Kerala's Changing Technological Environment:

Tracking ICT Diffusion Over Twenty Years

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Abstract

It is common in discussions on Kerala to note the state's unique model of development marked by high levels of social progress and corresponding slow economic growth. What receives less attention is the move made by the state in the last decade and a half to rectify the trends in economic growth by placing greater emphasis on the development of the information and communication technology (ICT) sector. Recognizing the role of information, knowledge, education, and science in spurring economic progress, the state government has developed an IT policy designed to encourage the growth and development of this sector. The very features of the Kerala model, its high literacy rates and investments in education, places it in a unique position to take advantage of the potential of ICTs to promote not only economic growth, but also social arrangements within science and education. This chapter examines the history of ICT diffusion in

Kerala over the last 15 years by examining two trends: 1.) the changes taking place in the education and research sectors of the state in terms of access to various technologies and 2) the development of various programs designed to eliminate the digital divide and encourage social and economic growth through the diffusion of ICTs.

Introduction

In the following paragraphs, we outline the changing technology scene in the state of Kerala over approximately the last 20 years. We seek to describe the shifts that have taken place in the diffusion of technology by first placing the discussion within the appropriate context highlighting the concept of the digital divide and the unique features of the Kerala model. Following this, we turn to state level initiatives designed to create a local environment favorable to the growth of the information and communication technology (ICT) sector by both investing in the necessary infrastructure and fostering a technologically trained and educated citizenry. From here, we track the trends in access to and use of ICTs within the education and research sectors of the state and among professionals and small business owners by summarizing the findings of one of the only longitudinal studies conducted on ICT diffusion in Kerala. Finally, we close by discussing what the future might hold for Kerala and the role of ICTs in that future.

The Digital Divide and The Kerala Model

The elimination of the global digital divide through the widespread diffusion of information and communication technologies has been heralded as one of the most pressing issues of the modern era. Stated simply, the digital divide "concerns the starkly differential extent to which various forms of information technology (such as the Internet, computers, and mobile phones)" are available in and benefit some countries and groups

more than others (James 2007: 284). The digital divide has characteristically been used to describe the disparity between more economically developed and less economically developed countries in their access to and use of ICTs (World Wide Web enabled computers and mobile telephones being among the most widely discussed). The digital divide also refers to within country divisions, historically stratified along gender, race, economic, and geographic i.e. rural and urban, lines.

Accounts from both academics and international development agencies highlight the important role access to and use of technologies is expected to play in both creating economic growth and establishing a more egalitarian, knowledge based, global society in which progress stems from a countries and individual's ability to access and produce knowledge[1]. Indeed in its 2007-2008 report examining the relationship between science, technology, and development, the United Nations Conference on Trade and Development (UNCTD) made the case that

> "in the context of a global knowledge economy fuelled by the fast pace of technological innovation, it is important for developing countries to lay good foundations for building their capacity to acquire and create knowledge and technology in order to take advantage of the opportunities offered by globalization and, at the same time, to address emerging global challenges" (xxiii).

Kerala, like many regions of the world, has recognized the critical role ICTs might play in creating and maintaining economic and social progress. Reflecting the emphasis placed on technology, knowledge, and scientific education by the international development community, the government of Kerala was one of the first in India to develop a policy designed to promote and accelerate the diffusion and use of ICTs within the region (Government of India 2008). First written in 1998 and followed by numerous iterations (one in 2001, one in 2007, and a draft of a new document in 2011), the Kerala

IT policy agenda lays out the goals of establishing "Kerala as a leading IT destination...[and] significantly enhance direct and indirect employment creation in the IT sector" through the growth of the ICT sector, transforming Kerala into a knowledge society (2001: 5). More specifically, the goals of the IT policy include, but are not limited to, building the necessary technological infrastructure to create an environment favorable to ICT development; enhancing the necessary human capital required to both produce and use new technologies through education and skill building; and establishing Kerala as an IT industry destination by attracting investments from within and outside the region (Nair and Prasad 2002).

The stance adopted by development agencies and the state of Kerala itself demonstrates the pivotal role that technology, knowledge and science play in both the international development discourse and national policy agendas. Although the focus tends to be on the relationship between ICTs, economic growth, and poverty alleviation, the process of technology diffusion also holds significant implications for the structure of *social* arrangements. Not only is the widespread diffusion of ICTs seen as being essential for the nature and practice of primary, secondary, and post-secondary education but ICTs are also touted as necessary for the very production of knowledge itself. Synchronous and asynchronous communication and access to a wide array of information through the World Wide Web have altered the processes of communication, collaboration, information retrieval and social networking and by extension the way in which people teach and research, learn and work.

The role of ICTs in the modern world is particularly relevant in the Kerala context, which is marked by relatively progressive social development but low economic

indicators. Kerala has the highest Human Development Index in India measured in terms of its advanced literacy rate and school enrollment, its dramatic reductions in fertility, its relatively long life expectancy, and its female to male ratio that is indicative of the greater gender equity in the region (CNBC 2011; Franke and Chasin 1994). In addition to possessing a population endowed with a high degree of human capital, the state also has the advantage of a fairly well developed infrastructure. In other words, Kerala is well equipped with the human resource and infrastructural base that might act as drivers of technology diffusion and development. Simultaneously, the economic indicators for the state are relatively poor. With its high unemployment rate and low GNP, the Kerala context goes against the dominant strand of thought in economics, which contends economic growth is a prerequisite for social development (Franke and Chasin 1994).

While an extensive amount of literature has been written on the development process in Kerala, what has been referred to as the Kerala model of development, less focus has been on the diffusion of ICTs in the state. The very features of the Kerala model outlined above, at least theoretically, position the state for the diffusion and use of ICTs and uniquely situate it to harness the potential benefits of the technologies, in this way countering its poor economic indicators. It is in this local and international backdrop that we examine the diffusion and use of ICTs in Kerala. We now turn to a discussion of a variety of initiatives and programs supported by the state government and designed to realize the ICT goals outlined above.

Designing an ICT Environment: The Role of State Level Initiatives

As part of its IT policy agenda the government of Kerala has focused on a multi-pronged effort aimed at: 1) establishing new initiatives designed to move the state

forward in its technological capabilities and at the same time ensure that the digital divide among the state's population is not exacerbated and 2) encouraging the growth of the ICT industry through the improvement of appropriate infrastructure and the creation of commercial parks. These efforts are aimed at bringing about improved access to, involvement with, and interaction using technology. Among the states more celebrated efforts in this regard are programs such as Akshaya, IT@School, and FRIENDS, to name a few.

As mentioned previously, Kerala is often celebrated as a state that has achieved Total Literacy. Building on this momentum, the IT@School initiative is a program implemented by the Department of General Education to make Kerala the first *IT* literate state by ensuring that all schools have Internet enabled computer access. Towards this end, the program targets over 12,000 schools and 60 lakh students for broadband Internet connectivity and infrastructural upgrades. FRIENDS, (Fast, Reliable, Instant, Efficient, Network for Disbursement of Services) on the other hand, is a program initiated to make it easier for citizens to engage in government transactions such as paying their electricity and telephone bills and taxes.

Within discussions of the digital divide, the urban/rural distinction is viewed as an important topic of concern given that urban connectivity far outreaches rural patterns of connectivity (Parpart et al. 2002). Here again, however, Kerala emerges as an anomaly. Because the population distribution of the region is fairly even, the urban/rural split is not as distinctive as in other countries. Even still, Akshaya is a program designed to ensure access to ICTs, particularly in rural areas. More than providing simple access, the program is also intended to ensure that users have both the skills to use the

technology and access to information that is relevant to their lives. The program aims to establish computer access within two kilometers of the homes of rural residents and to provide technology training to these same individuals.

In addition to these social initiatives designed to ensure that intra-country digital divides are not exacerbated or created anew, the state is also encouraging the development of IT parks. Kerala State Information Technology Infrastructure Limited (KSITIL) is the apex company formed as part of the IT Policy of the state government for pioneering the development of IT Townships and IT Parks in Kerala. Unlike other states in India, the developments in the IT sector are not confined to one or two cities in Kerala. Instead, a hub and spoke model has been planned wherein Thiruvananthapuram, Kochi and Kozhikode, the three corporations in the state will act as hubs and the remaining districts will act as its spokes. KSITIL is to be supported by Technopark, Infopark and Cyberpark in each of these districts respectively for the development of the districts falling under each hub.

Technopark, the first and largest technology park in India, is situated in Trivandrum, the capital city of Kerala. The park is dedicated to IT ventures. Launched in 1990, Technopark as of 2011 has 600,000 square meters of built-up space, and is home to over 250 companies, employing more than 35,000 professionals. Technopark is currently on an expansion mode by adding another 37 hectares as part of Phase III expansion and 450 acres (1.8 km^2) as Technocity, an integrated IT township. Technopark accounted for about 70% of IT exports from Kerala in 2010. The units in Technopark include domestic firms, joint ventures and subsidiaries of foreign companies engaged in a wide variety of activities, which include embedded software development, smart card technology,

enterprise resource planning (ERP), process control software design, engineering and computer-aided design software development, IT Enabled Services (ITES), process re engineering, animation and e-business. Technopark also hosts a Technology Business Incubation Cell and Software Competency Centre.

Infopark, in Kochi is established in 2004 is spread over a 100 acres (40.5 ha) campus with more than 3,400,000 sqft (315,900 m^2) of built up area, housing over 100 companies which employ around 15,000 professionals. The park is currently in expansion mode and is adding another 160 acres (64.7 ha) as part of the Phase II expansion. The notable companies in the park include TCS, Cognizant, Wipro, Ernst & Young, Arbitron, Etisalat DB Telecom, IBS Software Services, UST Global, Outsource Partners International and Xerox ACS to name a few. The software exports from Infopark touched Rs 900 crores in 2010 with an yearly growth of 40%. Cyberpark in Kozhikode is also planned in the lines of Technopark and Infopark, to build, operate and manage IT parks for the promotion and development of investment in IT and ITES industries in the Malabar region of Kerala. The Cyberpark is the third IT hub in Kerala. In accordance with the Hub and Spokes Model proposed by the Kerala Government to promote IT parks, the park is being developed in 43 acres (170,000 m^2) of land.

The Changing Pattern of ICT Access and Use

In 1994, a multinational project (www.worldsci.net) focusing on the research and educational communities (primarily local non-governmental organizations, universities, and research institutes) of Kenya, Ghana, and Kerala began tracking the changing nature of the scientific and technological environment within these three areas At the time the study began, the diffusion of the Internet in Kerala was in its infancy and mobile phones

were virtually unheard of. Following the pre-Internet study, this same project gathered three additional points of data, one in 2000, one in 2005, and one in 2010. Further, in November 2005, a "Special Kerala Session" had been conducted in the three day international conference on the 'Past, Present and Future of Research in the Information Society' (PPF Conference) organized by the project as the main science and engineering event at the World Summit in Tunis, Tunisia. Kerala was the only region that received a session of its own at the conference. Later, the presentations in the Special Kerala Session at the Tunisia Conference along with a few other studies of the project in Kerala was published in a volume in both English and Malayalam (Palackal and Shrum 2007). The edited book explored the nature and effects of information and communication technologies on scientific research and engineering, vis-à-vis development in Kerala. Because this project represents one of the only, if not the only, longitudinal studies available tracking the diffusion of ICTs within Kerala, we use it to guide our discussion of the changing patterns of ICT access and use.

Recognized historically as being a fairly advanced state in terms of its adoption and assimilation of various technologies, Kerala's progressive orientation, particularly as it relates to computer technology, slowed during the early nineties. This trend, a consequence of the population's concern that computers would ultimately replace human labor, was reflected in the scientific and educational communities of the state (Government of India 2008). The pre-Internet study discussed above revealed that while nearly 100% of the sample possessed ready access to a landline telephone, only approximately 6% employed email, a little over half (52.3%) reported access to a fax machine, 68% to a printer, and 61% to a computer (Shrum 1996). Given that those

employed within the institutions examined also tend to be some of the most innovative users of new technologies and cutting-edge ideas, one could argue that computer and email technology was virtually absent not only from these institutions but the state as a whole. Indeed, a very few of the sample of academics, researchers, and NGO employees viewed developing email connectivity to be a top priority at the time they were interviewed.

Just a few years later, and approximately corresponding with the 2001 IT policy agenda, the situation was quite different in terms of both macro ICT indicators measuring access and use across the state and in terms of micro level qualitative and quantitative studies. By the early part of the twenty-first century, Kerala ranked first among all Indian states in the density of telephone connections, third in mobile phone usage, and eighth highest in terms of Internet users (Davidson, Sooryamoorthy and Shrum 2002). While the percentage of those reporting access to a fax machine increased by only 8 percentage points to 60%, the percentage of those reporting access to a computer and printer increased significantly to approximately 87% and 86% respectively.

The most dramatic increase in access, however, occurred in regards to email. The percentage of those reporting ready email access jumped to 86% from 6% in 1994, while close to 100% (94%) identified as email users - even if they lacked ready access (Soorymoorthy et al. 2007; Ynalvez et al. 2005). While connectivity was far from 100% (indeed only approximately half of those reporting access to computer also reported connectivity), and many of the individuals in this sample reported sharing their work computers, those working in research and educational institutions were much more keen to move in the direction of using ICTs as a tool in their work (Davidson et al. 2002).

Indeed many saw it as an indispensible resource (or at least one that would theoretically be at some point).

By 2005 the diffusion of some of these technologies had reached a saturation point, while access to others had stagnated or declined. Ready access to a fax machine declined over this period, perhaps an indication of it becoming an obsolete technology as quicker, more efficient mechanisms for communication and information transferal became more widely available. While 90% of those employed within the research and educational institutions of the state reported ready access to a printer, nearly 100% reported ready access to a personal computer (97.7%), landline telephone (98.1%), and email (94.2%). Compared to national trends, Kerala was also performing quite well. By 2008, *The Hindu,* an English newspaper printed in India, reported that Kerala had the highest penetration of computers and Internet, double the national average (Roji and Godsy 2010). In other words, in just over ten years time the ability to access information and communication technologies had changed dramatically.

But perhaps the most interesting trend over this time period was the emergence of the mobile telephone as an important technology. As mentioned above, Kerala has historically been a leader in its adoption and orientation to telecommunications. According to a report issued by the Government of India's Planning Commission (2008), Kerala was the "first state in India to automate all telephone exchanges, the first to link the exchanges through STD facility, the first to provide public telephone facilities in all panchayat headquarters, and the first to provide public telephones in every village" (248). This same report highlights the fact that in 2005 the state's teledensity, or the number of

telephones per 100 people, was significantly higher than the rest of India—19.5 in Kerala compared to 9.7 for the country.

In part a reflection of this culture, mobile telephone technology diffused rapidly from the beginning of the new millennium to 2007, and this can be seen in both state level statistics and micro level studies on the diffusion of technology among a variety of samples of the population. By the end of 2007, there were approximately 10 million mobile phone customers in Kerala, comprising 15% of mobile connections in all of India. Indeed, while the proportion of the Indian population living in Kerala is approximately 3%, the state possesses the highest proportion of mobile use in the country. Evidence from a sample of professionals and small business owners in the state indicate that while less then 33% had owned or used a mobile phone in 2002, by 2007 96% currently owned and used a mobile phone (Palackal et al. 2011).

While these state and country level statistics are illustrative of the changing technological environment in the region, they mask any internal disparities which may still exist within the state. For instance, the closing of the digital divide has been viewed by many as a useful tool for alleviating gender inequality. Although few empirical examinations into the topic of gender and ICT diffusion have been conducted in the region, what has been done does not suggest an unproblematic or straightforward relationship between technology diffusion and gender inequality.

Undoubtedly, gender gaps in access to and use of various technologies have declined significantly among certain segments of the population. For instance, using both quantitative data and qualitative interviews from researchers employed within universities and national research institutes, it has been found that men and women have

approximately equal access to the Internet, email, and personal computers and both are equally likely to identify as active users of the technology. Miller et. al. (2006) and Miller and Shrum (2011) discovered that female researchers access to technologies increased dramatically between 1994, 2001, and 2005, such that by 2005 many of the gender disparities in access had disappeared.

In terms of the consequences of women's increased access to technologies, however, the evidence is contradictory. Palackal et. al. (2007), for instance, using qualitative interviews with female scientists in India found that email was being used for communication purposes to develop a larger number of contacts outside of the immediate area. Miller and Shrum (forthcoming), on the other hand, discovered that the greater access was not associated with increased contacts. Instead, women actually reported a decrease in their number of ties to others over time. These results suggest the possibility that female researchers in Kerala may not be using email for specific types of communication purposes.

Researchers examining gender differences outside of the scientific and academic arenas have found similarly contradictory findings. Arun and Arun (2002), for instance, note that while ICTs in Kerala have provided women with increased employment opportunities through such activities as software production, they have also reproduced the larger pattern of gender inequalities present within Indian society. In other words, the evidence regarding gender disparities points to the idea that technologies are not an unequivocal solution for social disparities and their diffusion will often have unintended consequences.

Conclusion

In this paper we examined the history of information and communication technology diffusion in Kerala over the last twenty years. Kerala has witnessed dramatic shifts in its technological environment in terms of both governmental policy and the diffusion of Internet enabled computers and mobile phones. While it is difficult to deny that the rapid advancement of ICTs is having a remarkable impact on the nature of global relations, in this paper we largely did not address issues of outcomes or effects. Although the same social motivations that produced Total Literacy may lend themselves to Total Connectivity, questions of consequence remain. Because technology is seen by many as a potential panacea for world poverty and inequality, it is vital to examine this issue further. To truly realize the ability of ICTs to produce social change by providing people with improved opportunities to access a greater variety of information regarding health care, education, market prices, and farming techniques policies must consider the existing economic, social and cultural milieu into which they are introduced. ICT policies, in other words, must consider the "norms and practices that affect both labour markets and households because these, in turn, affect both the outcome and sustainability of ICT-based development" (Arun and Arun 2002).

Notes

1. In April of 2002, for instance, the World Bank issued a report outlining its position on the introduction, dissemination, and implementation of communication and information technologies (ICTs) in developing areas of the world. According to the report, access to and use of technology possesses the potential to alleviate poverty and provide "opportunity, security, and empowerment for poor people" (2002: vii). The report goes on to briefly assert that the utilization of ICTs can bridge the digital divide not only across countries but also between men and women by "protect[ing] the people and promot[ing] social justice and equity" (64). More recently, on March 14th of 2006, the United Nations implemented what they term a Digital Solidarity Fund designed to finance projects that address "the uneven distribution and use of new information and communication technologies [to] enable excluded people and countries to enter the new era of the information society."

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