloa, Hawaii.

Leonard-Barton, D. 1992. "Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development," *Strategic Management Journal* (13:S1), pp. 111-125.

Levinthal, D.A., and March, J.G. 1993. "The Myopia of Learning," *Strategic Management Journal* (14:1), pp. 95-112.
Lindell, M., and Whitney, D. 2001. "Accounting for Common Method Variance in Cross-Sectional Research Designs," *Journal of Applied Psychology* (86:1), pp. 114-121.
Lubatkin, M., Simsek, Z., Ling, Y., and Veiga, J. 2006. "Ambidexterity and Performance in Small-to Medium-Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration," *Journal of Management* (32:5), pp. 646-672.
Lucas, H.C. 1999. *Information Technology and the Productivity Paradox: Assessing the Value of the Investment in IT*. New York, NY: Oxford University Press.
March, J.G. 1991. "Exploration and Exploitation in Organizational Learning," *Organization Science* (2:1), pp. 71-87.
Milton, L.P., and Westphal, J.D. 2005. "Identity Confirmation Networks and Cooperation in Work Groups," *Academy of Management Journal* (48:2), pp. 191-212.
Mom, T., Van Den Bosch, F., and Volberda, H. 2007. "Investigating Managers' Exploration and Exploitation Activities: The Influence of Top-Down, Bottom-up, and Horizontal Knowledge Inflows," *Journal of Management Studies* (44:6), pp. 910-931.
Mom, T., Van Den Bosch, F., and Volberda, H. 2009. "Understanding Variation in Managers' Ambidexterity: Investigating Direct and Interaction Effects of Formal Structural and Personal Coordination Mechanisms," *Organization Science* (20:4), pp. 812-828.
Mooney, J.G., Gurbaxani, V., and Kraemer, K.L. 1996. "A Process Oriented Framework for Assessing the Business Value of Information Technology," *ACM SIGMIS Database* (27:2), pp. 68-81.
Mukhopadhyay, T., Kekre, S., and Kalathur, S. 1995. "Business Value of Information Technology: A Study of Electronic Data Interchange," *MIS Quarterly* (19:2), pp. 137-156.
Nunnally, J.C. 1967. *Psychometric Theory*. New York, NY: McGraw-Hill.
O'Callaghan, R., Kaufmann, P.J., and Konsynski, B.R. 1992. "Adoption Correlates and Share Effects of Electronic Data Interchange Systems in Marketing Channels," *Journal of Marketing* (56:2), pp. 45-56.
O'Reilly, C., and Tushman, M. 2004. "The Ambidextrous Organization," *Harvard Business Review* (82:4), pp. 74-83.
Oh, W., and Pinsonneault, A. 2007. "On the Assessment of the Strategic Value of Information Technologies: Conceptual and Analytical Approaches," *MIS Quarterly* (31:2), pp. 239-265.
Podsakoff, P.M., and Organ, D.W. 1986. "Self-Reports in Organizational Research: Problems and Prospects," *Journal of Management* (12:4), pp. 531-544.
Prieto, E., Revilla, E., and Rodriguez, B. 2007. "Information Technology and the Ambidexterity Hypothesis: An Analysis in Product Development," *Instituto de Empresa Business School Working Paper* (WP07:06).
Rai, A., and Tang, X. 2010. "Leveraging IT Capabilities and Competitive Process Capabilities for the Management of Interorganizational Relationship Portfolios," *Information Systems Research* (21:3), pp. 516-542.
Raisch, S., and Birkinshaw, J. 2008. "Organizational Ambidexterity: Antecedents, Outcomes, and Moderators," *Journal of Management* (34:3), pp. 375-409.
Raisch, S., Birkinshaw, J., Probst, G., and Tushman, M. 2009. "Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance," *Organization Science* (20:4), pp. 685-695.
Ranganathan, C., and Brown, C.V. 2006. "ERP Investments and the Market Value of Firms: Toward an Understanding of Influential ERP Project Variables," *Information Systems Research* (17:2), pp. 145-161.
Ravichandran, T., and Lertwongsatien, C. 2005. "Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective," *Journal of Management Information Systems* (21:4), pp. 237-276.
Ray, G., Muhanna, W.A., and Barney, J.B. 2005. "Information Technology and the Performance of the Customer Service Process: A Resource-Based Analysis," *MIS Quarterly* (29:4), pp. 625-652.
Rothaermel, F., and Alexandre, M. 2009. "Ambidexterity in Technology Sourcing: The Moderating Role of Absorptive Capacity," *Organization Science* (20:4), pp. 759-780.
Santhanam, R., and Hartono, E. 2003. "Issues in Linking Information Technology Capability to Firm Performance," *MIS Quarterly* (27:1), pp. 125-153.
Schein, E. 1992. *The Role of the CEO in the Management of Change: The Case of Information*

Technology, Sloan School of Management. Cambridge, MA: MIT.
Sheremata, W. 2000. "Centrifugal and Centripetal Forces in Radical New Product Development under Time Pressure," *Academy of Management Review* (25:2), pp. 389-408.
Siggelkow, N., and Levinthal, D. 2003. "Temporarily Divide to Conquer: Centralized, Decentralized, and Reintegrated Organizational Approaches to Exploration and Adaptation," *Organization Science* (14:6), pp. 650-669.
Smith, W., and Tushman, M. 2005. "Managing Strategic Contradictions: A Top Management Model for Managing Innovation Streams," *Organization Science* (16:5), pp. 522-536.
Subramani, M. 2004. "How Do Suppliers Benefit from Information Technology Use in Supply Chain Relationships?," *MIS Quarterly* (28:1), pp. 45-73.
Taylor, A., and Helfat, C. 2009. "Organizational Linkages for Surviving Technological Change: Complementary Assets, Middle Management, and Ambidexterity," *Organization Science* (20:4), pp. 718-739.
Tushman, M., and O'Reilly , C. 1996. "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change," *California Management Review* (38:4), pp. 8-30.
White, H. 1982. "Maximum Likelihood Estimation of Misspecified Models," *Econometrica: Journal of the Econometric Society* (50:1), pp. 1-25.
Williams, R.L. 2000. "A Note on Robust Variance Estimation for Cluster-Correlated Data," *Biometrics* (56:2), pp. 645-646.
Zahra, S.A., and George, G. 2002. "Absorptive Capacity: A Review, Reconceptualization, and Extension," *Academy of Management Review* (27:2), pp. 185-203.
Zuboff, S. 1988. *In the Age of the Smart Machine: The Future of Work and Power*. New York, NY: Basic Books.