ICTS FOR THE BROADER DEVELOPMENT OF INDIA:
AN ANALYSIS OF THE LITERATURE

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ABSTRACT
India is known around the world for the success of its export-oriented ICT services industry, but this paper asks whether ICTs have been valuable in providing broader development benefits to all Indian citizens. Secondary data from academic articles with a focus on India are used to analyse the contribution of ICTs towards the achievement of specific development goals. The analysis shows that many ICT-based initiatives have taken place over the last decade and some positive effects have resulted. However, the beneficiaries are almost always not the poorest or most disadvantaged groups, it is hard to scale up initiatives to have effects throughout India, and the need for attitudinal and institutional change remains a fundamental problem. It is argued that ICTs should not be seen as 'silver bullets' for development but neither are they irrelevant. Rather, they are potentially important contributors towards development in India but only through their integration in wider sociotechnical interventions.

Keywords: India; development; ICT; e-government; health information systems; telecentres; mobile phones; civil society; empowerment; poor and disadvantaged groups

1. INTRODUCTION

India is well-known around the world for its rapid economic growth rates over the last fifteen years or so, fuelled in part by the spectacular growth in its export-oriented software and ICT-based services sector. Many other countries look to India as a model for global outsourcing and try to imitate elements of this in their own strategies (Carmel 2003; Heeks and Nicholson 2004). Success at a particular period of time does not, of course, guarantee its continuation and commentators have expressed concerns such as rising wage rates and skills shortages of ICT professionals (CACM 2007), and increasing competition from countries such as China (Negroponte 2003). It is likely, however, that India will remain a major player in the ICT industry for years to come and thus its global image as an ICT success story will continue.

Viewed from a broader development perspective, things are not so simple. The new wealth that has arisen in India from the ICT boom benefits the relatively wealthy and educated in the first instance (Kambhampati 2002). Will this trickle down to the poor and uneducated? Statistics paint a mixed picture of the current situation. On the one hand, India is now the world's fourth largest economy in purchasing power parity terms, and has enjoyed high growth rates for over a decade rising to an average of over 8% per annum in the period 2004-7 (World Bank 2007). On the other hand, India was ranked as 128th out of 177 countries on the human development index 2005 (UNDP 2005) which is a composite index based on life expectancy, literacy and education levels, and economic standard of living. Shocking statistics include the percentage of malnourished children under 5 being 46%, the adult female literacy rate as only 48%, and the percentage of the rural population using adequate sanitary services as 18% (World Bank 2007, UNICEF 2004).

A major development issue, therefore, is whether India can seriously address the needs of all of its people, including the vast numbers of poor and uneducated in the rural

areas and the urban slums. A related sub-question is whether, and to what extent, can ICTs be used to provide development benefits to all Indian citizens. There are increasing attempts to use technology in this way through projects such as e-government services and telecentres in poor areas. The purpose of this paper is to use the published academic literature to examine such development initiatives and to address the following research questions: what has been achieved to date in terms of the use of ICTs for the broader development of India, what remains problematic and what approaches should be adopted in the future?

The main empirical basis for the paper is secondary data drawn from examining all peer-reviewed academic articles over the last decade with an explicit focus on ICT projects in India in a range of selected journals. These included three journals with a specific ICT for development focus, namely *Information Technologies and International Development, Information Technology for Development* and the *Electronic Journal of Information Systems in Developing Countries.* These were complemented by articles in eight mainstream IS journals, a list of which can be inferred from the references given at the end of the paper. The full set of papers included a substantial number with a focus on the Indian outsourcing phenomenon but these have been largely excluded from the material that follows due to the emphasis in this paper on the broader development of India. A total of 45 papers were included for the analysis which follows.

The rest of the paper is organised into three sections. The next section develops a framework for analysing ICT initiatives aimed at development goals in four broad categories. The research literature in each of these categories is then examined to describe initiatives that have taken place in India, what development impacts have been achieved, and other implications from the studies, including difficulties that have been encountered. The discussion and conclusions section then synthesises results from these analyses to address the research questions above and, more generally, to discuss the role of ICTs in development as part of wider sociotechnical interventions.

2.   ICTS AND DEVELOPMENT GOALS

There is a growing literature on ICTs in developing countries (see Walsham and Sahay (2006) and Avgerou (2008) for literature reviews) but a number of researchers (e.g. Heeks 2006, Thompson 2008) have argued that much of this literature does not address the question of what is meant by development. The methodological approach adopted in this paper was to start with the case examples of ICT-based initiatives in India reported in the surveyed literature and to group them as aimed at four broad development categories as shown in Table 1. It should be noted that these categories are somewhat overlapping since, for example, 'better lives for the poor' could arise from initiatives in all the other three areas.

The broad categories were then broken down into more specific development goals such as improved health care, more efficient government services and reduced corruption. This list of specific development goals, as shown in the third column of Table 1, is somewhat eclectic, reflecting the varied objectives of ICT-based initiatives and approaches displayed in the literature. However, the specific goals in the list can be seen to fit within the five categories of development 'freedoms' described by Sen (1999), particularly those of economic facilities, social opportunities and transparency guarantees.

Broad Development Category	ICT-based Initiatives	Specific Development Goal
Better lives for the poor	• Health information systems • Telecentres • Mobile phones	• Improved health care • Access to information for better freedom of choice • Better economic and social opportunities
Improved government services	• Computerised back-end administrative systems • E-government direct services • Use of GIS	• More efficient services to citizens • Visible direct services • Better planning and implementation of infrastructure
Enhanced internal economic activity	• Internet banking and e-commerce • Adoption of ICTs in private sector companies • ICT in agricultural supply chains	• Better financial services to citizens and businesses • More efficient enterprises • Improved efficiency in the key sector of agriculture
Improved civil society	• Computerised records in land reform • Empowering slum dwellers and other local communities through information and ICTs • Provision of broader information on civil society	• Increased efficiency and reduced corruption • Improved social and political participation of disadvantaged groups • Information as means to affect negative attitudes such as apathy and indifference

Table 1. Framework for Analysis of ICT-based Development Initiatives

The first broad development category is summarised as *better lives for the poor*. The Millennium Development Goals (United Nations 2009) focus strongly on this area with targets to end poverty and hunger, and significantly improve health and education for the poor. ICTs are seen to have high potential in a number of these areas, including that of health, where effective gathering and use of data through computerised health information systems is seen as a key prerequisite to improved health care delivery and the better assessment of health programmes (Braa et al 2004). Telecentres are a second area where ICTs have been widely applied with the aim of bridging the digital divide for the poor (Reilly and Gómez 2001), providing them with access to information and better freedom of choice. However, it is recognised that bridging the digital divide is not solely a matter of technology but also of the social, political, institutional and cultural contexts which shape people's access and use of ICTs (Warschauer 2003). The usage of mobile phones is growing at a phenomenal rate in the developing countries as a whole (Heeks and Jagun 2007) and there is hope that this technology can offer flexible support to the improvisation capabilities of the poor in trying to improve their lives, providing better economic and social opportunities.

A second broad development category is *improved government services*. One ICT-based approach to this is through the provision of computerised back-end administrative

systems. Such systems are aimed to contribute to development through more efficient services to citizens, although the effects may not be easily visible to them. In contrast, the term e-government has come to prominence throughout the world in the last decade, mostly to describe the highly visible direct services which government can deliver to citizens through the use of ICTs. There is an increasing amount of research devoted to this topic, although Heeks and Bailur (2007) argued that much of this work is over-optimistic in tone. A further type of ICT-based initiative aimed at improving government services is through the use of geographical information systems (GIS). Many issues that fall within the remit of government are inherently spatial in nature, such as the planning of roads and utility systems, and GIS offer a way of analysing alternative approaches which takes full account of geography and which utilises data from a variety of local sources and remote sensing technologies. The specific development goal is the better planning and implementation of infrastructure, providing improved economic and social opportunities.

A third desirable development outcome is *enhanced internal economic activity*. ICT-based initiatives here include internet banking and e-commerce aimed at providing better financial services to citizens and businesses. More generally, the adoption in private sector companies of a whole range of ICT-based approaches pioneered in Western countries from the operational to the strategic level is aimed at more efficient businesses across all sectors. However, one should be wary of assuming a simple relationship between technology adoption and improved performance as noted in the general literature on ICTs in developing countries (see, for example, Avgerou and Walsham 2000). Agricultural supply chains are of particular interest to countries such as India, with a high proportion of its people living in rural areas and deriving their income from agriculture, and ICTs offer the potential to improve efficiencies in the supply chain, for example through the provision of up-to-date price information.

The final development category in the framework is *improved civil society*. One of the potential benefits of ICTs that has been discussed for many years is its 'informating' capability (Zuboff 1988), whereby the technology does not merely improve the efficiency of processes but simultaneously produces enhanced data on these processes. Such data can be used for monitoring and control, but Zuboff argued that it could also be used for local empowerment of workers through increased understanding. In the context of developing countries, can information and ICTs be used in this way to empower poorer and less advantaged groups, thereby improving the functioning of civil society and the accountability of people such as government officials? Three areas will be discussed in this paper: firstly, computerised records in land reform aimed at increased efficiency and reduced corruption; secondly, empowering slum dwellers and other local communities through information and ICTs, aimed at improving the social and political participation of disadvantaged groups; finally, the provision of broader information on civil society more generally as a means of affecting negative attitudes such as apathy and indifference towards major social inequities.

3.   ICTs to Support Better Lives for the Poor

Cecchini and Scott (2003) summarised a range of ICT-based applications aimed at poverty reduction in the context of rural India. These include supporting pro-poor market development through computerised milk collection centres, improving access to basic health services through approaches such as telemedicine, e-government services, and improved access to microfinance through smart cards for example. Whilst this is a useful set of examples, it is not clear that they necessarily succeed in benefiting the poor and disadvantaged. This section will draw on more detailed analyses of three areas of ICT application in India to see to what extent the development objective of being pro-poor was achieved in particular projects. A summary of the material in this section is given in Table 2.

ICT Application and Development Goal	Achieved Impact	Further Implications
Health information systems: improved health care for the poor	• Some evidence of limited progress in particular states • But still a long way to go to realise the full potential of health IS in India	• Disjuncture between macro-level policy and micro-level implementation • Difficult of scaling heterogeneous networks of technology, people, processes and institutional context
Telecentres: access to information for better freedom of choice	• Many initiatives with some reported benefits • But problematic issues include financial viability • Poor and disadvantaged often not reached	• Need for alliance of funding agencies, government organisations, NGOs, villagers etc. to create viable long-term projects • Sociology of governance approach
Mobile phones: better economic and social opportunities	• Massive growth in mobile phone ownership in India • But benefits to the poor not clear • Nevertheless some hard evidence of success stories	• High potential for this bottom-up technology • But need for more research work on whether and how mobile phones impact the lives of the poor

Table 2. ICTs to Support Better Lives for the Poor

3.1 Health Information Systems

Primary health care is particularly important in countries such as India with a large poor population dependent on publicly provided health services. The provision of effective primary health care requires detailed data on target populations, on health programmes such as immunisation, on epidemics such as HIV/AIDS, and on tracking and monitoring health care and outcomes over time. Madon et al (2007) argued that information and communication technologies provide an immense potential to support the effective gathering and analysing of health data, and they described the implementation of a computer-based health information system known as HISP (Health Information Systems Program – see Braa et al (2004)) in the Indian state of Andhra Pradesh. The project was started in one pilot district called Kuppam but was later expanded to a wider area and elements of it were then utilised throughout the State. However, its overall impact remained limited in both geographical scope and usage.

Madon et al (2007) drew on this experience and others to argue that there is often a disjuncture between macro-level policy priorities and micro-level implementation of health projects such as HISP. They derived a set of 'key enablers' to try to bridge this gap. Enablers included the provision of infrastructure such as physical buildings and power supply, the need to set targets through local consultation processes, and capacity building at the local level in terms of the capabilities of primary health care workers, doctors etc. Noir and Walsham (2007) drew on research on health information systems in the Indian states of Karnataka and Andhra Pradesh, in addition to field work in the capital New Delhi, and argued that ICTs often plays a mythical or ceremonial role rather than being linked closely to local action.

Examples of this include submitting faulty, inaccurate or missing data in reporting procedures at the local level in order to avoid penalties or other sanctions from superiors at higher levels, where more accurate data might reflect badly on what was happening in the field.

Sahay and Walsham (2006) also drew on the field experience of HISP in Andhra Pradesh to discuss the difficult issue of how to build scalable health information systems that connect macro and micro levels, avoid data being used for ceremonial purposes only, and build effective analytical health capacity at all levels. Scaling is a crucial issue in India where local pilot projects may be successful in a single village for example, but India has over 600,000 villages. The authors argue that scaling of health information systems should not be regarded as primarily a technical problem of expanding ICT provision, although this is important, but as a socio-technical issue involving the scaling of a heterogeneous network of technology, people, processes and the institutional context. It is clear from the published research articles that India still has a long way to go to realise the full potential of ICT and health information systems to support improved health care for the great mass of its people.

3.2   Telecentres

ICT applications in health systems aim to benefit the poor in an indirect way through improved health care provision. A more direct approach to the use of ICTs aimed at bettering the lives of the poor is through the setting up of telecentres. Many telecentre projects were started in India over last decade or so and there is a sizeable research literature on the topic, some of which will be summarised here. For example, Kumar and Best (2006) described the SARI (Sustainable Access in Rural India) project in the state of Tamil Nadu. Some 80 telecentre kiosks were set up offering a range of services including basic computer education, e-mail, web browsing and various e-government services including the provision of certificates. Although the kiosks succeeded initially in delivering the e-government services, many failed subsequently. Kumar and Best identify a range of reasons for the failure including lack of trained staff, movement of key officials and, at a deeper level, opposition from government officials at the local level who perceived a threat from the kiosks to their role, authority and influence in the community and, more darkly, to their opportunities for corruption. In a later paper on the SARI project, Best and Kumar (2008) noted that all the privately run telecentres closed whilst those run by a Non-Governmental Organisation (NGO) did not, largely due to additional financing provided by the NGO to offset losses.

Gollakota (2008) analysed a telecentre kiosk initiative, also in Tamil Nadu, by the sugar manufacturer EID Parry aimed at providing information to farmers, with some of the kiosks being company owned but some operating through kiosk franchisees who were also able to offer more general computer-based services such as Internet browsing, communication services and desk top publishing. Gollakota concluded that better relationships between local farmers and the company were achieved through the project, which had 36 kiosks by 2006, but there were also problems. There were concerns that caste, community and gender influenced access to the kiosks and therefore that the poor and disadvantaged were often not reached by the initiative. In addition, there were serious problems of financial viability for the franchisees since, in poor rural areas, it is difficult to generate adequate revenue to make such a business viable. Rao (2008) examined a wide range of telecentre projects throughout India and echoed this concern about financial viability in addition to issues such as staff capability, community acceptance, and adequate service delivery. Kuriyan et al (2008) examined the extensive Akshaya telecentre project in the state of Kerala, and argued that it is problematic to achieve the twin goals of commercial profitability of telecentres with social development for those at the bottom of the pyramid.

It is clear that telecentre projects are not a simple way to bridge the so-called digital divide for poor people, but nevertheless many authors writing on the topic do not wish to see

their abandonment but look for a more sophisticated way of thinking about and addressing the problems of telecentres. Kanungo (2004) drew on empirical data from a telecentre project in the union territory of Pondicherry to argue the need for social processes that bring together an alliance of funding agencies, government organisations, NGOs, villagers, scientists etc. This focus on actors and governance processes of telecentre projects was also addressed by Madon (2005), drawing on her own field research on the Akshaya project mentioned above. Madon suggested a 'sociology of governance' approach to analysing telecentre projects and processes, focusing on how interactions are managed between a host of players including the government, private entrepreneurs, international donors, telecommunications suppliers, local companies, civil society organisations and individual community members. Rajalekshmi (2007) used a similar theoretical perspective on the Akshaya project, but focused on the important role of the local intermediary in service provision to the community.

3.3   Mobile Phones
There are currently over three billion mobile phones in the world and there are more than twice as many in the poorer compared to the richer countries (Heeks and Jagun 2007). Of course, mobile phone ownership is skewed towards the wealthier groups in poorer societies but nevertheless mobile phone usage amongst the poor is not negligible, in India or elsewhere. Mobile phone ownership in India was estimated to be around 340 million at the end of 2008 with mobile operators currently targeting smaller villages and towns to attract new users (RNCOS 2009). It is also a remarkable bottom-up phenomenon, in that mobile phone ownership and usage results primarily from the aggregate of individual purchasing and use decisions.

The rapid spread of this new technology across the planet has, in large measure, outstripped research on the topic. Nevertheless, Donner (2008) was able to review around 200 studies of mobile phone use in the developing countries. He noted that there were still relatively few detailed studies of rural users and he called for further research which provided a better understanding of linkages between richer and poorer communities, and between rural and urban users. The same author (Donner 2007) provided an example of such work in an Indian context through a study of small businesses in the town of Hyderabad, and the role played by the mobile phone in customer acquisition and retention. He concluded that mobile phones were still not crucial to these small businesses in customer acquisition and retention, and that we should be careful to ascribe major transformative benefits to the mobile phone without hard evidence of how this is achieved.

It is clear that we are at a very early stage in our understanding of the impact of the mobile phone on the lives of the poor, in India and elsewhere in the developing world. An example of work that increases such understanding was provided by Abraham (2007) in his detailed case study of the extensive use of mobile phones in the fishing industry in Kerala. He concluded that there were clear benefits to the fishermen in areas such as responding to market demand, wasting less time and resources and being less isolated and at risk in emergencies. Abraham argued more generally that demand-driven bottom-up interventions are more likely to succeed in developing countries than are top-down ones, and that technologies such as the mobile phone which reduce transaction costs are likely to be better investments than amorphous, ill-defined attempts to bridge the 'digital divide'. Jensen (2007) studied the same fisheries case using different field data and an economics lens, and he also concluded that there were measurable benefits from the mobile phone technology including the complete elimination of waste, a dramatic reduction in price dispersion and an increase in both consumer and producer welfare.

4.   ICTs to Support Improved Government Services

Government remains a crucial player in the context of India, despite the increased emphasis on the private sector in recent years. Central government is based in Delhi, but India is divided into 28 states and 7 union territories, and state governments are responsible for the delivery of many of the government services to citizens. In this section, three aspects of ICT support for the goal of improved government services are discussed: district-level administrative reform; e-government services delivery; and land management through geographical information systems (GIS). A summary of the material in this section is given in Table 3.

ICT Application and Development Goal	Achieved Impact	Further Implications
Computerised back-end administrative systems: more efficient services to citizens	• Relatively marginal impact due to difficulty of changing administrative culture and complex governance structures • Focus shifting to front-end systems	• Culture needs to shift to working more efficiently and creatively but very hard to achieve • Need to consider link between front-end and back-end government systems
E-government direct services: visible direct services	• Some success stories but beneficiaries are mainly the better-off • Computerised systems do not necessarily reduce corruption • Core (back-end) administrative processes may remain untouched	• Pro-poor systems need to have this as a criterion for success rather than financial viability • Corruption and administrative inefficiency need to be addressed in conjunction with technology
Use of GIS: better planning and implementation of infrastructure	• GIS may be something of a mismatch with local cultural attitudes and administrative structures • Top-down projects may fail due to failure to deliver benefits at 'lower levels'	• Need to construct knowledge alliances that integrate top-down scientific knowledge with bottom-up indigenous knowledge

Table 3. ICTs to Support Improved Government Services

4.1   Computerised Back-end Administrative Systems

Early efforts on trying to use ICTs to support improved state-level government in India were focused on back-end administrative systems, and pioneering academic research which traced such initiatives was carried by Madon (1992, 1993) in the Western Indian state of Gujarat. Indian states are divided into districts for administrative purposes and Madon examined the implementation of the Computerised Rural Information Systems Project (CRISP) in the nineteen District Rural Development Agencies (DRDAs) in Gujarat. CRISP was designed to support routine reporting of statistics by the agencies but also more tailored and innovative applications reporting on specific anti-poverty programmes taking place.

Madon (2006) reviewed this early work together with later visits to the DRDAs in 2003. This latter empirical research showed that, if anything, use of computerised systems had regressed in 2003 to its pre-1990s levels, despite improved computing capabilities measured in technical terms. Her explanation for this phenomenon included the diversion of effort away from back-end government administration to front-end government services, which we will examine in the next sub-section. However, she also noted the shift in the whole governance structures over the period from the early 1990s to around 2005, for example in the greatly increased emphasis on the role of NGOs in providing services to citizens. This creates more complex and diverse reporting and accountability structures which complicates the reporting and monitoring role of the DRDAs, reducing the importance of systems such as CRISP.

Bhatnagar (2000) argued that the impact of CRISP, and a second district-level computerisation programme called DISNIC, had been marginal 'because the task of changing the administrative culture is enormous'. Madon (2006) also supported this view but, as already noted, she added the analytical explanation of shifting governance structures. In addition, and perhaps of most interest to looking forward, Madon argued that front-end applications providing government services to citizens are dependent on efficient back-end administrative systems and thus that they should not be considered in isolation to one another. She recognised, however, the difficulty in making fundamental changes to government administrative capacity since, in her words, it is 'not just about training but about developing staff capacity to work creatively in a world of uncertainty'. The next section addresses front-end applications but, as we will see, some researchers follow Madon in questioning whether front-end change alone can produce high value from such initiatives.

4.2   E-Government Direct Services

Many of the states in India have embarked on e-government programmes and initiatives. For example, Krishna and Walsham (2005) described two systems in the state of Andhra Pradesh. The first of these was the Computer-Aided Administration of Registration Department (CARD) system which computerised the registration of property transfers, resulting in significant reductions in processing time. The second was the e-Seva project which set up computerised centres where citizens can pay bills to multiple agencies, register births and deaths, get a passport and so on. The previous manual processes had to be done in different places, involved large amounts of citizen time and often bribery to the desk officials to speed things up.

Krishna and Walsham described these as 'success stories' for e-government and attributed the success to a variety of factors including the hands-on leadership provided by the Chief Minister of Andhra Pradesh, Chandrababu Naidu, the involvement of multiple stakeholder groups such as consultants, government staff and private firms, and the willingness to persist and learn over time. Whilst undoubtedly beneficial to some Indian citizens, the term 'success' is problematic. Dabla (2004) carried out extensive empirical work in Andhra Pradesh and concluded that projects such as CARD and e-Seva were mainly of benefit to urban dwellers and the relatively well-off with few benefits to poor and rural social groups. One of the objectives of the e-government projects was to reduce corruption, namely the payment of bribes to government officials for preferential treatment. However, Caseley (2004) argued that, ironically, CARD reforms had made corruption easier since staff no longer had to find and copy documents by hand, freeing them up to concentrate on extracting additional money from citizens.

Other states in India with substantial e-government initiatives include the southern state of Kerala, as described in an uncritical way by Kumar (2003). In contrast, Vasudevan (2007) provided a rather more nuanced picture of the STAR project in the state of Tamil

Nadu, whose objectives and core technologies were similar to those of the CARD project in Andhra Pradesh. A complementary initiative in Tamil Nadu was REGiNET, a citizen accessible website to find the guideline value of any property in the State. Officials of the Tamil Nadu government claimed that STAR and REGiNET were superior to CARD since they enabled data entry and retrieval in both Tamil, the local language in the State, and English, whereas CARD used only English. In addition, CARD did not provide the online services enabled by REGiNET. However, Vasudevan (2007) qualified this claimed success in Tamil Nadu with the observation that the core processes of document registration were unreformed and that government officials persisted with citizen-unfriendly practices such as not allowing people to sit in government offices, not making prior appointments resulting in long queues, and continuing to solicit bribes

A further case study of e-government, aimed specifically at poor communities, is provided by the Gyandoot project in the drought-prone rural Dhar district of the state of Madhya Pradesh. Sreekumar (2007) described how this started in 2000 with the objective of enhancing participation by citizens and government together in community affairs through creative uses of ICTs, and of ensuring equal access to emerging technologies for the oppressed and exploited segments of society. 40 kiosks were set up in different parts of the Dhar district and they offered a wide set of services such as agricultural prices, online registration of applications, rural email, information regarding government programmes etc. However, Sreekumar observed that the kiosks were mainly used by the literate and middle-income groups and he described three particular case studies on how the complex layers of social power that characterize Indian village society severely limit the potential of an initiative like Gyandoot to provide empowerment for the poor and disadvantaged. An earlier paper by Cecchini and Raina (2004) also concluded that the poor were not participating in the project, and that usage was low. They argued the need for pro-poor services rather than financial viability as a criterion for success, the important role for intermediaries to enable poor people to access e-government applications, and campaigns to raise awareness.

4.3   Use of GIS

Specific technologies seem to offer unique opportunities for improved government activities at the national as well as state level, and GIS are a good example of this. Walsham and Sahay (1999) described a set of 10 GIS projects in India, which took place under the umbrella of the Ministry of Environment and Forests, aimed at using GIS technology to improve land management in selected districts around the country. Systems were developed by 8 different Indian scientific institutions, and some efforts were made to transfer these systems to district level. However, five years after the start of the project, none of the systems was in real working use at district level.

Walsham and Sahay offered some explanations for this lack of success. They argued that India is not a map-based culture and thus that the GIS technology did not match well to Indian approaches to spatial issues, and that the GIS projects attempted to integrate across different agencies with different responsibilities such as agriculture, forestry and roads, whereas Indian agencies at the district level are highly siloed in nature. In addition, the projects were top-down and did not involve 'lower level' people with local knowledge. More generally, these projects could be taken as examples of top-down technology-push ICT projects through alliances of western vendors and indigenous government and scientific elites, which fail to deliver benefits to those at the bottom of the pyramid. Such failures are all too common, as reported in the broader literature on ICTs in developing countries (Heeks 2002).

A later study by Puri (2007) painted a somewhat brighter picture of future opportunities through GIS. Puri examined a GIS project in the district of Anantpur in the state

of Andhra Pradesh. This project respected the need to recognise the knowledge that communities have of the land that they inhabit, in addition to the potential benefits of GIS technologies. Puri described how the project involved participatory mapping carried out by the local villagers, the results of which were then incorporated in the GIS. The project was regarded as successful in that the GIS was utilised to help generate improved approaches to land management practices. Puri argued that the case study demonstrated the need to construct knowledge alliances that integrate top-down scientific knowledge with bottom-up indigenous knowledge. Such approaches require, however, a relatively enlightened view on the part of Indian government officials and GIS scientists in placing value on the local knowledge of 'low status' villagers.

5.   ICTs to Support Enhanced Internal Economic Activity

There is some evidence in the literature (Arora and Athreye 2002) that the ICT outsourcing boom has had a positive knock-on effect on other firms and institutions in India. This section examines the literature on ICT adoption in internal economic activity in India to see what evidence there is for the effective use of ICT in Indian firms and economic supply chains, excluding the highly successful export-oriented ICT services industry. A summary of the material in this section is given in Table 4.

ICT Application and Development Goal	Achieved Impact	Further Implications
Internet banking and e-commerce: better financial services to citizens and businesses	• New private sector banks use ICTs to provide greatly improved service • Some evidence of knock-on effect on public sector banks	• Better banking systems do not eradicate poverty but can create a better supporting environment for development
Adoption of ICTs in private sector companies: more efficient enterprises	• Limited research on this topic • Some evidence of increased adoption of ICTs	• More research needed, not just on ICT adoption, but whether and how this supports enhanced economic performance
ICT in agricultural supply chains: improved efficiency in the key sector of agriculture	• India's largest rural ICT initiative helps farmers to better market their produce and cut out middlemen	• Benefits tend to go to the better-off rather than women, small farmers, agricultural labourers, lower castes etc.

Table 4. ICTs to Support Enhanced Internal Economic Activity

5.1   Internet Banking and E-Commerce

Kannabiran and Narayan (2005) argued that the economic liberalization of the 1990s in India and the opening up of the economy to foreign competition, which had major positive effects on the ICT services industry, put great pressure on the Indian banking industry to improve its services. New private sector banks were created during this period and the business models of these banks revolved around a strong ICT backbone. The authors described a case study of one these new banks, to which they gave the fictitious name of the International Hope Bank (IHB). They detailed how IHB used ICTs to provide Internet banking facilities to its customers and e-commerce capabilities for both B2C and B2B applications. Some major challenges were encountered on issues such as computer security and providing adequate

bandwidth on a reliable basis, but the overall conclusion was that IHB was providing a greatly improved service to its customers through its use of ICTs.

Kannabiran and Narayan ended their article with a discussion of the wider implications for development in India. Although the new banks such as IHB have made a difference, the majority of banking market share in India rests with the large state-owned banks who have not responded to changed customer needs with the same speed and agility as IHB. However, in recent years, these public sector banks have significantly increased their spending on ICTs and business transformation in order to compete with the private sector banks such as IHB. The authors argued that an improved technology backbone would enable the traditional banks to better perform their role of financial intermediation and credit disbursement to the rural areas. In addition, the authors noted that the Reserve Bank of India, the country's central bank, was starting to use ICTs more effectively, for example in a state-of-the-art real-time gross settlement system to handle all large value payments across the country electronically that puts further pressure on the traditional banks to upgrade their systems and processes. The authors considered that such approaches would not eradicate poverty by themselves but would create a more supportive environment for the goal of accelerating economic growth across India as a whole.

5.2   Adoption of ICTs in Private Sector Companies

Tarafdar and Vaidya (2004) described a research study of 18 Indian firms with respect to their adoption of electronic commerce. These firms were from a wide range of sectors including banks and other financial institutions, courier and distribution services, industrial product companies, and educational and consultant services. The authors derived three key sets of drivers for the adoption of e-commerce related to pressures from the external environment, problems in organisational performance, and internal proactive actions. A later article by the same authors (Tarafdar and Vaidya 2006a) analysed e-commerce adoption by four firms in the financial services industry, focusing in more detail than their first paper on the role of top management, aspects of organisational culture, characteristics of IS professionals employed by the firm, and organization structure. A third paper, again by the same authors (Tarafdar and Vaidya 2006b), looked at more general ICT adoption by nine Indian organisations and identified three categories of firms which they labelled innovative, enlightened and reluctant users of information technology and systems.

The authors of these research studies argued that there is a dearth of research on the adoption of ICT in Indian firms and thus that their studies provided some valuable data and analysis of this topic, although they noted the limitations of relatively small sample studies. Two other qualifications are as follows. Firstly, the authors do not cross-reference their own earlier papers so that it is impossible to tell whether these studies are built on the same data or whether they describe multiple data sets. Secondly, and more importantly, the papers seem to accept ICTs as a good thing, and do not examine the question as to whether more technology use produces better performance.

5.3   ICT in Agricultural Supply Chains

A specific in-depth case study of the use of ICTs to improve economic performance was provided by Kumar (2004). This paper described 'India's largest rural ICT initiative known as eChoupal'. It was started in 2000 by the India Tobacco Company and involved the setting up of large numbers of village Internet kiosks, or eChoupals, initially in the state of Madhya Pradesh. The scope of the project was extensive and by 2006 involved around 36000 villages in 6 Indian states, each eChoupal covering around 6 villages (UNDP 2006). The eChoupals are run by local entrepreneurs and provide futures' price information to farmers, in local languages, enabling them to sell their produce directly to the India Tobacco Company,

bypassing the middlemen and wholesale markets. Kumar (2004) analysed the financial sustainability of the project and concluded that it had a payback period for the company of about 4 years.

The value of the project to the company was in reengineering the agricultural supply chain in a way that was beneficial to them in financial terms. The company also claimed (UNDP 2006) that this built the capacity of the farmers to participate in the supply chain and to make effective use of ICTs. Kumar, however, gave a rather more qualified analysis of this issue. His interviews at village level suggested that caste affiliations, political alignments, and size of one's farm influenced access to eChoupals and thus to what extent individual farmers were better off. This is not an argument against eChoupals per se, but Kumar noted that further research was needed to understand the impact of eChoupals on the lives of rural women, small and medium-sized farms, agricultural labourers, lower castes, and the destitute.

6.   ICTs to Support Improved Civil Society

This section examines the literature on ICTs to support improvements in the functioning of civil society, through such means as increased transparency, reduced corruption and information for empowerment of the disadvantaged. A summary of the material in this section is given in Table 5.

ICT Application and Development Goal	Achieved Impact	Further Implications
Computerised records in land reform: increased efficiency and reduced corruption	• Increased transparency • But not necessarily less corruption • And did not benefit landless farmers	• Systems may be aligned to view of development as increased efficiency rather than wider development goals of benefiting less advantaged people in rural areas
Empowering slum dwellers and other local communities through information and ICTS: improved social and political participation of disadvantaged groups	• NGOs acting an information intermediary for slum dwellers • Letting local communities choose which technologies to use	• Importance of mediation role for disadvantaged groups • Need for local indigenous approach to supporting communities with information and ICTs
Provision of broader information on civil society: information as means to affect negative attitudes such as apathy and indifference	• Successful ICT sector could help provide information about underdogs in Indian society • Some evidence of informational exchange between rich and poor groups in Bangalore	• Negligence of the suffering of others perhaps only sustainable when we know little about it

Table 5. ICTs to Support Improved Civil Society

6.1   Computerised Records in Land Reform

Cecchini and Scott (2003) identified computerised land records as one of the potential benefits to Indian citizens through increased transparency, less corruption, better delivery of government services and greater government responsiveness. However, as we have seen in

the earlier examples of CARD in Andhra Pradesh, and STAR and REGiNET in Tamil Nadu, this potential is not always realised. The computerisation of one or more elements of the whole process of the production, registration and transfer of documents does not always produce quicker response overall, reduced corruption or increased transparency of the whole process.

A further detailed empirical example in this area was provided by Prakash and De' (2007) in their description of Bhoomi, a land record computerisation project in the state of Karnataka. They linked the computerisation of land records to wider objectives of land reform in India, and noted that inaccurate land records have been a means of manipulation for powerful sections of Indian society and a cause of rural conflicts and unrest. The Bhoomi system created a database of about 20 million records and a linked document called an RTC (record of rights, tenancy and crops). The RTC had previously been issued through a manual process by a village accountant but, with the Bhoomi system, farmers had to travel to the sub-district headquarters and receive their RTC certificate through a Bhoomi kiosk.

All of this seems at first sight to offer increased transparency and less scope for local corruption. However, Prakash and De' used their extensive field data to demonstrate that it is not as simple as this. Firstly, the Bhoomi system computerised only one document in the overall land registration process, leaving a range of other documents on land title, cadastral maps etc. unaffected and unavailable to the scrutiny of citizens. Secondly, the computerised RTC certificates benefit land-owning farmers only, since landless farmers often have an unofficial sanction to the lands they farm, and do not interact with the Bhoomi system. Thirdly, transparency should not always be seen as beneficial, since the authors noted that the visibility of the RTC records enabled land sharks in some cases to better target vulnerable farmers. Prakash and De' linked their reservations concerning the Bhoomi system to broader issues of development, arguing that the system was aligned to a view of development as increased efficiency, whereas it did not contribute to wider development goals of capacity building and increased choice for people in rural areas, especially small and landless farmers.

6.2   Empowering Slum Dwellers and Other Local Communities Through Information and ICTs

A large disadvantaged group in Indian society are the slum dwellers in the mega-cities and other urban centres, estimated to number over 60 million (Buckley et al 2007). Madon and Sahay (2002) argued that one element of this disadvantage is the lack of two-way information flow between slum dwellers and government officials. This results in government actions, for example in the provision or urban services and infrastructure, being disconnected from the needs of the slum dwellers. In addition, slum dwellers are often unaware of what government services and facilities are available and how they can access them. Madon and Sahay noted that a growing number of grass-roots NGOs have tried to address this situation by acting as an intermediary, and they described a case study of an NGO called Jana Sahayog working in the slums of Bangalore and using an information-based model of NGO-mediated intervention.

Jana Sahayog used a variety of means to carry out their role including the production of audiotapes to present the world of slum dwellers as seen by them, a vernacular monthly newspaper covering issues of concern to slum dwellers and the maintenance of a web site to enlist the interest and support of activists, researchers and others. Whilst relatively small scale, the model of information-based mediation is an interesting one of potential value in other contexts in India and elsewhere. Indeed, Beck et al (2004) compared the Jana Sahayog initiative to a case of mediation for a marginalised group in Sweden to argue the importance of the mediation role of government agencies, NGOs and international agencies in trying to

draw disadvantaged groups into having a more participative and engaged part to play in the information society.

Srinivasan (2006) extended these ideas of mediation for communities more generally by arguing that ICT-based initiatives need to engage such communities without pre-identifying development goals. Rather, he argued that it is important to adopt a model and methodology of engaging communities to develop and articulate their own goals of information access and thus, ultimately, an indigenous approach towards cultural, political and economic aspects of development. Srinivasan described the initial stages of trying to implement such an approach in the Village Incubator project in Southern India. The intention was to engage with two village communities in Andhra Pradesh and Tamil Nadu through a partner NGO. The plan was to introduce video and other technologies, but in a non-doctrinaire way as to the potential value of these technologies to the community. The value would be allowed to emerge through community meetings and other forms of dialogue.

6.3   Provision of Broader Information on Civil Society

Ezer (2006) argued that Indian students and professors in higher educational institutions tend to see ICT as supporting their personal goals and the success of the modern sector in India, not development for the poor. The author labels the broader indifference of the privileged towards the poor as Ghandi's third assassination to follow his actual murder and the Indian nuclear test of 1998. In a similar vein, Angell and Ezer (2006) described the Indian wealthy and middle class as the 'new barbarians' and argued that they have enormous desire to succeed in the global economy with little consideration for the needs of the poorer masses of Indian people.

Not everyone would agree with these generalisations, although there are undoubtedly significant numbers of Indians who perceive India as a success story based solely on economic growth rates and the consequent advantages to the relatively wealthy and educated. However, there are many challenges to this view of the world from within India itself, for example from the actions of some of the people described in the case studies in this paper. The Nobel prize-winning economist Amartya Sen gave a talk to the Indian ICT industry organisation NASSCOM (Sen 2008) in which he argued that the ICT industry could and should do a lot for India's poor, going beyond trickle-down effects and individual philanthropy.

A key way in which Sen believed that the successful ICT sector could help would be in a contribution to the systematisation, digestion and dissemination of diverse clusters of information about the lives of the underdogs in Indian society. He argued that negligence of the suffering of others is sustainable only when we know little about that suffering. More information in itself can go a long way to breaking the chains of apathy and indifference. In a related but more specific way, Madon and Sahay (2001) discussed the linkages between poor and wealthy groups within the city of Bangalore, arguing that local processes were intertwined with global influences in that city, and that poor groups were increasingly involved in complex alliances, some with richer and more powerful groups. This network of relationships offers strong possibilities for informational exchange, dissemination and subsequent action.

7.   DISCUSSION AND CONCLUSIONS

This paper has addressed the research question as to what development goals have been achieved in India to date through the use of ICTs beyond the export-oriented ICT services industry. One way to summarise an answer to this question is to refer to Sen's (1999) list of five types of 'development freedoms' which he regards as important in going beyond simplistic development measures such as gross national product. These are political

freedoms, economic facilities, social opportunities, transparency guarantees and protective security.

Following this framework, the literature analysed in this paper suggests that ICTs have contributed to 'economic facilities' through initiatives such as telecentres, the use of mobile phones for farmers and others, improved agricultural supply chains, and better banking services. There are also some early signs of contribution of ICTs to improved health care which Sen argues is a key condition for an individual being able to benefit from economic facilities. 'Social opportunities' have been generated through the widespread use of mobile phones and the more limited use of telecentres. Examples of Sen's category of 'transparency guarantees' can be seen in the visibility of computerised land records, and e-government services for the payment of bills. The contribution of ICTs to 'political freedoms' can be seen as rather limited to date, but with early examples of NGOs empowering slum dwellers through the provision of improved information.

What problems have been encountered in trying to use ICTs to support the achievement of development goals? A first problem relates to who benefits from the technology and the answer that comes across in a consistent way from the literature is almost always not the very poor, landless farmers, lower castes or sometimes women. Initiatives such as telecentres, e-government direct services, ICT-facilitated agricultural supply chains and computerised land reform tend to benefit those who are already in a relatively privileged position. It is also noticeable that the poorer Indian states such as Bihar and Orissa are not mentioned at all in the ICT-based literature in contrast to reported work in relatively richer states such as Kerala, Andhra Pradesh or Gujarat.

A second problem is that many of the ICT initiatives are limited in scope and scaling them up to deal with whole states or the whole country involves a complex socio-political process that is very difficult indeed. For example, cases of the beneficial use of mobile phones, such as in the Keralan fisheries industry discussed earlier, are interesting but, as yet, do not demonstrate a widespread and scalable development effect across the country as a whole. Initiatives to improve health information systems in India require wholesale change across the entire health system in terms of the way in which work is carried out and recorded, people's attitudes to information and its use, and issues of hierarchy and control.

This leads on to a third problem which can be argued to be the most fundamental for ICT-based initiatives aimed at development. Many of the studies reported in this paper emphasised the crucial need for major attitudinal and institutional change in order for an ICT-based initiative to be successful. For example, core administrative processes need to be reformed in government institutions in order for the front-end e-government services to be effective. However, it is widely recognised that such reform of the administrative culture in government is enormously difficult to achieve. Computerised systems, such as those involved in land registration for example, do not by themselves reduce corruption if this is deeply embedded within existing attitudes and processes.

So what can be said, more generally, about the future role of ICTs in the broader development of India? It is clear from the analysis in this paper that ICTs are not a 'silver bullet' that solves development problems in isolation from broader social reform. On the other hand, ICTs are not unimportant in many areas and sectors of Indian society and this influence is likely to increase in the future through the growing global pervasiveness of technology. A more sophisticated view of technology in India than that of silver bullet or irrelevance is to see ICTs as potentially important actors in heterogenous networks of people, organisations, technology and institutions (Latour 2005). In a similar vein, Avgerou (2008) suggests the need for ICT implementation in developing countries to be viewed as 'a process of techno-organisational intervention associated with global politics and economics'.

ICTs should not, therefore, be viewed as magic solutions to endemic and deep-seated problems of inequity and disadvantage in India. Rather, ICTs should be seen as an integral part of development policies and projects aimed at bettering the lives of all Indians, including the poor and disadvantaged. For example, as described by the National Rural Health Mission (NRHM 2009) in India, health care reform needs to include many interlinked elements such as increases in public expenditure, changes in organisational structure, and strengthening of manpower capabilities. However, improved health data and its use in computerised health information systems is also viewed by the NRHM as a key element of health reform. ICTs are a necessary but not sufficient step towards achievement of the development goal of improved health for the poor in India. Similarly, ICTs can be contributors towards many other development goals in India but only through their integration in wider sociotechnical interventions.

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