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The Effect of Application Ambidexterity on Firm Agility

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ABSTRACT

Firm agility is quickly becoming an essential capability for companies to effectively compete in hypercompetitive environments. At the same time, firms are using applications that enable close integration coupled with an increased ability to reconfigure processes. Such applications should manifest a balance between integration and reconfigurability. This is the concept of applications ambidexterity. The IS literature has selectively focused on either integration or reconfigurability. By focusing on only one characteristic we have been unable to understand the IT - agility relation. Research suggests that integration and reconfigurability alone cannot explain the true nature of the IT - agility relation. This conceptual paper attempts to understand the complementary effects of integration and reconfigurability on firm agility. It contributes to the literature by theorizing the role of IT application ambidexterity on firm agility through the mediating variables of knowledge exploration, knowledge exploitation and process adaptability.

Keywords

Agility, Ambidexterity, Integration, Reconfigurability.

INTRODUCTION

Traditional “make and sell” strategies, although useful for static environments, are ineffective for environments where change and hypercompetition are the norm (D’Aveni, 1994). With the onset of intense competition, firms cannot simply rely on efficiency in operations but rather have to continuously reconfigure their processes, products and services. Success of organizations in such turbulent environments is dependent on the nimbleness with which firms sense opportunities and respond to them (Overby, Bharadwaj, and Sambamurthy, 2006; Sambamurthy, Bharadwaj, and Grover, 2003). Agility, at the firm level, is defined as the ability of firms to sense and respond to opportunities and threats with speed and surprise (Dove, 2001; Overby et al., 2006; Sambamurthy et al., 2003).

Although research has studied the link between IT and agility, there is a lack of clear understanding regarding how IT affects the ability of firms to respond to market environments. Some literature suggests that IT facilitates responding to opportunities and threats in the market (Magretta, 1998; Ravichandaran and Lertwongsatien, 2005). On the other hand, there is also evidence in the literature suggesting that IT, reduces firms’ ability to be flexible to market requirements (Davenport, 1998; Langdon, 2006). It is, therefore, unclear how IT affects agility. Our contention is that these inconsistent findings are due to two reasons. First is the selective focus that IS research has maintained on the integration and reconfiguration characteristics of IT applications (Saraf, Langdon, and Gosain, 2007). By focusing on only one characteristic we have been unable to understand the IT - agility relation. Research suggests that integration and reconfigurability are two important characteristics that enable agility and that integration or reconfigurability alone cannot explain the true nature of the IT - agility relation (Braunscheidel and Suresh, 2009)

Moreover, although the literature has stressed that IT creates digital options through knowledge and process constructs (Overby et al., 2006), research has lagged in delineating those particular knowledge and process constructs and their role in the IT - agility relation. Hence, we do not understand what these process and knowledge constructs are and how they fit into the broader nomological net.

This conceptual paper attempts to understand the IT-agility relation by assessing the complementary effect of the degree of integration and the degree of reconfigurability (Rai and Tang, 2010) enabled by IS applications on firm agility. This complementary effect is referred to as the ambidexterity of IS applications of a firm. Moreover, we also contribute by incorporating the process and knowledge constructs that mediate the relation between IT characteristics and agility. Our research model attempts to clarify the relation between IT applications’ ambidexterity and firm agility.

THEORETICAL BACKGROUND

IT Application Characteristics and Agility

We define the integration characteristic as the extent to which IS applications of a unit work as functional whole in conjunction with the IS applications of other units (internal and external to the firm). Reconfigurability is defined as the degree of flexibility embedded in IS applications that allows them to incur small penalties for making changes to IS assets. The two IT application characteristics, integration and reconfigurability, represent efficiency and adaptability (Langdon, 2006). Although the two characteristics are not necessarily opposite, firms often achieve one at the expense of the other (Duncan, 1995; Langdon, 2006), reducing firm focus to either integration or reconfiguration. Interestingly, IS research has also limited itself to a selective focus on either the integration or the reconfiguration characteristic of IT applications. Due to this selective focus, it is not clear how the two characteristics of IT applications affect process agility in a combined, complementary manner. For instance, some literature suggests a positive association between integration and agility. Integrating with customers and suppliers has, for instance, allowed firms such as Dell, Kodak and Cisco Systems, to sense their customers' needs and respond to these needs by close collaboration with suppliers (Rai, Patnayakuni, and Seth, 2006). Integration, therefore, affords a blurring of organizational boundaries and provides firms the ability to sense and respond to opportunities and threats in the market (Magretta, 1998). However, while focusing on integration, studies have also suggested a negative effect of integration on agility (Goodhue, Wybo, and Kirsch, 1992; Langdon, 2006). Integration, therefore, has also been argued to hinder agility.

Similarly, in the case of IS reconfiguration, the literature has argued that greater reconfigurability allows greater capability to cope with changes in the environment and hence faster responses (Byrd and Turner, 2001). Contrarily, there is also literature that suggests that firms that stress reconfigurability in their systems lose the advantages of integration with current partners and thus are unable to adapt rapidly enough to match market environments (Saraf et al., 2007). This is because increased adaptability comes at the expense of tight intermeshing of processes with partners (Burgelman, 1991).

Considering the fact that both characteristics have been used individually to propose both, positive as well as negative relationship with firm agility, it is unclear how the two characteristics affect agility in a complementary manner. We suggest that instead of a selective focus, the complementary effect of integration and reconfigurability (Rai and Tang, 2010) should be assessed on firm agility. The organizational change literature refers to the ability to do conflicting activities at the same time as ambidexterity (Tushman and O'Reilly, 1996; Tushman and Romanelli, 1985). Borrowing from this concept, we refer to the complementary effect between integration and reconfiguration as *IT application ambidexterity*. By focusing on both, integration as well as reconfiguration, we expect to investigate the effect of IT application ambidexterity on the ability of a firm to be adaptive to its environment. Our focus, therefore, is on the complementary effect of these two characteristics, rather than a selective focus on either integration or reconfiguration.

The Mediating Role of Process and Knowledge

In addition to a selective focus on either integration or reconfiguration, another reason for an inconsistent understanding between these characteristics of the IT applications and agility is that the literature does not establish what process and knowledge constructs are relevant in explaining the IT - agility relation. The few studies that do investigate these constructs have used concepts that are different in nature and effect and hence do not clearly explain the IT-agility relation. For instance, Lyytinen and Rose (2006) suggest that firms shift their focus to either exploration or exploitation depending on the need of the current environment. Setia, Sambamurthy, and Closs (2008) use the notion of process assimilation in supply chain processes to investigate the role of IT in agility, while Sarker and Sarker (2009) use the ideas of process agility and scanning. None of the studies explain *how* agility is enabled using these notions. We contend that to understand the IT-agility relation, we must assess the mediating role of process adaptability, knowledge exploration and knowledge exploitation that are enabled by ambidextrous IT applications.

The Degree of Responsiveness in Agility

The organizational adaptation literature (March, 1991; Tushman and O'Reilly, 1996; Tushman and Romanelli, 1985) stresses that there is a difference in degree of responsiveness that a firm can attain to successfully reply to opportunities and threats. Based on this distinction, agility can be divided into either operational or strategic. The two are different as each requires a

different degree of change. Operational agility requires minor adjustments in processes. Strategic agility, on the other hand, is related to major changes. Their difference, in a sense, is characterized by convergence and reorientation of strategies in firm processes (Benner and Tushman, 2003). The first is related to incremental changes, where the changes are more operational improvement. The second is related to radical changes, where the changes are more operational innovations in nature.

This paper incorporates this notion of degree of responsiveness in agility and presents a fine-grained analysis of the impact of the two characteristics of IT applications on firm agility (operational and strategic). By making this distinction in the degree of responsiveness we will be better able to elucidate the true relationship between IT and firm agility.

In summary, we use the ambidexterity concept and extend it to IT applications to focus on the balance and the complementary effect of the two characteristics of integration and reconfiguration. In addition, we investigate the mediating role that relevant process and knowledge constructs play in the IT-agility relation. Also, we incorporate the notion of degree of responsiveness to take into account the difference in the level of agility that firms can attain.

RESEARCH MODEL AND HYPOTHESES

We develop a conceptual model that helps understand how IT application ambidexterity affects firm agility (operational and strategic). Fundamentally, the model suggests that ambidexterity in IT applications enables operational agility (the ability to respond to change by incorporating incremental changes in processes) because it allows better coordination among partners and allows them to be more adaptive to one another (Barki and Pinsonneault, 2005; Weick, 1976). In addition, the model suggests that ambidexterity in IT applications enables strategic agility (the ability to respond to change by incorporating radical changes in processes) because the synergistic effects of integration and reconfigurability of ambidextrous IT applications allow the processes to be more adaptive and responsive to changes such as variations in product lines, product quantities as well as requirements of adopting new technologies to acquire strategic advantage.

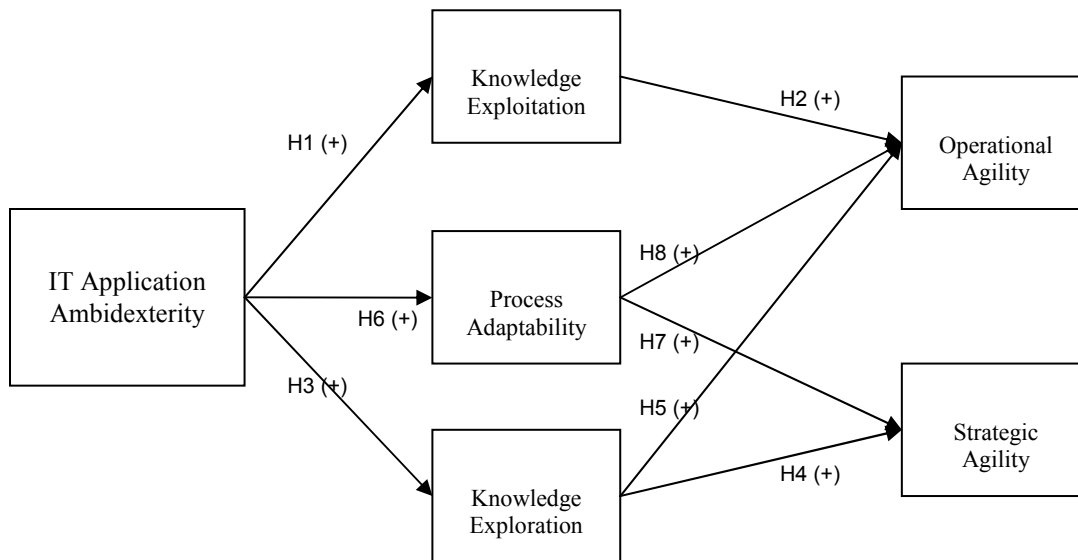


Figure 1. A Model of Firm Agility

The basic premise of our research model is that ambidextrous IT applications allow business processes to draw on the advantages of two characteristics, integration and reconfiguration. By coupling both these characteristics, firms gain

operational and strategic agility in their business processes through the mediating variables of knowledge exploration, knowledge exploitation, process coupling and process adaptability. The research model is presented in figure 1.

Ambidexterity and Knowledge Exploitation

Knowledge exploitation is the gaining of knowledge from firm's current partners. Application ambidexterity serves as an important enabler of a firm's ability to exploit its current knowledge sources. The synergistic effect of integration and reconfigurability is important for firm's ability to exploit knowledge from a partner for the following reasons.

In order to take advantage of application ambidexterity, characterized by integration and reconfiguration, the actors involved in the business process have to thoroughly understand each others' end-to-end routines and become aware of their interdependencies while creating process linkages (Malhotra, Gosain, and El Sawy, 2007). This imposes design rules that force partners involved in the business process to map interfaces seamlessly with each other and in the process evolve together by drawing on each other's knowledge (Brusoni and Prencipe, 2006). An understanding of partner processes enhances firm capacity to exchange knowledge due to increased absorptive capacity (Malhotra, Gosain, and Sawy, 2005). Thus, the focal firm can quickly recognize value-creating knowledge residing in partner firms and builds a greater capacity to transfer and apply this knowledge.

Exploitation of knowledge requires the application of old certainties to new purposes. This involves that firms try out new uses of previously acquired knowledge or expertise. This capability of experimenting with old knowledge is enabled by the degree of reconfigurability that a firm has in its systems that are tightly integrated. Thus, both integration and reconfiguration characteristics are critical in order to exploit knowledge. First, the integration capability allows firms to gain knowledge from various sources (Malhotra et al., 2007). Next the reconfiguration capability allows firms to experiment with this knowledge and exploit it for further uses. The greater the degree of integration enabled by IT applications, the greater the possibility of promotion of communication and coordination of viewpoints by similar product and process representations and enhancement of shared meanings (D'Adderio, 2003; Saraf et al., 2007). On the other hand, the greater the reconfigurability enabled by IT applications, the greater the possibility of transforming, mixing and exploiting this gained knowledge for other purposes. Combined, both the capabilities allow the firm to tap into knowledge resources that are readily available to it and exploit these knowledge resources for other purposes (Saraf et al., 2007). In a sense, firms gain abstract interpretations of firm processes through the integration capability (D'Adderio, 2003; Schilling, Vidal, Ployhart, and Marangoni, 2003) and these abstract interpretations can then be used for different purposes through the reconfiguration capability. Hence, it is proposed,

Hypothesis 1: IT application ambidexterity has a positive effect on knowledge exploitation.

Knowledge Exploitation and Operational Agility

Research shows that combination of different streams of knowledge is key to the ability to sense and respond to a new opportunity (Aranda and Molina-Fernandez, 2002). The primary rationale for this argument is that when firms exploit knowledge and insights from various external sources they increase their ability to arrive at varying understandings of an issue or market trend (Grant and Baden-Fuller, 1995). This phenomenon is similar to the process of bringing divergent thinking to work on a problem. Bringing different perspectives from multiple knowledge sources to solve a problem challenges the dominant mindset and improves the chances of appropriately sensing and responding to opportunities (Leonard and Sensiper, 1998). For instance, Toyota has emerged as a market leader, not by keeping its suppliers at arms length, but by exploitation of information and knowledge from partners and this has nurtured a cycle of continuous fine-tuning which keeps Toyota ahead of its competition (Dyer and Hatch, 2004). Without such heterogeneous insights a firm might simply decide in favor of the obvious solution which might not necessarily be the most appropriate one.

Transfer and expansion of knowledge from external sources allows access to intellectual capital, and promotes opportunity scanning which translates in an increased capability to sense and respond to environmental threats and opportunities (Powell, Koput, Smith-Doerr, and Owen-Smith, 1999). Moreover, a firm which combines knowledge from current partners and

customers also expands the range of the environment which it surveys, hence it becomes an extended enterprise (Rai et al., 2006) which is better equipped at sensing and responding to environmental changes.

Higher exploitive knowledge management fosters routines for efficiency and continuous leveraging of current knowledge repositories. Thus, routines for efficiently identifying and addressing problems and opportunities and matching them with relevant knowledge are highly refined (Benner and Tushman, 2003). Since operational agility is related to sensing and responding by slight improvements in processes and technologies, it is often the case that the knowledge required to incorporate that change already exists in current partners of the firm. Thus, by exploiting this existing knowledge firms can quickly identify and match opportunities with knowledge pools (Benner and Tushman, 2003). Hence, it is proposed,

Hypothesis 2: Knowledge exploitation has a positive effect on operational agility.

Ambidexterity and Knowledge Exploration

Knowledge exploration is the gaining of knowledge from outside the focal firm's current network. That is, it is knowledge that is external to the current network of partners. This knowledge is gained by making new connections outside of the current network. In addition to a positive effect on knowledge exploitation, application ambidexterity also has a positive effect on knowledge exploration. The IS literature suggests that common integrated systems can play the role of boundary objects and allow firms to efficiently span the syntactic, semantic, and pragmatic boundaries (Brown and Duguid, 1998; Carlile, 2002; Malhotra et al., 2007). The system's ability to access various sources using the afforded reconfigurability plays a crucial role in this process. In their study of supply chain systems, Malhotra and colleagues (2007) found that standard enterprise business interfaces can enable spanning of firm boundaries and, in turn, promote flow of new knowledge across boundaries. They reported that boundary objects allow an enterprise to recognize new opportunities for information exchange, thus firms explore for knowledge with greater ease. These systems, essentially, increase the range of information that may be accessed. Application ambidexterity affords a greater range of options and reduces the search and coordination costs (Dedrick, Xu, and Zhu, 2008).

Thus, firms have the flexibility to search on different platforms for new knowledge and through the highly reconfigurable nature of applications there is a greater ability to integrate this new knowledge into business processes. Hence, we propose

Hypothesis 3: IT application ambidexterity has a positive effect on knowledge exploration.

Knowledge Exploration and Strategic Agility

Since strategic agility is related to sensing and responding by incorporating change that is radical, knowledge exploration would have a positive enabling effect on strategic agility for the following reasons.

First, as strategic agility requires that firms radically change their processes to respond to opportunities, it entails that firms engage in practices that increase variance in their knowledge repertoire (i.e. explore for new knowledge) (Cooper, 2000). Exploring for new knowledge increases the chances that a firm might come across radically different knowledge repositories and methods to create radically different products and services. Firms engaging in explorative knowledge management are likely to pick up a wider array of heterogeneous information and knowledge regarding events, practices, technologies and processes as well as prospective partners (Rodan and Galunic, 2004).

Second, knowledge exploration also instills in firms a tendency to make novel associations and linkages about phenomena and strengthens assimilative power of the firm (Cohen and Levinthal, 1990). By having a varied pool of knowledge firms will be better able to quickly recognize a change in market trends. Thus, due to the variation in its knowledge pool the firm will be less likely to ignore an architectural innovation for an incremental one. In addition, exploring for new knowledge also helps firms in understanding of complex new ideas (Rodan and Galunic, 2004). Given the fact that understanding new ideas

and concepts might be filled with uncertainty, drawing upon new knowledge sources that explain the complexity of the new idea might help dispelling some of the uncertainties and may result in more efficient and faster understanding of complex phenomena. This would lead to an increased overall ability to recognize the need for incorporating radical changes. Hence, we propose

Hypothesis 4: Knowledge exploration has a positive effect on firm strategic agility.

Knowledge Exploration and Operational Agility

In addition to a positive effect on strategic agility, knowledge exploration would also have a positive effect on operational agility. As defined earlier, operational agility is related to incorporating incremental changes in firm processes by making continuous improvements. These improvements are often related to the current knowledge that firms have access to, either internally or through existing partners. It is also likely, however, that exploration of new knowledge and new ideas would help in making improvements to current processes (Galunic and Rodan, 1998 ; Grant, 1996). Hence, we expect that knowledge exploration will have a positive effect on operational agility of firm processes.

Firms that engage in exploration for knowledge from external sources are able to sense and respond to opportunities and threats better than firms that do not (Nonaka, 1994; Okhuysen and Eisenhardt, 2002). This is because a firm which combines knowledge from new sources also expands the range of the environment which it surveys, hence it becomes an extended enterprise (Rai et al., 2006) which is better equipped at sensing and responding to environmental changes. Moreover, appropriating and probing for new knowledge sources improves operational agility as it allows firm units to further refine their current processes by keeping up-to-date with the latest technological trends (von Krogh, Nonaka, and Aben, 2001).

Having a new perspective through knowledge exploration ensures that firms do not get caught in a competency trap and that they renew their expertise by bringing in fresh knowledge sources every now and then from outside of the current knowledge base (Gupta, Smith, and Shalley, 2006; Levitt and March, 1988). Thus, by exploring for knowledge firms can quickly improve the efficiency of current operations as well as keep themselves abreast any technological advancement that may help refine current operations. Hence, we propose,

Hypothesis 5: Knowledge exploration has a positive effect on firm operational agility.

Ambidexterity and Process Adaptability

Process Adaptability is defined as the degree to which new processes can be quickly implemented, or current processes can be quickly refined or reengineered. Process adaptability can be enabled by the ability to quickly implement new processes, or by refining and reengineering current processes. The reconfiguration and integration capabilities synergistically create a capacity for readiness to change in processes (Rai and Tang, 2010). For instance, purchasing off-the-shelf business solutions and implementing them with ease requires the ability to quickly reconfigure the applications as well as the ability to integrate the new application with existing ones (Byrd and Turner, 2000). Both these capabilities are provided by application ambidexterity.

Combined, the integration and reconfigurability characteristic of the application ambidexterity facilitate the ability to refine and reengineer business processes with minimal penalty to time, effort, cost, or performance (Langdon, 2006). The reconfigurability characteristic of the ambidextrous applications is crucial as it can support a wide variety of changes in the processes by allowing different software, communication technologies and core applications (Byrd and Turner, 2000). The integration characteristic of application ambidexterity is important as it can enable the ability to easily connect any technology component to other components within or outside the organization (Nelson and Ghods, 1998)..

Several recent initiatives, such as the use of standardized components, enable the simultaneous and synergistic use of both the integrational and reconfigurational capabilities of application ambidexterity. For instance, interfaces that use open standards such as Web Service Definition Language (WSDL), Web standards URL and XML allow greater ability to be flexible while providing quick connect capabilities (Langdon, 2006). When firms invest in such technologies, they acquire the benefits of both integration and reconfiguration without making their investments rigidly defined to a specific partner (Langdon, 2006). This will have the overall effect of greater process adaptability. Hence, we propose,

Hypothesis 6: IT application ambidexterity has a positive effect on process adaptability.

Process Adaptability and Strategic and Operational Agility

Strategic agility primarily consists of the ability to undertake radical, strategic changes. Changes of this magnitude are often accomplished by tapping into new sources of competence and are the result of making new partner connections. Thus, an important element of strategic agility is the ability to accomplish radical changes by the inclusion of new partners. One crucial requirement for strategic agility is the ability to quickly adapt current firm processes by either radically changing or completely abandoning old processes in favor of creating new ones (Gosain, Malhotra, and ElSawy, 2005). Process adaptability of a firm, therefore, is essential in achieving a high level of strategic agility. The accomplishment of radical change through inclusion of new partners is a serious disruption as compared to a simple volume or feature change, as it requires much more effort to assess the new partner in order to create new partner-linked processes and systems (Gosain et al., 2005).

Process adaptability is expected to have a positive effect on firm strategic agility due to its ability to provide a broad range of options. An adaptive firm process enables a firm to quickly connect to new partners due to reduced asset specificity (Gosain et al., 2005). Radical changes can be accommodated with relative ease without major penalties in time or cost since process adaptability can efficiently allow firms to reengineer business processes with greater ease. Existing process parameters can be quickly customized to suit radical change. Functionality can be added, modified or removed with ease without any major overall hindrances (Byrd and Turner, 2001).

In addition to a positive effect on strategic agility, we expect that process adaptability would also have a positive effect on operational agility. It is likely that when current partners require changes in processes to match market demands the increased adaptability afforded by the process will prove advantageous (Gosain et al., 2005). Similar to radical changes, operational changes which are incremental fine-tuning of processes can also be easily handled due to this increased process adaptability. Hence, we expect that process adaptability, due its increased capacity to accommodate change, would have a positive effect on operational agility. Hence, we propose

Hypothesis 7: Process adaptability has a positive effect on firm strategic agility.

Hypothesis 8: Process adaptability has a positive effect on firm operational agility.

In summary, we proposed that IT application ambidexterity would primarily have a positive effect on operational and strategic agility through the mediating effects of knowledge exploration, knowledge exploitation, and process adaptability.

DISCUSSION AND CONCLUSION

Firm agility has been conceptualized by the IS literature as the ability to sense and respond to market opportunities and threats with speed and surprise (Overby et al., 2006; Sambamurthy et al., 2003). While the importance of agility for organizations grows due to a hypercompetitive environment (D'Aveni, 1994; Goldman, Nagel, and Preiss, 1995), firms have also strived to attain two crucial characteristics - integration and reconfigurability - in their applications. Such applications can be termed ambidextrous, where the balance between these two conflicting characteristics is sought.

Although IS research has selectively focused on either integration or reconfigurability, the combined effect of the two on agility is not clearly understood. Given the mixed results in the literature and the growing importance of the two constructs, an investigation of the relationship between the two constructs is highly pertinent. Our work has attempted to fill this important gap in the literature. We have presented a fine-grained understanding of this relationship by conceptualizing agility as of two types: operational and strategic. Using mediating variables of knowledge exploration, knowledge exploitation and process adaptability, our paper teases out the enabling effect of ambidexterity on agility.

Our paper contributes by opening the black-box of IT's effect on firm agility. One primary contribution of our work is the theorizing of the effect of a balance between two important characteristics of IT - integration and reconfigurability - on agility. Since previous research has maintained a selective focus, our understanding of the IT-agility relation has been limited. Hence, it is important to advance our understanding by considering the effect of the balance of the two characteristics. A secondary contribution of our work is theorizing *how* IT affects agility. That is, we specify the mediating variables that play an important role in unfolding the effect of IT on agility. The paper provides a foundation for further exploring the link between IT application ambidexterity and agility.

Future research is needed to empirically assess the model presented in this conceptual work. Exploratory interviews should be conducted to further refine the model. This should be followed with survey of a broader sample drawn from several industries. The effect of the mediating variables should be assessed using mediation analysis techniques. Further research is also needed to determine the optimal levels of integration and reconfigurability that allow a balance between the two. A balance would enable operational as well as strategic agility while minimizing the detrimental effects of focusing selectively on any one characteristic. Research is also needed to assess the effect of contingent factors that might play an important role in the IT-agility relation. For instance, research is needed to assess how factors such as firm size, market turbulence, competitive intensity, and technological change might affect the relation between agility.

REFERENCES

1. Aranda, D.A., and Molina-Fernandez, L.M. (2002) Determinants of Innovation through a Knowledge-Based Theory Lens, *Industrial Management and Data Systems*, 102, 5, 289-296.
2. Barki, H., and Pinsonneault, A. (2005) A Model of Organizational Integration, Implementation Effort, and Performance, *Organization Science*, 16, 2, 165-179.
3. Benner, M.J., and Tushman, M.L. (2003) Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited, *Academy of Management Review*, 28, 2, 238-256.
4. Braunscheidel, M.J., and Suresh, N.C. (2009) The Organizational Antecedents of a Firm's Supply Chain Agility for Risk Mitigation and Response, *Journal of Operations Management*, 27, 2, 119-140.
5. Brown, J.S., and Duguid, P. (1998) Organizing knowledge. 40(1) 90-111., *California Management Review*, 40, 1, 90-111.
6. Brusoni, S., and Prencipe, A. (2006) Making design rules: A multidomain perspective, *Organization Science*, 17, 2, 179-189.
7. Burgelman, R.A. (1991) Intraorganizational Ecology of Strategy Making and Organizational Adaptation: Theory and Field Research, *Organization Science*, 2, 3, 239-262.
8. Byrd, T.A., and Turner, D.E. (2000) Measuring the Flexibility of Information technology Infrastructure: Exploratory Analysis of a Construct, *Journal of Management Information Systems*, 17, 1, 167-208.
9. Byrd, T.A., and Turner, D.E. (2001) An Exploratory Examination of the Relationship between Flexible IT Infrastructure and Competitive Advantage, *Information & Management*, 39, 1, 41-52.
10. Carlile, P.R. (2002) A pragmatic view of knowledge and boundaries: Boundary objects in new product development 13(4) 442-455., *Organization Science*, 13, 4, 442-455.
11. Cohen, W.M., and Levinthal, D. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation, *Administrative Science Quarterly*, 35, 1, 128-152.
12. Cooper, L.G. (2000) Strategic marketing planning for radically new products, *Journal of Marketing* 38, 5, 49-57.
13. D'Adderio, L. (2003) Configuring Software, Reconfiguring Memories: The Influence of Integrated Systems on the Reproduction of Knowledge and Routines, *Industrial and Corporate Change*, 12, 2, 321-350.
14. D'Aveni, R.A. *Hypercompetition: Managing the Dynamics of Strategic Maneuvering* The Free Press, New York, 1994.
15. Davenport, T.H. (1998) Putting the Enterprise into the Enterprise System, *Harvard Business Review*, 121-131.

16. Dedrick, J., Xu, S.X., and Zhu, K.X. (2008) How Does Information Technology Shape Supply-Chain Structure? Evidence on the the Number of Suppliers, *Journal of Management Information Systems*, 25, 2, 41-72.
17. Dove, R. Response Ability: The Language, Structure, and Culture of the Agile Enterprise John Wiley & Sons Inc., New York, 2001.
18. Duncan, N.B. (1995) Capturing Flexibility of Information Technology Infrastructure: A Study of Resource Characteristics and their Measure, *Journal of Management Information Systems*, 12, 2, 37-57.
19. Dyer, J.H., and Hatch, N.W. (2004) Using Networks to Learn Faster, *Sloan Management Review*, 45, 3, 57-63.
20. Galunic, D.C., and Rodan, S. (1998) Research Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation, *Strategic Management Journal*, 19, 12, 1193-1201.
21. Goldman, S.L., Nagel, R.N., and Preiss, K. *Agile Competitors and Virtual Organizations: Strategies for Enriching the Customer* Van Nostrand Reinhold, New York, 1995.
22. Goodhue, D.L., Wybo, M.D., and Kirsch, L. (1992) The Impact of Data Integration on the Costs and Benefits of Information Systems, *MIS Quarterly*, 16, 3, 293-311.
23. Gosain, S., Malhotra, A., and ElSawy, O.A. (2005) Coordinating for Flexibility in e-Business Supply Chains, *Journal of Management Information Systems*, 21, 3, 7-45.
24. Grant, R.M. (1996) Prospering in Dynamically Competitive Environments: Organizational Capability as Knowledge Integration, *Organization Science*, 7, 4, 375-386.
25. Grant, R.M., and Baden-Fuller, C. "A Knowledge-Based Theory of Inter-Firm Collaboration," Academy of Management Best Paper Proceedings, 1995, pp. 17-21.
26. Gupta, A.K., Smith, K.G., and Shalley, C.E. (2006) The Interplay between Exploration and Exploitation, *Academy of Management Journal*, 49, 4, 693-706.
27. Langdon, C.S. (2006) Designing Information Systems Capabilities to Create Business Value: A Theoretical Conceptualization of the Role of Flexibility and Integration, *Journal of Database Management*, 17, 3, 1-18.
28. Leonard, D., and Sensiper, S. (1998) The Role of Tacit Knowledge in Group Innovation,, *California Management Review*, 40, 3, 112-132.
29. Levitt, B., and March, J.G. (1988) Organizational Learning, *Annual Review of Sociology*, 14, 1, 319 - 340.
30. Lyytinen, K., and Rose, G.M. (2006) Information System Development Agility as Organizational Learning, *European Journal of Information Systems*, 15, 1, 183-199.
31. Magretta, J. (1998) The Power of Virtual Integration: An Interview with Dell Computer's Michael Dell, *Harvard Business Review*, 76, 2, 72-84.
32. Malhotra, A., Gosain, S., and El Sawy, O.A. (2007) Leveraging SEBIs to Enable Adaptive Supply Chain Partnerships, *Information Systems Research*, 18, 3, 260-279.
33. Malhotra, A., Gosain, S., and Sawy, O.A.E. (2005) Absorptive Capacity Configuration in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation, *MIS Quarterly*, 29, 1, 145-187.
34. March, J.G. (1991) Exploration and Exploitation in Organizational Learning, *Organization Science*, 2, 1, 71-87.
35. Nelson, K.M., and Ghods, M. (1998) Measuring Technology Flexibility, *European Journal of Information Systems*, 7, 4, 232-241.
36. Nonaka, I. (1994) A Dynamic Theory of Organizational Knowledge Creation, *Organization Science*, 5, 1, 14-37.
37. Okhuysen, G., and Eisenhardt, K. (2002) Integrating Knowledge in Groups: How Formal Interventions Enable Flexibility, *Organization Science*, 13, 4, 370-386.
38. Overby, E., Bharadwaj, A., and Sambamurthy, V. (2006) Enterprise Agility and the Enabling Role of Information Technology, *European Journal of Information Systems*, 15, 2, 120-131.
39. Powell, W., Koput, K., Smith-Doerr, L., and Owen-Smith, J. "Network Position and Firm Performance – Organizational Returns to Collaboration in the Biotechnology Industry," in: *Research in the Sociology of Organizations*, J. Hagan and K.S. Cook (eds.), JRI Press, Greenwich, Connecticut, 1999, pp. 129-159.
40. Rai, A., Patnayakuni, R., and Seth, N. (2006) Firm Performance Impacts of Digitally Enabled Supply Chain Integratio Capabilities, *MIS Quarterly*, 30, 2, 225-246.
41. Rai, A., and Tang, X. (2010) Leveraging IT Capabilities and Comptetitive Process Capabilities for the Management of Interorganizational Relationship Portfolios, *Information Systems Research*, 21, 3, 516-542.
42. Ravichandaran, 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, 237-276.
43. Rodan, S., and Galunic, D.C. (2004) More than Network Structure: How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness, *Strategic Management Journal*, 25, 1, 541-562.
44. Sambamurthy, V., Bharadwaj, A., and Grover, V. (2003) Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms, *MIS Quarterly*, 27, 2, 237-263.

45. Saraf, N., Langdon, C.S., and Gosain, S. (2007) IS Application Capabilities and Relational Value in Interfirm Partnerships, *Information Systems Research*, 18, 3, 320-339.
46. Sarker, S., and Sarker, S. (2009) Exploring Agility in Distributed Information Systems Development Teams: An Interpretive Study in an Offshoring Context, *Information Systems Research*, 20, 3, 440-461.
47. Schilling, M.A., Vidal, P., Ployhart, R.E., and Marangoni, A. (2003) Learning by doing something else: Variation, relatedness, and the learning curve, *Management Science*, 49, 1, 39-56.
48. Setia, P., Sambamurthy, V., and Closs, D.J. (2008) Realizing Business Value of Agile IT Applications: Antecedents in the Supply Chain Networks, *Information Technology and Management*, 9, 1, 5-19.
49. Tushman, M.L., and O'Reilly, C.A. (1996) Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change, *California Management Review*, 38, 4, 8-30.
50. Tushman, M.L., and Romanelli, E. "Organizational Evolution: A Metamorphosis Model of Convergence and Reorientation," in: *Research in Organizational Behavior*, L.L. Cummings and B.M. Staw (eds.), JAI Press, Greenwich, CT, 1985, pp. 171-222.
51. von Krogh, G., Nonaka, I., and Aben, M. (2001) Making the Most of Your Company's Knowledge: A Strategic Framework, *Long Range Planning*, 34, 421-439.
52. Weick, K.E. (1976) Educational Organizations as Loosely Coupled Systems, *Administrative Science Quarterly*, 21, 1, 1-19.