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An overview of growth in the ICT sector in India: can this growth be pro-poor?

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Abstract

This paper presents a review of the growth of the ICT sector in India and explores the possible impact on poverty – more specifically rural poverty within the country. Given the early stages of expansion of the ICT sector in developing countries, the literature on its impact on poverty reduction is at a rudimentary stage. The paper identifies issues critical to examining if ICT in developing countries has implicit poverty reduction pathways. The discussions are based on the Indian experience. The identified areas bear potential for further research into ICT growth and poverty reduction in line with the millennium development goals.

The current literature on the growth of the ICT sector in India is reviewed followed by a discussion on who the poor are, what is their interface if any with the local ICT sector and what is meant by pro-poor growth. It is envisaged that profiling the ICT sector and the poor will lay the pre-requisites to benefit from the growth in the ICT in developing countries. The process will first highlight ICT features that can be incorporated in the development policies. Areas where the poor are most disadvantaged are identified next. A discussion, exploring how the integration of ICT might be harnessed to overcome areas of disadvantage for the poor follows. The paper proposes possible channels and transmission mechanisms of benefit from the ICT growth to the poor in India.

Key words: ICT, rural poverty, pro-poor growth, India,

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1. Introduction

Amidst growing evidence that ICT can play a constructive role in development (Indjikian and Seigel, 2005, Chapman et al., 2003; Heeks 2002; Heeks 1999; Hongladarom 2004; Mansell and When, 1998; Panos, 1998; World Bank, 1998), this paper explores the possible impact of ICT growth on rural poverty in India. The Indian economy is currently growing at an annual rate of 10% year-on-year and has experienced average annual growth of 6% for the last two decades (The Economist, 2004;176; World Bank, 2001; 69). The ICT sector represents nearly 3 percent of the country's GDP (NASSCOM, 2002). The software development component of the ICT sector in particular has expanded at a significant pace in the last ten years. The software exports are increasingly becoming an important source of foreign exchange in the country. An attempt is made in this paper to understand the extent to which the rural poor in the country are benefiting from this growth.

The 'digital-divide' underpins much of the ongoing discourse on whether ICT can be harnessed for mitigating poverty in developing countries. The 'digital-divide' debate owes its origins to sceptics like Bill Gates who argue that the poor living on less than $1 a day have no need for ICTs (McNamara, 2003;4). The proponents of ICTs (UNCTAD, 2003) on the other hand would consider ICTs as tools that can be used to provide the poor economic opportunity and improvement in human well-being (Sen, 1985). The World Bank (WDR, 2001) identified three critical areas in poverty reduction efforts: opportunity, empowerment and security. Since then vast amounts of resources have been invested (UNCTAD, 2003;1) in ICTs in many developing countries. The objective of this investment was: to enhance opportunities by improving access to market and health care, to empower the poor by expanding their use of public services and increase security by widening access to micro-finance.

To what extent are these objectives being met? Data and research on the economic consequences of ICT in developing countries is at its infancy. Within this background the methodology adopted to understand and examine the possible impact of ICT growth on poverty in India is as follows: the paper reviews the available literature on the growth of the ICT sector in India and traces its evolution in section 2. This is followed by a discussion on poverty in India – rural and urban in section 3. The current discourse on what is meant by pro-poor growth is considered next. The key issues and indicators of pro-poor growth are then grounded within the Indian context. It is envisaged that by contextualising pro-poor growth, the investigation of whether growth

in the ICT sector has the potential to be pro-poor in India will capture the indigenous reference points. This is done by looking at the application of ICT in poverty reduction programmes adopted across many states in India in section 4. Although a crucial step – evidence based analysis and any definitive conclusions are restricted due to the early stages of implementation. The purpose of this study is to identify issues that are critical to examining if investment in ICT in developing countries has implicit poverty reduction pathways based on the Indian experience. This has implications for further research into ICT growth and poverty reduction in line with the Millennium Development Goals. Section 5 presents the conclusions of the paper.

2. The ICT sector in India

The growth of the ICT sector in India was given the impetus during the economic reforms that began in India in 1992. While achievement in some sectors, including the ICT sector have been noteworthy, India remains one of the most protected economies in the world using proxies such as average tariffs (World Bank, 2001;14). In the last decade since reform began the per capita income growth has been impressive at 3-5% a year leading to a doubling of GDP per capita over the period from US$882 to US$1780 (PPP, 1985 base year) (World Bank, 2001; 69; World Bank, 2002). Yet the country has a low human development index ranking of 127 with a HDI value of 0.59 (UNDP, 2004;141).

The origin of the ICT sector in India and its rapid growth are situated in the culmination of multiple factors during the 1980s and the early 1990s. These were a combination of global market forces, changing political ideologies and the growing numbers of skilled English speaking labour in the country. Prior to the mid 1980s, the political regimes were inward looking and restrictive to the growth of the private sector (Patnaik and Candrashekhar, 1998;67-91, Ghosh, 1998). By the mid 1980s the political ideology in the country was changing in favour of outward looking economic policies. The liberalisation and the economic reforms were well underway in India by the early 1990s. Two other events were taking place simultaneously.

By the late 1980s nearly 150,000 English speaking highly skilled engineers were graduating in India with limited domestic demand (Arora et al., 2001;1270). The ICT revolution in the West especially in the United States was spreading and creating new opportunities around the same time. All three events resulted in the formation of a

number of Indian firms that responded to this growing demand. The number of Indian software firms grew from just 38 in 1988 to over 545 in 1999 with employment figures rising from 90,000 to 250,000 in the same period (ibid, NASSCOM, 2002). The export revenue of the software industry has risen from $130 million in 1990 to almost $8 billion in 2001 (D'Costa, 2003;211). India's balance of payment (BoP) in the fiscal year 2003-04 experienced a steep positive growth of 85.04 percent year-on-year basis (GoI, 2005). In terms of US$ the balance of payments stood at US$ 31.42 billion compared with US$ 16.98 billion in the previous fiscal year. This is largely attributable to the growth in the export revenue from the ICT sector. The rapid pace of expansion has led the World Bank to identify it as the model for exhibiting the potential of the private sector in India (World Bank, 2001; 6).

The ICT sector in India comprises three main sub-sectors. These are: the software industry – domestic[1] and exports, domestic computer maintenance services and business process outsourcing (BPO). The ICT sector as a whole represents 2.87% of the country's GDP while software exports make up over 16% of the total exports (NASSCOM, 2002). The National IT Task Force has set an annual export target of $50 billion and domestic target of $35 billion by 2008. The unique feature of the software industry is the dominance of the export oriented strategy. 65% of the total software revenue is generated through exports (Arora, 2001). This is of particular significance given India's tradition of restrictive and inward looking stance on industry[2].

The domestic and export markets exhibit distinct features in terms of the type of software and the stage of software development. Findings of a field study of the software industry (Arora et al. 2001; 1273) note that the domestic projects are larger[3] and at times more challenging than the export projects. Development of Indian dialect word processing has not been very successful and is at a very rudimentary stage[4]. The same study also notes, that while the trend is rapidly changing, until recently the export package comprised products of low design, coding, testing and customised software for some developing countries. The industry serves a wide domain consisting of banking,

[1] Domestic export revenue totalled $2.5 billion in 2001-02 (NASSCOM, 2002)
[2] Despite the opening up of the economy in the early 1990s, many sectors reflect the country's long legacy of heavy regulation and protection (World Bank, 2001; 14).
[3] The screen based trading of the Bombay Stock Exchange and the Reservation system for Indian Railways are example of large scale projects served by the domestic software industry.
[4] This is an important issue in considering the benefits of ICT technologies for the poor who can best communicate in the local dialect only. See next section for details. There are over 20 dialects spoken in India (GoI, 1991).

warehousing, education, medical, manufacturing and transport to name a few (UNCTAD, 2003; 141, Arora et al. 2001; 1273).

The mushrooming of business process outsourcing (BPO) services in developing countries is the outcome of globalisation of the world economy (UNCTAD, 2003, D'Costa, 2002c, Correa, 1996). The opening of economies has facilitated the firms based in the US and Europe to not only tap into the pool of cheap skilled labour but also benefit from the much lower infrastructure costs (Gartner, 2003)[5].

Surprising as it may seem, India has succeeded to date in capturing 80% of the international outsourcing market (UNCTAD, 2003; 135). An English speaking skilled workforce and savings linked to lower wages are major factors contributing to the growth of BPO in India (D'Costa, 2002c, Joseph, 2002). The bulk of the BPO clients are from the US and over a quarter from Europe – mainly the United Kingdom (UNCTAD, 2003; 138). The revenue from BPO in India in 2002 reached $2.3 billion (NASSCOM, 2003). The current workforce of 100, 000 in the BPO industry in India is expected to increase over ten times to 1.1 million by 2008 (Wipro, 2003).

What implications does the expansion of the ICT sector discussed above have for the country in terms of capital accumulation and human development? Factors important in exploring this question are the regional variations and the uneven spread of the ICT industry in India. The ICT sector is highly technical skill-intensive and requires command over English[6]. It is therefore located in urban pockets that are situated in areas of 'regional advantage' as noted by (Saxenian, 1994).

The three southern states of Karnataka, Tamil Nadu and Andhra Pradesh continue to dominate the ICT industry in terms of the human capital[7]. A recent World Bank study (World Bank, 2000; 47) found that with just 23.35% of the country's population, the three states are home to the largest proportion of the country's engineering institutions – 51% of degree level and 31% of diploma. All three states have around 80 percent urban adult literacy and all have above average HDI ranking amongst the 35 Indian states (GoI, 2001; 188,141, Dreze and Sen, 1998). The capitals

[5] It is estimated that average salaries of IT workers in developing countries are lower by up to 80% of comparable workers in developed countries (UNCTAD, 2003, p. 135). D'Costa (2003, p. 218) notes that Indian salaries in various IT services are between 7-40 percent of the US industry figures. Arora et al. (2001; 1275) indicate that one person-year onsite work is billed at about $90,000-$100,000 while comparable offshore work is billed at about $25,000-$35,000.

[6] In the absence of strong software development in the Indian dialects (Arora et al., 2001), English is used as a medium to operate the ICT sector in India.

[7] 36% of the ICT firms in the country are located in these three states and generate a revenue of 36% (NASSOM, 1998).

of these states – Bangalore, Chennai and Hyderabad have emerged as the major ICT centres in the country. Maharashtra and to a lesser extent Gujarat, both western states, are the only other regions in the country to match the southern ICT clusters in terms of the total firms and revenue[8] (World Bank, 2000; 48). The northern and eastern regions remain sterile of any significant ICT clusters with the exception of the technology park around New Delhi (Arora, 2001;1272).

The divergent regional dimensions are rooted in a wide range of factors. These include: the traditional political urban bias, the upper class value system focused towards professional training, a more rigid and slow changing socio-cultural order in the northern states where modern higher education is slowly being made accessible by all. (Bharadwaj, 1995, Bhalla, 1995).

The continuing concentration of ICT firms in the southern and western urban clusters may be viewed as reinforcing the regional economic imbalance in the country. D'Costa (2003;216) argues that the trend of some Indian firms them selves becoming MNCs while narrows the gap with their foreign counter parts, exacerbates the capital accumulation gap with other Indian firms. The success of the clusters has in turn provided a further impetus to expanding the technical education base in these states.

In short, the growth of the ICT sector in India is centred on selected urban clusters. The growth has been good for the economy though not without contention. The clustering of the industry has not only polarised rural India but also generated regional imbalances and uneven development (D'Costa, 2003).

The next section explores whether the growth in India's ICT sector, predicted to be a major player in the global ICT market, can include the 433 million of her people living below one dollar a day in future. A discourse on the potential of this being the beginning an era of a more inclusive development process in India in line with the Millennium Development Goals follows next. Some of the ICT pathways that are being made integral to policies geared towards mitigating poverty in rural and urban India are reviewed to study the impact on poverty.

3. The ICT growth and poverty: Is this growth pro-poor?

The digital divide is not as pronounced anywhere amongst the global ICT players as it is

[8] 30% of the ICT firms are in the western ICT cluster and generated approximately 41% of the revenue (NASSCOM, 1998).

in India. An overview of the digital divide through selected indicators shown in Table 1 illustrates the regional disparities. Countries in South Asia and Sub-Saharan Africa are indicative of the current level of the digital divide in the poorest developing countries. A comparison of India with Israel, Ireland and the US is considered in Table 2 to focus on India's digital divide status amongst the ICT global players[9]. The meaning of digital divide adopted here is not restricted to the 'differences in technology diffusion' (Chinn and Fairlie, 2004;1). It also incorporates some of the identified causes (Dasgupta et al., 2001, Wallsten, 2003) for these differences. In particular, levels of income and human capital amongst the global ICT players are compared to study the existing digital divide.

At the regional level, when compared with countries of South Asia and Sub-Saharan Africa, India is ahead in the ICT 'diffusion' indicators. Though it is far behind its economic rival China. High proportion of rural population with low literacy is a distinct feature of most developing countries. This may aggravate the participation of people with low skills in a high skill intensity ICT sector. The digital divide can further widen if a large section of the population remains unable to participate in the ICT sector. The purpose though is not to highlight India's performance in the developing world. The focus here is on India's digital divide among countries with which it is competing in the global ICT market. In addition to the ICT 'diffusion' indicators, Table 2 gives income and human capital indicators for India, Israel, Ireland and the US. India's GNI per capita is a meagre $460 as compared with Ireland's $22,850 and Israel's $16,750 (World Bank, 2001;56-57). The dominance of rural agricultural population in India (72%) unlike in Israel (8%) and Ireland (41%) indicates the high proportion of the labour that is unable to participate in the skill intensive ICT sector. The high percentage of rural population perhaps also weakens the overall diffusion indicators where India is significantly behind its competitors. In relative terms India's pool of human capital required for the ICT sector is almost half that of Ireland and less than a quarter of Israel. The absolute number of software engineers though is higher in India due to the high population base. The ICT sector in India has emerged as primarily an urban industry due to the skill requirements, as discussed in the previous section. In short, the digital divide between India and her ICT competitors stands wide and indicates the polarised spread of the ICT sector in the country.

[9] During the 1990s India had 16% of the global software market, NASSCOM projected India's share to rise to almost 25% by 2003 (Arora et al., 2003; 1269). At present the Indian software industry is at par with the Irish and Israeli software industry in terms of revenue and export.

Table 1: The Digital Divide in South Asia, Sub-Saharan Africa and China (2001)

Country/region	Computers per 100	Internet users per 100	Telephone lines per 100*	GNI per capita US $	Population	Literacy (2002) (% ages 15 and above)
India	0.58	0.68	3.8	460	1.2bn (72%)	63.1
Pakistan	0.41	0.34	2.3	420	144 mn (67%)	41.5
Bangladesh	0.19	0.14	0.4	360	131 mn (74%)	41.1
China	1.90	2.57	13.7	890	1.3 bn (63%)	90.9
South Africa	6.9	28	11.2	2820	43.2 mn	86.0
South Asia	0.5	0.6	-	-	-	-
Sub-Saharan Africa	1.0	0.7	-	-	-	-

Population figures in brackets indicate % of rural population

Source: International Telecommunications Union (2001), World Bank (2001), HDR (2004)

*Telephone lines may become less important as the 3G mobile technology becomes affordable.

Table 2: Digital divide indicators for India, Israel, Ireland and the US (2001)

Country	Computers per 100	Internet users per 100	Telephone lines per 100	GNI per capita US $	Export Revenue US $	Engineers per 10,000 (1999)*	Population (% of rural population)
India	0.58	0.68	3.8	460	7.5 bn	40	1.1 bn (72%)
Israel	24.6	27	47.6	16,750	2.8bn	135	6.4 mn (8%)
Ireland	39.1	32.8	48.5	22,850	8.0 bn	75**	3.8 mn (41%)
US	62.5	50.1	66.7	34,380	300 bn***	18	285 mn (23%)

*The Economist, 20th February, 1999, **approximate figure, calculated by total software engineers/population

***Approximate figure, includes domestic software revenue for some firms.

Source: International Telecommunications Union (2003), World Bank (2001), UNCTAD(2003)

Poverty reduction in India will affect the 2015 Millennium Development Goals because no other country is home to more of the world's poor. More than a third (36%) - 433 million - of the world's dollar-a-day poor (1993 PPP line) reside in India (260 million

on the national poverty line), a fifth of the world's children not in primary school are in India and India is home to a quarter of the world's under five year old deaths and a quarter of maternal deaths each year. Of India's poor the overwhelming majority - 75% are rural of which the overwhelming majority - 80% are dependent on agriculture (Deaton and Dreze, 2001;126; Datt and Ravallion, 2002;1; World Bank, 2001; 7, 9, 11, 35). The rural and urban adult literacy levels in 2001 census year were 57% (44% for females) and 80% (73% for females) respectively with an overall average of 65% (GOI, 2002; 186-188). The following section examines whether growth in the ICT sector can benefit a largely rural population with low literacy levels.

While India aspires to capture a significant proportion of the ICT global market by 2008 (NASSCOM, 2002)[10], 72% of the country's population with 56% literacy (43% female literacy) continues to live in the rural sector. Of the agricultural rural population 62 percent of households operate holdings under 2.0 hectares (1991) and the 22 percent rural households are landless (1991), in all 84 percent of the rural households can be characterised by a low non-labour and physical asset base (Tiwari, 2001). Although there are significant variations at inter state levels, low-income households with poor ownership bundles continue to dominate the population in rural India (Ravallion and Datt, 2002, Dreze and Sen, 1989).

Four areas where the rural poor in India are most disadvantaged are: education, gender disparities, health and nutrition. Although literacy has improved in India[11], many countries including China and Indonesia have overtaken India in literacy rates (World Bank, 2001; 22)[12]. At the current literacy rate of 2.75% per annum India will take 16 years to catch up with Sri Lanka's literacy rate of 90% (ibid.).

Gender inequalities in education are more visible in rural India than in urban India. For example rural female literacy is 46.5 % as compared with 73% urban female literacy. The primary school enrolment for girls in the rural sector is just 42% (GoI, 2001;204-205).

While rural infant mortality had decreased from 123 (1981) to 79 by mid 1990s, access to primary health care remains scarce. On an average there is one primary

[10] Arora et al. note that according to Dataquest (31 July 1996, 43-44) India has 16% of the global market in customised software development.
[11] From under 18% in 1951 to 65% in 2001 (World Bank, 2001; 22)
[12] In the 1950s China had comparable low literacy levels. Dreze and Loh (1995) point out to the virtual elimination of illiteracy in the younger age groups in China. Indonesia has achieved 85% literacy with 80% female literacy as compared with just India's 54% female literacy in 2001 (World Bank, 2001; 23, GoI, 2001; 186).

health centre per 27,364 rural persons in India (GoI, 2001; 259). Malnutrition continues to be an acute problem in India despite the absence of severe epidemics, famines and war related adversities. 53% of children below 4 years continue to be severely malnourished (World Bank, 2001; 23).

In summary, poverty in India is characterised by the following unique features. Poverty is increasingly becoming a rural phenomenon. 75% of India's poor live in the rural sector of which the overwhelming majority - 80% are dependent on agriculture as noted earlier in page 2. The rural adult literacy at 57% (44% for females) is much lower than urban literacy at 80% (73% for females) (GOI, 2002; 186-188). Rural areas consistently have worse health outcomes in terms of infant mortality, maternal deaths and access to primary health care. Furthermore gender inequalities in terms of socio-economic and schooling opportunities are more pronounced in the rural sector. Can the ICT growth in India then benefit the majority of the country's population - the rural poor?

An exhaustive review of the growing debate on whether ICT growth gives rise to polarised societies and its impact on poverty is given in Adeya (2002). Two schools of thought emerge from the numerous studies that contribute to the discourse. First, the view that ICTs widen the economic divergence between developing and developed countries (Braga, 1998, Brown, 2001, Chowdhary, 2000). While others support the view that ICTs can be harnessed to meet economic and human development goals (Barlow, 1998, Hudson, 2001, Kibati, 1999). Lately each view has been subjected to further scrutiny and debate. The former is examined for not only widening the digital divide between countries but also within countries – as discussed in the present paper. The latter view has attracted intense input on how the ICTs maybe integrated into the development strategy to mitigate poverty (World Bank, 2002, James, 2003, UNCTAD, 2003). The present paper discusses this within the Indian context. A more fundamental issue here is the understanding of the type of growth that may benefit the poor.

In recent literature the debate on the nature and characteristics of growth that may benefit the poor has gained much momentum (Dollar and Kraay, 2002, Ravallion and Chen, 2003, Ravallion, 2004). The term increasingly being used to describe this is 'pro-poor growth'. The many definitions of the term (Kakwani and Pernia, 2000, Baulch and McCullock, 2000) fall into two broad categories. One, where the poor benefit directly through rise in incomes such that the headcount ratio declines. The other, where the poor benefit through reductions in the inequality measures. The outcome of a crude

application[13] of either of the definitions to the ICT growth can be speculated. Over the last decade growth in the ICT sector in India has been phenomenal, propelled mostly through export earnings (detailed discussion given in section 2 of this paper). The industry remains localised in 5 urban centres – Bangalore, Hyderabad, Chennai, Mumbai and Delhi. Linkages with the rural economy appear to be nonexistent as demonstrated by the findings of a field survey (Pigato, 2001). The study indicates that as late as 2001 radios were the only type of technology owned by most rural poor and the access to computer or the internet was rare. Informal networks through friends, family and local leaders were most relied for information. In a context of such sparse diffusion and ownership of technology, it appears that the benefits of the ICT growth have yet to reach the rural poor. The inequality measures between rural and urban populations have possibly worsened given the higher accessibility of IT services in the urban sector[14] in contrast to the rural sector. From the observations noted above with reference to the second definition of pro-poor growth, it can be concluded that ICT growth in its current format is not pro-poor. In the absence of empirical studies to quantify the impact of ICT growth on poverty reduction the verdict on the first definition of pro-poor growth is inconclusive. There is need for meticulous empirical work to establish definitive outcomes of the impact of ICT growth on rural poverty in terms of the decline in the headcount ratio.

4. ICTs in Poverty Reduction Strategies: How might the ICT growth be made pro-poor?

In recognition of the existing gap between the skills of the rural population and those needed for benefiting from the ICTs, a national ICT strategy has been formulated (UNCTAD, 2003; 63-65). The purpose of national ICT programmes is a stocktake exercise geared towards identifying sectors that may benefit through ICTs. These then form the basis for policy and strategy formulation (UNCTAD, 2003, 65). In most developing countries, as in India the focus of the national strategies is to explore ways of using ICTs to reduce poverty in line with the Millennium Development Goals (UNCTAD, 2003; 63, Joseph, 2002) and become integral to the PRSPs.

[13] In the absence of data that can be subjected to robust empirical analysis, the conclusions are drawn from speculated discussions based on overall poverty trends.

[14] Benefits to the economy are contested on the grounds of regional disparities (D'Costa, 2001) and 'Dutch Disease' (Joseph, 2002 ; 15-17).

Within the context of rural India ICTs are being extensively applied in numerous sectors to overcome the digital divide to reach the poor in mitigating poverty. The objective is to enhance opportunities for the poor. These include improving access to information and health care, to empower them by increasing their use of government services and to provide security through access to microfinance (PREM, 2002).

The World Bank's Poverty Reduction and Economic Management Network (World Bank, 2002) through its experiences in rural India has identified projects where ICTs are entwined in the programmes. The Gujarat computerized milk collection is an example of pro-poor market development. This system ensures fair prices and immediate payments to small farmers. The small farmers could neither afford the 10-day lag in payments nor the hardship imposed through underpayments in the old system. The use of handheld computers provided by InfoDev sponsored India Health Care Delivery Project in Andhra Pradesh is intended to cut time spent on collecting and registering data. The freed time would allow the midwives[15] to expand administering immunizations, offer advice on family planning and educate people on mother-child health programmes. Since January 2000, a government owned computer network – Gyandoot has been launched in Madhya Pradesh. The objective is to improve the accessibility and use of government services by the rural poor. This is done by reducing the time and money villagers spend in communicating with government officials through Intranet kiosks network. The kiosks are able to provide a wide range of documentation for a minimal fee. This not only saves time and effort in commuting to the nearest government office but also to avoid the practice of bribing the officials. The introduction of smart cards to facilitate microfinance to the poor is based on holding the credit profiles of the clients and reducing transaction costs. Swayam Krishi Sangam (SKS), a microfinance institution in Andhra Pradesh expects to lower the cost of delivering by eliminating paperwork, reducing errors and fraud. A summary of these projects is given in Table 3a.

These are but a few examples of the numerous ICT based projects being implemented in many states in India. Again there are significant regional variations (Bhatnagar, 2000). The results of these efforts are inconclusive primarily because such projects are still at very early stages and data on the impact of ICTs on poverty reduction is at infancy (McNamara, 2003; 3). Some recent fieldwork (Kumar, 2004;

[15] Midwives provide most health services in rural India covering up to 5,000 per midwife across multiple villages (World Bank, 2001).

Meera, et al., 2004) has been carried to study the performance of ICT projects in agriculture (summary given in Table 3b). Kumar (2004) has evaluated the financial sustainability of India's largest rural ICT initiative known as eChoupals. Meera et al. (2004) have examined three rural projects aimed at improving the information delivery systems in agriculture (Gyandoot, Warana and iKisaan). The eChoupals are distinct in their focus on the agricultural sector through providing the necessary crop and market related information to the farmers. The study concludes that eChoupals can be useful and financially viable providing these are viewed as tools to enable the exchange of information. Meera et al. (2004) found that majority of the primary users were literate, male, young farmers though the effective reach of a government project in marginal areas to the illiterate and poor is noted. The study concludes that the investigated projects were overall beneficial to the farmers. However, an area where much work remains to be done is the gender participation in rural ICT projects. The study observed poor engagement of women farmers in all three projects.

Table 3a: Examples of pro-poor projects using ICTs

Project	State	Objective
Computerised milk collection	Gujarat	Fair prices and immediate payments to small farmers
India Health Care Delivery Project	Andhra Pradesh	Minimise registering time to enable expansion of immunisations, family planning & mother + child health programmes.
Gyandoot	Madhya Pradesh	Improve access and use of government services by the rural poor
Swayam Krishi Sangam	Andhra Pradesh	Microfinance institution to lower cost of delivery by eliminating paperwork, reducing errors and fraud

Source: PREM (World Bank, 2002)

Table 3b: Summary of fieldwork studies by Kumar (2004) and Meera et. al. (2004)

Project	Sector	Objective	Performance	Key points
echopals (Kumar, 2004)	Agriculture	To provide crop & market related information to the farmers	Useful provided viewed as tools to enable the exchange of information	- poor engagement of women farmers - primary users were literate, young male farmers
Gyandoot, Warana and iKisaan (Meera, Jhamtani, & Rao, 2004)	Agriculture	To improve information delivery system in agriculture	Overall beneficial to the farmers	- sparse reach to the illiterate & marginal farmers noted

The above noted projects are part of the national ICT strategies where the aim is to reach the poor and make the development process an inclusive one (UNCTAD, 2003; 63-65). The challenge is whether this can be achieved within the Indian context. In the past leakages and misappropriation of subsidies to the rich have tended to exclude the

poor from the development process (Bhalla, 1993, Chelliah, 1999, World Bank, 1991) in India. Many projects that provide Internet access in rural India end up benefiting the middle-class and educated men (World Bank, 2002). Women's restricted mobility, their lack of education and sometimes, male dominance over information have tended to exclude them from these projects. The development of software in the local dialects has been slow as pointed earlier. This has been a significant obstacle to the use of ICTs by the rural population (World Bank, 2002). The picture-based software is being adopted but a large number of user interface issues remain unresolved.

Some areas where further research maybe useful to overcome the difficulties are: (1) development of a more user friendly interface combining the local dialect and the picture based software, (2) incorporating local knowledge and conditions. This may prevent outside control and top-down approaches (Cecchini, 2004), factors that were attributed to the failure of the e-governance programme in Rajasthan. Two areas that appear to be critical in the success of these newly emerging programmes are rural literacy and inclusion of women.

A possible conceptual framework for ICT growth to be good for poverty reduction can be hypothesized. The model Sumner (2005;6-8) for FDI-poverty linkages could be transposed to ICT-poverty linkages. For example, for ICT growth to be good for the overall economy there must be a positive net transfers to the macro-economic accounts. For ICT growth to be good for poverty reduction there need to be net positive transfers at microeconomic levels. These can be through positive local spillovers to the indigenous economy. Evidence from the growth of the ICT sector in India through the impressive increase in the export revenue and BoP discussed in section 2 suggests a positive outcome on the macro-economic accounts. Conditions for positive spillovers to the rural economy where 80% of India's poor live are discussed below.

Given the low rural literacy levels as discussed in section 3 and Table 1, the rural sector is largely devoid of the technical skill-intensive base required for the 'take-off' of the ICT sector. The positive spillovers can therefore be only indirect. Proponents of 'growth is good for poor' in recent literature as seen in the work of Dollar and Kraay (2002) would argue the following: Since the income of poor rises proportionally with average per capita income growth, the benefits of the ICT growth would be reflected in the incomes of 80% of India's poor who live in the rural sector. Further more as growth in itself is sufficient for poverty reduction, concerns regarding pro-poor growth are unnecessary. This view assumes that economic growth is shared. The assumption

remains one of the most contested issues in development studies (White and Anderson, 2001, Dagdeviren et al., 2001). It is argued that the share of the growth the poor draw depends on their initial share in the national income. In India, the majority of poor who live in rural areas have a minute share in the country's national income[16] (Chelliah and Sudarshan,1999;62). The indirect benefits of ICT growth that the rural poor can avail would therefore remain small.

One of the impacts of the ICT growth on the indigenous economy has been to expand the demand for skilled labour. With the predicted growth of ICT in India the demand for skilled workers is expected to increase to over ten times by 2008 (Wipro, 2003). What opportunity is there for the rural workforce to bridge the digital divide discussed in section 3 and participate in the ICT growth? For this to occur, the ICTs will need to be embedded in the development strategy in line with the increasing recognition of its role in development (Chapman et al., 2003; Heeks 2002; Heeks 1999; Hongladarom 2004; Mansell and When, 1998; Panos, 1998; World Bank, 1998). In particular, mainstreaming ICT as tools to contribute in (1) the process of providing healthcare and education at lower cost and greater coverage (2) facilitating access to information amongst the excluded groups (3) enhancing the use of public services (4) strengthening the capacities of local groups, local governance and decentralization (5) promoting the partnership between NGOs, government and the local communities to achieve poverty reduction.

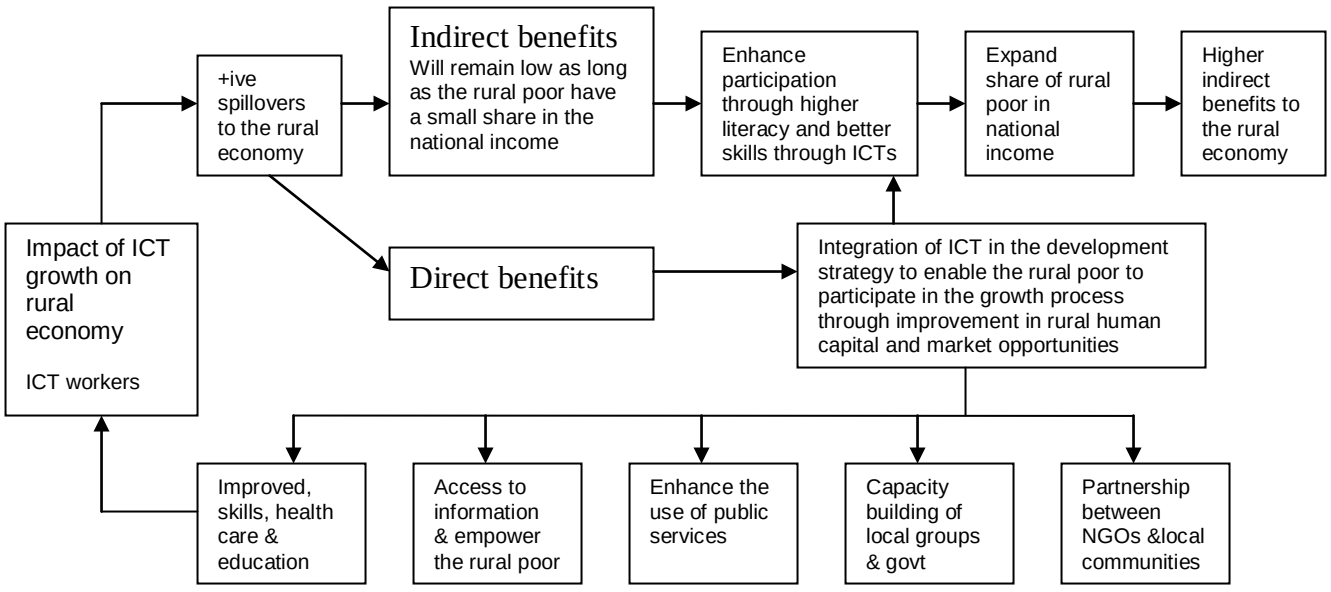
Integration of ICT into the Poverty Reduction Strategy Papers (PRSPs) along the lines suggested above can have positive vertical and inter-sectoral linkages. The concept of linkages and economic growth originally put forward by Hirshman (1958) has been applied within the Indian context by Mellor (1976). More recently Sumner (2005;7) has discussed these to illustrate the spillovers of FDI to the indigenous economy. In the context of ICTs these could include backward linkages between the economy and local communities through higher participation of the local skilled labour. Forward linkages between the economy and rural communities could be through outsourcing to the rural sector. The available pool of skilled labour has been a crucial factor in India's global competitive advantage in the ICT sector as noted in section 2. The expansion of skilled labour can exert a downward pressure on the costs and further reinforce India's position

[16] 58 % rural households have incomes upto Rs 20,000, 27% have incomes between Rs 20,000 – 40,000, 12% between Rs 40,000-86,000 and just 3% households have incomes over Rs 86,000 (Chelliah and Sudarshan,1999;63).

in the global ICT market. There might also be positive horizontal and intra-sectoral spillovers through increased competition and the adoption of new products and technologies. The local firms may further expand their capacities to export.

Some pathways for how the ICT growth might be made pro-poor can be conceptualised further. Section 3 illustrates the digital divide in India not only in terms of diffusion of technology but also the skills and literacy gap. Positive spillovers of ICT discussed above are based on the availability of skilled labour. The digital divide in India reflects a different situation – especially with respect to the rural sector. The necessary condition for benefits of ICT growth to be realised therefore would be the deployment of ICTs to enable the improvement of rural human capital and increase participation in market opportunities[17]. In addition, for ICT to be good for (income) poverty reduction, ICT needs to have a positive impact on employment, income, wages and income inequality. ICT can benefit the rural sector by creating jobs indirectly and directly. Indirectly, by improving the skill base of rural labour through higher literacy and better health care thus stimulating the economy to generate employment opportunities. It can create jobs directly through horizontal and vertical linkages with local ICT firms. By helping to increase participation and empowerment of excluded groups it has the potential to reduce income inequality. Further more, its most unique feature is rooted in

Figure 1 Conceptual framework showing possible ICT – Rural Poverty linkages



[17] This is grounded in the debate on the Capability approach to multi-dimensional poverty put forward by Sen (1999;1,8)

its ability to narrow the digital divide that is inherent in its interface with the rural population with low literacy and skills.In short, many of the conceptual benefits of ICT to poverty reduction and inclusive development are linked to a variety of other factors. These include: the integration of ICTs in the development policy to achieve the identified target and harnessing the role of ICTs as enabler of development as well as enhancer of capacity building at the individual, community and societal levels. A summary of the conceptual linkages between ICT and rural poverty proposed above is indicated in Figure 1.

Conclusion

There is growing consensus on the positive role of ICTs in the development process in the literature. The success story of India's ICT sector is well documented. The emergence of ICTs as separate identity within the private sector in the Indian economy since the 1990s is a significant achievement. Prior to this period the political regimes in India were inward looking and restrictive to the growth of the private sector. A combination of changing political ideologies, global market forces and the growing numbers of skilled English speaking labour in the country catapulted the ICT sector in the global arena. The industry has not only generated the much needed export revenue but also contributed to India's healthy current account balance. The Indian ICT industry is arguably on its way to becoming a strong global player in the software and BPO sectors. It continues to provide employment opportunities for India's high-tech skilled labour. Just twenty years ago, the indigenous demand for this group was limited. The rapid pace of expansion has led the World Bank to identify it as the model for exhibiting the potential of the private sector in India (World Bank, 2001; 6).

So why question the impact of the ICT growth in India? In recent literature, the views of the proponents of 'growth is sufficient' have been contested and come under intense criticism. The search for pro-poor growth has gained much support and momentum in the current literature. The evidence for the ICT sector - though very rudimentary and in much need of further research, suggests that the ICT growth in India may not be pro-poor. This presents cause for concern and tension between the pro-growth school and pro-poor growth school with respect to poverty reduction. India is home to the largest number of the world's dollar-a-day poor (433 million), a fifth of the world's children not in primary school live in India and a quarter of the world's under five

year old deaths and a quarter of maternal deaths each year happen in India. Both income and capability poverty reduction in India will affect the 2015 Millennium Development Goals.

The purpose therefore to examine the impact of ICT growth and to understand how it might be made pro-poor is three folds. First, 72% of India's population with 56% literacy lives in the rural sector. It is important to understand the impact ICT growth has on the majority of the Indian population. Further more, poverty reduction in India can significantly affect the Millennium Development Goals. Second, the digital divide is not as pronounced amongst the global ICT players as it is in India. In terms of both diffusion of technology and the skills/literacy gap India fares worst and most polarised amidst her competitors – Ireland and Israel. Third, there is a possibility that India's poorest groups would be excluded from the benefits of new technology for the third time since independence in 1947.[18] The growing extensive application of ICTs in poverty reduction strategies in the country is encouraging. The process is at its infancy. It also faces the challenges of focusing the benefits to the most disadvantaged groups. Women participation remains very low in the ICT projects in all rural areas. Additionally, the slow progress in the development of software in the local dialects and picture-based software has been a significant obstacle to the use of ICTs by the rural population. These concerns need to be addressed in order to further the integration of ICTs in the development process.

This paper has attempted to conceptualise some pathways for suggesting how the ICT growth might be made pro-poor. The digital divide in India reflects not only the inequalities in diffusion of technology but also the skills and literacy gap. Positive spillovers of ICT are based on the availability of skilled labour. The necessary condition for benefits of ICT growth to be realised is therefore the deployment of ICTs to improve the rural human capital and increase participation. Further more, the sector is unique in it ability to narrow the digital divide that is inherent in its interface with the rural population with low literacy and skills. Some areas where further research maybe useful to overcome the difficulties are: (1) development of a more user friendly interface combining the local dialect and the picture based software, (2) incorporating local knowledge and conditions.

[18] The first being the post-independence industrialisation and planning process through the 1950 s to mid 1960s (See for example Rao, 1998), the second being the Green Revolution in the mid 1960s (Ghosh, 1998).

There is potential to overcome the obstacles through research in the identified areas. Given the global interest and support in poverty reduction, India has an opportunity through ICTs to make the development process an inclusive one.

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