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ABSTRACT

The paper we present here discusses ICT innovation in India using a narrative framework. We argue that ICT innovation has not really been a subject matter sufficiently researched in information systems from the perspective of innovation in developing countries. We use a grounded theory inspired approach and we discovered three narratives of innovation in India; a) the supply narrative, b) the technology narrative and c) the collaborative narrative. We detect the evolution of these narratives and aim to continue further work to understand the factors involved in the emergence and shift of these narratives on a more granular level.

Keywords: ICT innovation, narratives, ICT in developing countries, collaboration, ICT project management

INTRODUCTION AND MOTIVATION

The nature of innovation in developing economies is a key concern in IS research (Lyytinen and Rose 2003b). A core focus of understanding ICT innovation has especially been to understand the impact and nature of IT innovation in developing countries (Avgerou 2008; Walsham et al. 2007). Past research on ICT innovation in developing countries has, for example, focused on issues related to increased transparency and reduced corruption (Silva et al. 2007), building ICT based knowledge alliances (Puri 2007) and issues of standardization in the development of health information systems (Braa et al. 2007).

Nonetheless, ICT innovations in developing economies is relatively scarce (Walsham et al. 2007) though this is slowly changing. A further look at prior works of ICT innovation (especially the MISQ special issue on IS in developing countries) indicates that a lot of prior research has been context-specific. For example, ICT innovation literature in developing countries has focused on issues and challenges related to geographic information systems (Walsham and Sahay 1999) and healthcare supporting systems (Braa et al. 2007; Miscione 2007; Silva et al. 2007). A review of such literature reveals that while the impact of ICT innovation in developing countries and their interplay with social and cultural factors have been studied, the *actual nature and evolution* of ICT innovation in developing countries has mostly escaped investigation. In other words, the path and manner in which ICT Innovation takes shape, driven by the interaction between the local context and needs of the innovating entity, needs to be further investigated. Thus we want to draw the attention of the reader to the specific circumstances that exist in India enabling ICT innovation to take flight in particular but distinct manner.

Our paper (which is research-in-progress) aims to address this gap and tries to present the intrinsic nature of ICT innovation as evidenced in a developing country, specifically India. Through an evolutionary perspective that we unearth in this paper, we understand the evolving nature of ICT innovation in India and provide key insights into where ICT innovation in India is headed in the future. Following this introduction, we provide a literature review of key theoretical perspectives of ICT innovation. Then, we describe our methodology of grounded theory. After that, we discuss the results and implications. Following that, we end with contributions and future directions of this research-in-progress.

LITERATURE REVIEW

The Nature of ICT Innovations

Literature has often aimed to understand innovation as the creation of artifacts or new ideas that enable change of production, or how new ideas influence industrial or administrative transformation (Christensen 1992a; Dosi 1982; Teece 1986). As noted by Fichman (2004), the majority of IS research on innovation has been done within the dominant paradigm, which often uses economic and rationalistic models and the goal has been to understand "whether, when, and how to innovate with IT" (Swanson and Ramillier 2004, c.f. Fichman 2004, p. 315). As Lyytinen and Rose (2003b) reiterate, "to date, the study of IS innovation deals primarily with factors that explain the volume and extent of improvement in ICT deployment" (p. 303).

Lyytinen and Rose (2003a) express concern that ICT innovations reflect a fundamental discontinuity and that *they need to be theoretically captured* in order to gain an understanding of such innovations. Primed by this observation, and the fact that there has been little prior work on the nature of innovations (Walsham et al. 2007), we proceed to understand how innovation evolves in developing countries like India. We use the concept of narratives as theory in order to present our perspective on ICT innovations in developing countries. As has been noted in prior literature, the innovation literature has been based on the premise that innovation is a key factor for improving the socio-economic conditions in developing countries (Avgerou 2008; Walsham et al. 2007). With this observation, we set out to understand whether this is indeed the case through our explication of narratives as theory. As evidenced in our results, while innovations start with such a premise, the focus of innovation often shifts, thus lending a new character to the innovation process.

Narratives as Theory

This section of our literature review deals with the explications of narratives as theory. Pentland (1999) notes that narratives are "abstract conceptual models used in explanation of observed data" (p. 711). Previous literature has argued that narrative analysis is a useful way to tell the story of a complex set of events (Webb and Mallon 2007), such as ICT innovation in developing economies like India. As Pentland (1999) and Webb and Mallon (2007) note, narratives provide

a middle ground that tries to make a tradeoff between maintaining the richness in describing socio-political systems and the need to provide generalizations at the same time. Based on prior works (e.g. Alvarez and Urla 2002; Truex et al 2000), we understand the narratives as trying to tell a story interpretively about a certain set of events, leading to rich insights into the phenomenon.

In our context of ICT innovation in developing countries like India, we focus on narratives because they enable collective interpretation of such innovation practices and events, thereby lending a deeper insight into the nature of ICT innovation (Dubey and Robey 1999). Our stance of using narratives as theory is consistent with prior observations that aim to unfold a complex socio-technical process.

Narratives are often construed to be the "preferred sense-making currency of human relationships among internal and external stakeholders" (Boje 1991, p. 106). Noting their intrinsic link to sense making that is synonymous to theory building (Weick 1989), it may easily be argued that narratives are a form of theory where telling a story with rich insights, yet retaining sufficient generalizability is important. Many works, such as the one by Boje (1995), note the power of the narrative as a good theory, a notion that Pentland (1999) agrees with. In fact, the nature of narratives as a theoretical exposition is fundamentally supported by Gregor's (2006) seminal work on the nature of theory in IS. She mentions that theories (specifically what she calls type II theories) can exist for understanding, where the emphasis is on demonstrating a certain view point of the world.

METHODOLOGY: A GROUNDED THEORY INSPIRED APPROACH

The data we report on is part of a four module methodological investigation that we developed to map the ICT innovation in India from 2003 to 2007. This paper reports some insights emerging from the first module which we call the historical module. It is called 'Historical' because it took relevant public records of ICT innovation in India published in media reports, editorials and set pieces regarding ICT innovation. We acknowledge that due to the scarcity of space and the nature of the research-in-progress paper, we may not be able to elucidate the methodological explanations and steps we undertook in a manner we would have liked to. Here we very briefly state what we did and move on to the analysis.

Our aim was to generate narratives and produce an initial theoretical illumination of the process of ICT innovation in India. We undertook the analysis using a grounded theory inspired approach as our methodological choice as we wanted to understand and explain how ICT innovation has been understood and reported in India and use this as our basis to add fresh insight to ICT innovation literature for developing countries. A grounded theory inspired approach is suitable for such a purpose as it allows the researchers to stay close to the data and enables the theory to emerge from data. Before we embarked on our grounded theory inspired analysis, we ensured theoretical sensitivity by acquainting ourselves with economic development and innovation literature that we use as a lens to equip ourselves for conducting the data analysis (Schumpeter 1934; Simon 1985).

Data Collection

The historical module, as its name suggests, aims to go back five years in time from 2003 to 2007 and looks at: 1) publicly available records, 2) articles written in trade journals, 3) national and regional newspapers and magazines, in English and vernacular languages, with a technology section, 4) research journals and 5) specialized/trade magazines to capture instances where innovation has been reported. The data collection process was initiated in February 2008 and lasted for six months. During this period, three people with graduate degrees worked full time on identifying relevant articles where ICT innovation was publicly recorded. A database for all recorded material was uploaded to a database. Table 1 below shows a sample of the news outlets that were used to capture published material on ICT innovation in India.

Newspapers	Computer and Academic Publications	Other Sources
• The Times of India	• I4D Magazine	• Siliconindian.com
• Business Today	• DQ Channels	• Merinews.com
• The Hindustan Times	• Express Computer online	• Academic Open Internet Journal
• Business India	• Living Digital	

- The Hindu
- Outlook Business
- Economic Times
- Dainik Jagaran
- The Hindu Business Line
- Dainik Bhaskar
- Amar Ujala
- Financial Express
- Dataquest
- India Indian Academy of Science (Current Science Journals)
- Computer@home
- Journals of the Indian Institute of Science
- PC quest
- Network Magazine India
- Computer World
- DQ Week
- Voice & Data
- Digit
- Computronics
- Convergence Plus published by Comnet Publishers Pvt. Ltd.
- PC World
- The Indian Techonomist - Indian Computer News Bulletins
- Communications
- ZDNet India
- Informatics - a quarterly newsletter from NICNET
- Chip
- Mobile_innovation.org
- One world south Asia OAI (ekduniya.net)
- Top-tech-news.com
- www.iicd.org
- Network world.com
- InQuirer.net
- Infoworld.com
- Findarticles.com
- Techworld.com
- Research and market.com
- Dailttech.com
- Highbeam.com
- Cnetnews.com
- Itvidya.com
- ITnewsonline.com
- Vccircle.com
- PCadvisor.com

Table 1: Data Collection Sources on ICT Innovation in India

INITIAL RESULTS AND DISCUSSIONS - THE NARRATIVES THAT EMERGE

Following our grounded approach, we now discuss the three narratives that emerge in our initial analysis. We took all the newspaper reports and categorized them into groups. Through a series of categorizations, we narrowed it down to three narratives. We term these three narratives as the *Supply Narrative*, the *Technology Narrative* and the *Collaborative Narrative*. Our data analysis reveals certain patterns in the evolution of ICT innovation in India. We see that initially there was a predominance of what we call the supply narrative. Following that, there was a predominance of the technology narrative. And in recent times, we see an emergence of the third narrative, the collaborative narrative. We discuss each narrative below, along with examples gathered from our data analysis.

The Supply Narrative

The first narrative that emerges is the supply narrative. In this period, technology is perceived as a lever for improving governance, delivery of services, and monitoring citizen claims and transfers (both in cases of governmental and non-governmental enterprises). For example, early government policy targeted the development of technology for this purpose. In Table 2 we illustrate some instances of the supply narrative emerging from the code. Technology is seen here as augmenting governance and augmenting social services and improving efficiency in governance. In this narrative, technology being developed is formulated, conceived, designed and developed to target delivery of services and address governance issues aiming to enable efficiency at each juncture of technology intervention.

In Table 2 we notice such a characteristic manifested by two companies. Tender Management Software™ is primarily about providing solutions to the government in line with the philosophy and general social obligations associated with activities of the government, i.e. a larger public good like improved governance, improved health care etc. We refer to it as supply narrative because the technology is aimed at improving a particular aspect of an existing administrative or a public task. In both the cases the firms are supplying technology for a specific use.

Information system researchers look at IS innovation as the creation of new application of digital computer and communication technologies (Lyytinen et al. 2003a). Here communication technology is perceived as an extension of a particular trajectory within the given platform, i.e.

improving the stock of current technology for increasing efficiency while staying within the operating platform. Such an argument tends to focus on responding to particular technical constraints. Such innovations fall into the supply constraint narrative because technology is innovated to improve existing products and not necessarily for creating totally new products on new platforms. Swanson type 1 and 2 (Swanson 1994) definition of innovation talks of administrative innovation. The type 1 innovation is similar to the supply narrative because administrative innovation is designed to improve efficiency, like the departmentalization of software maintenance functions. The type 2 innovation focuses on product and process improvement, which as we conjecture, is part of the supply narrative, because the innovation is aimed at improving performance, efficiency or productivity of an existing platform.

The supply narrative considers innovation as a tool for administrative reform. Their main concern is to enable innovation within the organization with the help of policy instruments, procedures and organizational frames (Daft 1978; Daft et al. 1978). Here the preoccupation is not in seeking new ways, but improvising, or creating incremental changes to an existing administrative platform, targeted on a maximization strategy assuming limited resources. Overall, the key implications of the supply narrative include transparency in governance, strengthening of property rights, reduction of corruption and waste.

Company Name	**The Innovation**
C1 India Private Limited	C1 India's flagship product, Tender Management SoftwareTM (TMS) is an end-to-end Internet-based electronic tendering solution that automates the complete tender cycle. This product has been designed to suit the needs of any Government organization in India with minimal customization. It meets the prime requirements of the Government in the area of procurement, including demand aggregation, transparency, accountability, fiscal savings and standardization of processes across entities to bring in efficiencies and to deliver cost reductions. www.nasscom.in/innovation or www.c1india.com
NIIT	NIIT has launched Litmus, a testing product, targeting organizations within

	the BPO sector. It addresses the growing need of ITES companies to scale their operations through a process which makes recruitment faster, more consistent, objective and valid, while increasing their ability to access talent from across the country. www.niit.com

Table 2: Supply Narrative Examples

The Technology Narrative

The technology narrative considers information system innovations as innovations of technology. Innovation occurs as new technology is created, leading to new products, processes or services. The focus is purely on technology innovation for enabling technical changes. The key feature here is that the activities are focused at technology development without the preoccupation of where the technology buyer will apply it.

Company Name	The Innovation
Newgen Software Technologies Limited	Newgen is the first company in the Indian subcontinent to offer a software-based configurable solution that includes image-based clearing of instruments such as demand drafts, interest and dividend warrants in addition to cheques (with and without mediation by the central bank/clearing house), thereby drastically reducing the clearing time. www.newgensoft.com
Lisle Technology Partners Private Limited	Lisle Technology Partners has developed AthenaVerify, which performs an access path analysis for layer 3 network devices to verify security policy compliance. With AthenaVerify, security officers can employ a proactive approach to reduce the risk of a serious security breach that could endanger sensitive data or cause interruption in business operations. www.nasscom.in/innovation

Table 3: Technology Narrative Examples

The technology narrative, bracketed by the nature of innovation view is primarily a determinant of radical and breaking out themes, caused by focusing on the creation of new or novel technology establishing a new market (Henderson et al. 1990). A central theme of the technology narrative is to focus on innovation of technology, where the endeavor is to improve the existing sets of technologies and provide better technical solutions (e.g. Newgen in Table 3). Here their sole purpose is simply to improve technology. For example, Lisle Technology has created a competitive advantage in a narrow field of security by focusing on new technologies. Thus the technology narrative represents a group of firms whose sole aim is to develop new technologies for the sake of technical improvement.

In the technology narrative, improvement outcomes propel the firm on a new trajectory of growth, creating new markets for their product and establishing new leadership position for the firm. This is in line with the Schumpeterian view that explains innovation through the idea of "disruptive technologies" for sustaining the firm's competitiveness, i.e. an attempt by firms to be ahead of their competition by constantly adapting and incorporating new technologies and knowledge to their existing systems of production (Schumpeter 1934; Schumpeter 1942). The core of his argument revolves around the ability of technologies to spur change by destroying existing systems called "creative destruction". According to the technology narrative, firms are constantly on the lookout for changing their stock by innovating and consequently enabling the firm to break out of an existing architecture in order to adapt to a new one (Henderson et al. 1990). Linked to the breaking out idea is the radical perspective of technology innovation (Dess et al. 1984; Dewar et al. 1986).

In this narrative, in-depth knowledge allows actors to think of alternative ways to combine technologies, create new services or application to address new needs or markets. Innovation in the technology narrative is predicated on two key factors, diversity and cohesion. Diversity considers the makeup of the team members while cohesion addresses the working relationship between members, a precondition for sustaining the level of learning (Leonard 1999; Leonard et al. 1999; McFadyen et al. 2004; Paulus et al. 2003; Sutton et al. 1996). Primarily within a technology narrative, the modus operandi shifts from an established procedure to creating new ways to deliver the product, service or application by establishing new mechanisms or platforms for delivery, (Dess et al. 1984; Dewar et al. 1986) and creating challenges for others by making it expensive for competing firms to replicate (Cooper et al. 1976).

The competitive advantage in such a technology narrative is acquired, (Cohen et al. 1989) stored and used (Rothaermel et al. 2007) at the locus where new technology is being created and introduced. From the above discussion, the overall key implications of the technology narrative are the technical differentiation and competitive advantage gained through specialization. These are achieved by the firms in India by focusing on their core competencies on the basis of the technical know-how and the value they create for their clients. The solution is always a technical one and the innovation is directed at technological improvement.

The Collaborative Narrative

From the analysis of the empirical data, we detect a recent emerging narrative that predicates its argument on the ability for technology to enable people and firms to collaborate. Here innovation is perceived as a tool targeted at improving collaboration between groups, professionals, technologists and firms. Technology is designed to enable networked interactivity and solutions create an ecosystem that enables interaction, communication, networking and increasing the performance of individuals that use technology. In this narrative, the focus changes to collaboration as Indian companies become international and get integrated into the global supply chain. Better integration of Indian companies into the global value chain leads to a focus on technologies that aid collaboration.

Company Name	The Innovation
Adiance Technologies Private Limited	Adiance has launched 1videoConference alpha, an Open Source Web2.0 Video Conferencing Software for Asterisk. Organizations using this product have been able to carry out multi-party video conferencing using inexpensive and non-proprietary Video and Voice over IP technology, without leaving any footprint on the user system.
Wipro Technologies	Wipro has innovated the Factory framework that is understood and adopted by all the global business units of an enterprise. The Factory model introduces new processes/services such as demand management, re-usable estimation, centralized architecture and engineering services and infrastructure consolidation that are leveraged across all projects.

	www.wipro.com

Table 4: Collaborative Narrative Examples

Two key features of the collaborative approach dominate the innovation landscape in India. The first targets improving collaboration between software production units. The second collaborative area that appears to be dominating the innovation spectrum is associated with social networks. Firms in this space think of tools, applications and services to convert these networks within firms into productive units.

In our data analysis we also see a gradual evolution of the increasing importance of the collaborative narrative and we discuss the evolution of the narratives below. Table 5 below is in reference to our discussion.

Evolution of the Narratives

	2003	**2004**	**2005**	**2006**	**2007**	**Total**
The Supply Narrative	15	22	21	33	40	131
The Technology Narrative	31	22	27	22	41	142
The Collaborative Narrative	10	16	28	33	51	122

Table 5: Distribution of Instances of Narratives

Source: The Euro India Historical Module Database

Table 5 shows a distinct pattern in the evolution of these narratives. Here, the reader can notice that the growth of the supply narrative is high, but not consistent. This can be explained by the sustained government intervention in the market for ICT projects. The technology narrative demonstrates a large dependency of Indian firms to innovate in this sector. But the real story is neither the supply nor the technology narrative because we expected firms to have a government focus (supply narrative) due to the large project spread of the state and a technology dominance due to India's leadership in value added technical ICT services (technology narrative). The collaborative narrative is an emergent and surprising narrative because we did not expect it to be there and assumed the economy to be dominated by the previous two narratives. The steady

growth of the collaborative narrative indicates that innovation has shifted from a market for technical solutions to a market for enabling collaboration. This according to us appears to be the interesting story of Table 5.

We conjecture that the shift will have two sets of impact on ICT innovation in India. First, ICT innovation will no longer be limited to large or medium scale companies situated in the Indian metropolitan cities but innovation will be more contextual and unique. This innovation will continue to fall within the supply narrative. We also expect to see a shift in Indian innovative activity from building technology for services to a product provisioned on enabling collaboration. This does not automatically imply that all firms will immediately shift gear and move to a collaborative mode. What this implies is that being a developed country there are sectors of the economy that are indicating characteristics that needs better explanation in terms of innovation. *Currently ICT innovation literature dealing with developing countries has not identified this trend nor has it been explained*. The key argument of the collaborative narrative is primarily in its intent. The shape of the market and the innovation to come seems to have stimulated firms into developing products either focusing on low cost video communication or providing a new framework to develop low cost software globally (as Wipro is trying to do).

In summing up we would like to conjecture that innovations focused at enabling the adoption of collaborative frameworks will be a feature of the Indian ICT industry in the days ahead while the supply and the technology narratives will continue to play an important role. In general, the collaborative narrative implies better integration of technology and value perceptions, reduction in decision making time, increased productivity and shorter lead times from the factory floor to the shop floor.

CONTRIBUTION AND FUTURE DIRECTIONS OF THIS RESEARCH

We see our paper here as contributing on two fronts. One, it provides a deeper insight into the phenomenon of complex technological innovation in India. It reveals three distinct narratives of such innovation. While ICT innovation in developing countries has been discussed in prior research, the true nature of the evolutions of such a complex socio-technical process has often escaped close scrutiny. The reason is that most ICT innovation has focused on the factors and impact of ICT innovations (Fichman 2004), without delving into the true nature of what the

innovations are. Our paper provides this insight, by showing how there are three distinct narratives of ICT innovation in India.

The second important contribution of this paper is to highlight the evolution of this process over time. In our data analysis, we find that the narratives are evolving from one stage to another. For example, in early years we find a dominance of the supply narrative and the technology narrative and more recently we see a distinct emergence of the collaborative narrative, *which we feel is an important story that has not been unearthed in prior innovation literature, especially for developing countries.* Thus, not only do we discover the nature of the narratives, but we also find the shift in the nature of ICT innovations in a developing country such as India. It would be difficult to predict the socio economic implications, except to speculate that the government sector will continue to drive the supply narrative. Innovation in this sector will continue to dominate but as a consequence of the collaborative narrative emerging, there is an increasing likelihood that larger computer firms will look to smaller towns to set up shop and attract local skilled workers to these towns as the collaborative narrative becomes a dominant paradigm for delivering domestic ICT service, innovation within the collaborative paradigm will look to new business models and markets. The impact of the large firms going domestic is likely to be demand for higher quality of education in the regions and demand for better skilled computer engineers.

It should be noted that our "research-in-progress" work provides initial glimpses into the nature of ICT evolution in developing economies. In order to further illuminate us on the nature of this complex phenomenon, our future directions of research include the following: 1) to investigate the social, economic, and technological factors that govern each narrative and how they interplay with each other in order to develop this narrative and 2) to investigate the key drivers of change from one narrative to another. For example 'why did India move from a supply to a technology to a collaborative narrative?' Answers to such questions will lead us to a better understanding of what ICT innovation means in a developing country like India and how it evolves over time, thus leading to better prescriptions on how to possibly stimulate and manage such innovations in the future. Additionally, it may be possible to analyze events related to ICT evolution in a multidimensional manner. For example, an event could be related to two different narratives. Analysis of such issues will provide us with a better understanding of the possible interplay of the three narratives- this would be a great avenue for future research.

In addition, our next research focus along this line of inquiry is in using the same methodological reasoning to conduct this study in China. This would enable us to get a better picture how two of the largest Asian countries in terms of population are likely to develop and use technology in the future. Also, our aim is to compare the evolutions of the ICT innovations in these two countries. This would give us greater insight into this complex process of ICT innovation that includes social, economic, administrative and technological factors. This has implications for IS research and the IT industry at large.

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