

# Antecedents of ICT Innovation in Emerging Economies: A Research Program

*(Research-in-Progress)*

by

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## ABSTRACT

*Studies on enterprise IT innovations have established the relationships between a number of determinants and enterprise innovativeness. However, such studies in general have been conducted in developed economies. Recent literature has called for broadening innovation-related research to other contexts, such as emerging economies. It must be noted that emerging economies suffer from several innovation-related limitations, including poor innovation infrastructure, weak legal system, among others. Yet, practice suggests that in recent times, emerging economies are demonstrating high levels of innovativeness. However, to our knowledge, little or no studies have been conducted on this topic till date. Using a multi-methodology approach (including case studies, a pilot survey and a large scale survey) within the ICT industry in India, This proposed study aims at examining what factors will impact the development of four types of innovations for IT enterprises in India, one of the largest emerging economies in the world.*

**Keywords:** *Product Innovations, Process Innovations, Organizational Innovations, Environmental Innovations, Emerging Economies, Collaborative Capacity, Multi-methodology*

## INTRODUCTION

Innovation has continued to occupy centre ground in times of prosperity as well as in times of hardships. When economic crises affected economies across the globe in 2008, causing sales and income slump for companies, creativity still lived on, or even flourished, as companies were

trying to figure out new ways to earn revenue more effectively and efficiently (Arndt 2009). It is thus not surprising that innovation-related research has been attracting a lot of attention in academia since early 1900's. One popular stream of innovation-related research relates to the investigation of antecedents of enterprise innovations. Years of research has shown that whether enterprises are able to innovate, and how well they can innovate tends to be determined by various factors, such as firm size (Baldrige and Burnham 1975; Blau and McKinley 1979; Damanpour 1996; Pierce and Delbecq 1977), organizational culture (Jassawalla and Sashittal 2002), knowledge management (Li and Kozhikode 2008), organizational resources (Damanpour 1991; Nohria and Gulati 1996), inter-organizational networks (Ahuja 2000; Chang et al. 2006; Goes and Park 1997; Mahmood and Mitchell 2004; Minkes and Foxall 1982; Powell et al. 1996; Teece 1989) and more recently information technology (Fichman 2001; Lyytinen and Rose 2003; Marcus 1981; Powell and Dent-Micallef 1997; Swanson 1994). However, most of these determinants of enterprise innovations have collected their data from advanced economies which Andersen et al. (2004) view as one of the major problems associated with innovation research. Indeed, Anderson et al. (2004) have suggested that researchers need to conduct more studies in different national contexts to test the generalizability of the conclusions drawn from past innovation research. Responding to their call, we place this study in the context of emerging economies, where, to our knowledge, little or no studies on innovation have been conducted.

Emerging economies have their uniqueness as regard to innovation, compared with advanced economies. On the one hand, the general innovation infrastructures in emerging economies are weak (Mahmood and Mitchell 2004), suggesting that it is difficult for organizations in those countries to develop innovations. On the other hand, evidence has shown that enterprises in emerging economies are consistently innovating. Given this paradox we propose to investigate *how enterprises innovate in emerging economies*. More specifically, we focus on the situation in India. According to a recent survey, India ranks in the second place among 28 emerging economies in the world. Over the past few years, India has experienced a significant economic growth, reflected from the high Gross Domestic Product (GDP). The average annual growth rate ranges between 6 to 7% ("Emerging Market India"). In this sense, choosing India as the study context can well represent the situation of emerging economies. We take a multi-method approach to study the factors affecting innovation in emerging economies. Specifically, our study involves a qualitative study, followed by a pilot survey, and another proposed survey. We

believe that our research program allows us to make the following contributions: first of all, it tests the generalizability of the existing results surrounding antecedents of innovations in advanced economies in other contexts and hence clearly responds to Anderson et al. (2004)'s call; secondly, it examines and unearths certain specific factors that enable certain emerging economies to innovate despite relatively poor overall innovation infrastructure in severe contexts; thirdly, we examine the antecedents of four different types of innovations, which has not been empirically examined in prior literature; finally, we attempt to study ICT innovation (Information and Communication Technology) by drawing samples of ICT companies in the data collection.

The rest of the article is organized as follows. In the next section, literature in innovation, emerging economies, etc. are reviewed, and research question is proposed; then, in the third section, the three-phase multi-methodology approach is discussed, the results of first two phases are presented and the plan for the third phase is described.

## **LITERATURE REVIEW**

### **Define Innovation**

Our endeavor is to briefly outline key research on innovation in information systems. The industrial perspective aims to understand innovation by framing innovation either a response to a technological constraint or a response to an organizational/ institutional constraints. Innovation has after been defined as the new ideas that enable change of production or as how new ideas influence industrial transformation (Dosi 1982; Teece 1986). Furthermore, Anderson et al. (2004) adopted West and Farr (1990)'s definition to distinguish innovation from creativity. They emphasized that first of all innovation should consist of application, meaning that innovation is more than an idea but a process of generating ideas and putting the ideas into practice; secondly, Damanpour (1996) defined innovation as "a means of changing an organization, either as a response to changes in the external environment or as a preemptive action to influence the environment", which emphasizes the influence of innovation to organizations.

Based on such a broad definition, innovation can be further divided into different categories, including product/service innovation, process innovation, administration innovation, environment innovation, and so on (Damanpour 1996). A product innovation is the market

introduction of a new or significantly improved good or service with respect to its capabilities, user friendliness, components or sub-systems. Product innovations are critical for many enterprises as they are able to bring changes in markets, technology, and competition (Dougherty and Hardy 1996). A process innovation is defined as changes in throughput technology for an enterprise or an operating unit (Ettlie and Reza 1992). It can be the implementation of a new or significantly improved production process, or the invention of a new distribution method, or more advanced support activity for your goods or services. Although process innovation does not directly improve the product an enterprise produces or the service an enterprise delivers, it has been widely recognized that the introduction of process innovation can have a significant impact on productivity, which might also bring competitive advantages to an enterprise (Ettlie and Reza 1992). Environmental innovations consist of “new or modified processes, techniques, practices, systems and products to avoid or reduce environmental harms” (Beise and Rennings 2005). Organizational innovations (or administrative innovations) are those that change an organization's structure or its administrative processes, including “the implementation of an idea for a new policy pertaining to the recruitment of personnel, the allocation of resources, the structuring of tasks, of authority, of rewards” (Damanpour 1987).

### **Innovation in Emerging Economies**

Emerging economies are defined as “low-income, rapid-growth countries using economic liberalization as their primary engine” (Hoskisson et al. 2000). The institutional contexts for organizations in emerging economies are totally different from that in advanced economies (Bruton et al. 2007). For example, the macroeconomic stabilization is hard to achieve in emerging economies, making external financial assistance difficult to obtain for domestic firms. (Hoskisson et al. 2000) Furthermore, the legal infrastructure in emerging economies is not only weak but also developing very slowly, which makes it especially difficult for organizations to introduce innovations as the property rights cannot be well protected (Nelson et al. 1998). Because of the unique characteristics of emerging economies, it is important to take such special contexts into account for innovation research in these countries. Further, Mahmood and Mitchell (2004) have suggested that emerging economies lack in all of the four aspects of innovation infrastructure: capital, scientific labor markets, knowledge sourcing, and vertical intermediation. First of all, the capital markets in emerging economies are immature, making it difficult for

organizations to find investment for innovation. Secondly, good research facilities and talented scientists are necessary for innovation, while there is a scarcity of such resources. Thirdly, the protection for property rights is weak in many emerging economies. Finally, pools of vertical intermediaries such as suppliers and distributors are far from strong in emerging economies (Mahmood and Mitchell 2004). The unique attributes of emerging economies determine that how organizations in emerging economies innovate cannot be the same as the mode of organizational innovation in developed economies.

Despite the fact that emerging economies are playing an increasingly important role in the world economy, there is a dearth of research in innovations in such economies. A review of the articles in JSTOR database (business journals only) using the keyword “innovation”, we found out that out of almost 1000 innovation related articles, only four studies based their research in emerging economies (See Table 1). Moreover, none of the articles targets the issue of IT innovation in emerging economies.

<b>Table 1. Studies of Innovation in Emerging Economies</b>		
Mahmood and Mitchell (2004)	Two Faces: Effects of Business Groups on Innovation in Emerging Economies	The authors found out that there is an inverted U-shape relationship between groups' share of sector sales and the sector's innovation performance. Samples were drawn from Korea and Taiwan between 1981 -1995.
Chang, Chung, and Mahmood (2006)	When and How Does Business Group Affiliation Promote Firm Innovation? A Tale of Two Emerging Economies	The authors explored business groups' roles in facilitating affiliate firms' innovation. They found out that the benefit of business groups for firm innovativeness is contingent on a country's institutional environment at a specific time.
Zhou and Li (2008)	Product innovation in emerging market-based international joint ventures: An organizational ecology perspective	This study investigated product innovation in market-seeking international IV in a large emerging economy. The authors found out that IJVs' innovativeness is dependent on organizational orientation defined by IJV contract, and is also contingent on local environment.
Ayyagari, Demirc, and	Firm innovation in emerging	This is a report from World Bank based on a

Maksimovic (2007)	markets: The roles of governance and finance	sample of over 10,000 firms across 34 emerging economies. The results showed that ownership structure, exporting values, managers' education level and managerial experience, and access to external finance all contribute to firm innovativeness in emerging economies.
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Two of the four studies in Table 1 examine the influence of business groups, a form of inter-organization networks, on organizational innovation. According to Mahmood and Mitchell (2004), business group makes organizations in emerging economies able to develop innovations, in spite of the weak innovation infrastructure. Along the same line, Chang et al. (2006) suggested that business groups can facilitate affiliate firms' innovation, but such benefits are contingent on the wider environmental context of a country at a specific time.

While the above studies indicate the role of some salient isolated features on innovation in emerging economies, some of which have been found in the literature on advanced economies, none of the studies provides an understanding of a more comprehensive set of factors affecting innovations in emerging economies. Further, none of the studies focus on ICT innovation, another void that this current study attempts to address.

### **Antecedents of Innovation in Advanced Economies**

Since early 1990s, much of the efforts of researchers have been directed toward studying antecedents that may determine whether enterprises can innovate or not and also what abilities they must acquire to innovate.

Conducting a content analysis of innovation research published between 1997 and 2002, Anderson et al. (2004) argue that innovations are affected by enterprise-level, working group/project-level and individual-level factors. Enterprise-level antecedents include factors such as firm size, organizational culture, organizational resources, and organizational structure; project-level antecedents include factors such as leadership style, team structure, and team climate; individual-level antecedents include factors personality, motivation and cognitive ability (Anderson et al. 2004).

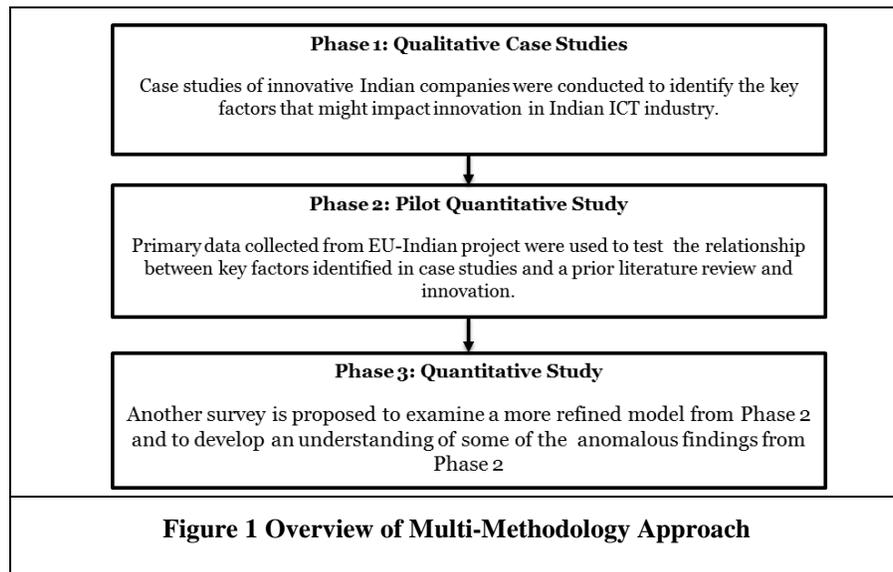
Firm size is one of the most studied enterprise-level factors that affect innovation. In most situations, firm size is expected to have a positive relationship with innovation (Baldrige and Burnham 1975). First of all, increased size leads to increased complexity, an attribute that is suggested to promote innovation (Blau and McKinley 1979). Further, bigger organizations tend to have more slack resources for innovation (Damanpour 1996), and more interactions through external linkages (Baldrige and Burnham 1975).

Organizational culture has also been suggested as important for innovations. What kind of organizational culture promotes innovation? By conducting an interpretive study to compare differences in culture between high-innovative companies and low-innovative companies, Jassawalla and Sashittal (2002) identified several features of highly innovation-supportive cultures; these include a) favouring collaboration, creativity, and risk-taking, b) having intensive meeting schedule to share information, develop and exchange ideas, and solve problems and conflicts, and c) leadership focusing on simultaneous change on a day-to-day bases.

Research and development (R&D) activities are usually associated with idea generation and innovation development, which makes organizational R&D effort another significant factor that can affect organizational innovation. Relying on industrial data, Acs and Audretsch (1988) found out that there is a positive relationship between R&D expenditure and numbers of innovations in an organization, but the rate of increase in innovations decreases as R&D expenditure goes higher. Similar to internal R&D activities, external knowledge acquisition is also imperative to enterprise innovations

Network structure has also been proved by researchers to have an impact on innovations in enterprises (Ahuja 2000; Goes and Park 1997; Pierce and Delbecq 1977; Powell et al. 1996; Szeto 2000; Teece 1989). Pierce and Delbecq (1977) suggest that inter-organizational interdependency help organizations with innovation development because of the shared information and shared resources. Moreover, Powell et al. (1996) reveal that the locus of innovation is within the networks of inter-organizational relationships, and such relationships are especially crucial for innovation in emerging industries. Finally, Szeto (2000) also pointed out that inter-organizational networks contribute to the development of an organization's innovation capacity.

## METHODOLOGY



The above discussion highlighted the role of key antecedents in fostering general innovation in advanced economies. Sensitized to the role of these factors and in order to understand the effects of the specific antecedents of product, process, organizational, and environmental innovations in emergent economies, we turned to a multi-method approach. The multi-methodology approach is composed of three phases (at present we have completed the first two phases). In phase 1, case studies of Indian companies in the ICT industry were conducted to explore the possible factors that might impact enterprise innovations in emerging economies. In Phase 2, a pilot study was conducted with primary data from innovative firms in the Indian ICT industry to empirically test whether the factors identified in Phase 1 and through a prior literature review would affect each of the four types of innovations. Finally, in Phase 3, we propose to examine a more unified model developed from the results of Phase 1 and Phase 2, and also understand some of the anomalous findings. We present our multi-methodology approach in Figure 1.

### Phase 1- Case Studies

We will share some of the insights from interviews gathered while interviewing the CEO, CTO, and founding directors of innovative IT companies in India.

### Case 1

Company A, is a research laboratory established by the government of India to provide technical solutions to the Indian industry. In this instance we were introduced to a project that was developed over a five-year period to make the process of tea tasting specified. The idea was to combine tasting, smelling and texture verification empirically so as to determine the quality of the tealeaves.

One of the success factors revealed in the development of this innovation was seen as the management team's experience. Experience is an important determinant of who gets the job and how far he is able to move in their management hire key. Experience is said to explain the approach of individuals to new ideas. For instance greater experience determines a better understanding of the subject matter which determines the innovativeness of firms. The CEO of this company argued:

"We take in at least 5-year-experience people, especially people with experience abroad, who we believe can develop a great product and provide great service, as people in developed country do. This way we believe we can be more innovative" "Innovation is uninteresting at the moment because we do not have any people with experience abroad, so how can we innovate, tell me?"

Sales value was also seen as important as one CEO mentioned:

"I am not so sure I understand you... we have low volumes but high margins, We are a focused company and our task is to deliver value at competitive rates, Now is that innovation" "We compete with large firms all over the world, most of these firms have huge sales figures, if they want they could easily outcompete us but they cannot because the IT market does not rely on mussels alone, it also needs some foresight and an understanding of the micro-dynamics of how a business model evolves."

### Case 2

Our second case highlighted the role of firm size and R&D expenditure, factors that have also been suggested in the context of advanced economies.

Company B, started its life in the mobile and ERP space in 2005 and is based in Pune (Maharashtra, India). Their founders were engineers from leading technical universities in India.

Size of the firm is often related to the innovativeness of firms, the larger the firm the conjecture claims the more potentially innovative it can be. According to the importance of size, one of the respondents argued that:

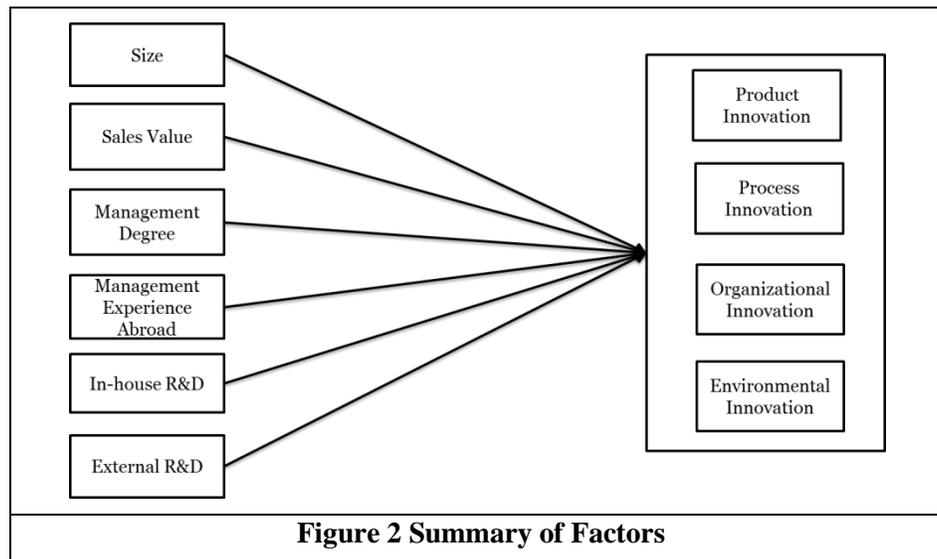
"We are small but we are innovative, look at the awards we received in India in the past five years, go to the hay math website and you will see how innovative we are in our delivery model. Why should we become big, we should stay small because it is cheaper and we are more innovative"

In-house R&D is another factor that has been talked about a lot.

“You see for me thinking of the problem as an integrated approach was the key to the solution of the tea tasting problem, if I had an R&D mindset I would be able to get the money but I do not think I would be able to work out a solution. My basic instinct was to think out of the box and not as a scientist engaging with R&D”

### Discussion of Case Studies

From the case studies and a prior literature review, we have identified six variables that might affect enterprise innovations in India, including management experience abroad, firm size, sales value, in-house R&D, external R&D, and management degree. Summary of the six factors is presented in Figure 2.



### Phase 2-Pilot Study

#### Data

Primary data from ICT industry in India was used to test the impacts of the six factors that have been identified in Phase 1. Data was collected through Euro-India ICT cooperation project. In the first step of the data collection, experts of the project scanned publically recorded IT innovations looking into all major journals and magazines from 2003-2007, to get the first sample of companies named innovative with IT. In the second step, they divided India into five regions (east, south-east, south, west, and north) and appointed an expert team for each region to filter the regionalized findings from the first step. In the third step, a survey team for each region was set up to contact the selected sample of companies. In each company, a managerial representative and a project manager were identified and were asked to fill in the survey question on-line. If in

doubt a person from the team would be available for contact. Our final usable sample included 217 completed surveys.

### *Measures*

The four dependent variables (product innovation, process innovation, organizational innovation, and environmental innovation) were coded as binary variables (0/1). If the enterprise has introduced either product or service innovation during the three-year period, we coded its product/service innovation as 1; if the enterprise has introduced neither product innovation nor service innovation, we coded its product/service innovation as 0. Similar coding was applied to process innovation, organizational innovation, and environmental innovation.

Size was measured by the number of full time employees. There are five levels of firm size: number of full time employees less than 250, from 251 to 500, from 501 to 2000, from 2001 to 10000, and more than 10001. These five levels were coded as 1 to 5 respectively. Sales values of 1 to 5 represent less than 50 lakhs, from 51 lakhs to 1 crore, from 1 crore to 50 crore, from 50 crore to 100 crore, and more than 100 crore. Management experience was assessed as binary variable. If the management has any experience abroad (studying, training, or working), the management experience abroad was coded as 1; otherwise, it was 0. In-house R&D was measured by whether the enterprise has engaged in any in-house R&D activity during the three years period; external R&D was measured by whether the enterprise has engaged in any external R&D activity (yes was coded as 1 and no was codes as 0). Management degree of 1 to 9 represents primary school, secondary, vocational training, technician/polytechnic, university/college of arts and social, university/college of science, university/college of business/management/commerce, university/college of technical engineering, and professional engineering and training institutes.

### *Results and Discussion*

We ran a linear logistic regression for each type of innovation on all six independent variables. Table 2 provides a summary of the results for all the four models. From the results, we can see that first of all, different types of innovations are affected by different factors and no factor consistently influences all kinds of innovations. Secondly, sales value is showing no significant effect on any innovation. Thirdly, management experience abroad is negatively related to process

<b>Table 2. Summary of Pilot Study Results</b>				
	Product Innovation	Process Innovation	Organizational Innovation	Environmental Innovation
Size	-0.392 (0.263)	<b>0.463</b> <b>(0.069)</b>	-0.060 (0.805)	<b>0.286</b> <b>(0.012)</b>
Sales Value	0.269 (0.443)	-0.230 (0.310)	0.205 (0.381)	-0.424 (0.137)
In-house R&D	<b>1.534</b> <b>(0.032)</b>	0.708 (0.192)	<b>0.205</b> <b>(0.000)</b>	1.568 (0.151)
External R&D	-0.952 (0.187)	-0.037 (0.948)	-0.616 (0.247)	0.096 (0.878)
Management Experience Abroad	-0.333 (0.612)	<b>-0.159</b> <b>(0.052)</b>	0.586 (0.162)	-0.345 (0.496)
Management Degree	0.305 (0.174)	-0.159 (0.352)	0.001 (0.996)	<b>-0.206</b> <b>(0.065)</b>
Note: p value in parenthesis				

innovation and management degree is negatively associated with environmental innovation, which is contrary to what we expected. In summary, the results of the pilot data provided some support for the factors identified in the Phase 1, but further examination is needed for explaining the effects of sales value, management experience abroad, and management degree.

### **Phase Three/Future Plans**

In this phase, we prepare to examine the anomalous findings from the pilot study. In addition, another objective of this phase is to examine the role of “collaborative capacity”, a notion brought up by some of our interviewees in our case studies, as fostering innovations within emerging economies. The concept of collaborative capacity was first brought up by community researchers (Goodman et al. 1998). When it comes to the organizational context, collaborative capacity is conceptualized as *the ability of the enterprises to develop systems and structures for working with other enterprises within the enterprise network aimed at leveraging each other’s competency*. To build collaborative capacity, collaborative network is one important approach. Business group, which was suggested to be the central approach for enterprises to develop innovations in emerging economies (Chang et al. 2006; Mahmood and Mitchell 2004), is a specific manifest of collaborative capacity. We seek to conduct a large scale survey using the

samples of innovative IT firms identified a prior in our pilot study but not surveyed as part of the pilot.

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