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Regional Human Development Report

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Promoting ICT for Human Development in Asia 2004

Realising the Millennium Development Goals

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Promoting ICT for Human Development in Asia

Realising the Millennium Development Goals

INDIA

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Preface

Information and Communication Technologies (ICTs) have become an indispensable tool in the fight against world poverty. In the Asia-Pacific region, ICTs have changed the course of development providing nations with an unprecedented opportunity to meet vital development goals such as poverty reduction, basic healthcare, and education, far more effectively than before. Nations that succeed in harnessing the potential of ICTs can look forward to greatly expanded economic growth, dramatically improved human welfare and stronger forms of democratic governance.

The benefits of ICTs, however, have not progressed at the same pace across countries. Some countries have succeeded in harnessing the potential of ICT for human development better than others. ICTs have also created a digital divide, for example between rich and poor, males and females, rural and urban areas, etc. Connectivity, infrastructure, human capacity, knowledge creation and exchange, underpinned by cohesive national e-strategies feeding into national development plans, remain a daunting challenge. Efforts are needed to ensure level playing fields and encourage strategic and effective use of ICTs to further human development and help eradicate poverty and inequality.

The India Country Study was initiated with the aim of examining the question of how best can ICTs be used to bring about social transformation and development; specifically, what are the ways in which ICTs can be harnessed to best address the key critical concerns and sectors of human development - poverty eradication, healthcare, education, human resources and environmental management and economic development.

In order to operationalise a conceptual framework to assess the role and impact of ICTs on human development across the Asia-Pacific region, the Study drew upon the United Nations' Millennium Development Goals (MDGs) which establish clear targets against which ICT for human development can be assessed. The MDGs consist of eight global goals accepted by the world's leaders at the Millennium Summit in September 2000. These offer us a comprehensive framework to track progress towards specific aspects of human development.

This Country Study reviews and assesses progress made in India in drafting and implementing its national e-policies and e-strategies towards the country's national development goals and targets and the eight MDGs. This Country Study is one of nine studies in the Asia-Pacific region undertaken to feed into the Regional Human Development Report on "Promoting ICT for Human Development in Asia".

It is fair to say that India is one of the strong actors in the field of ICTs in Asia. This has been possible because the Government of India has ensured a conducive environment for diffusion of ICTs and their use for development through appropriate policies and programmes, legal reforms and the setting up of a National Task Force on IT and Software Development.

The performance of India's ICT sector is also widely held up as an example of the significant and positive effects that the ICT revolution can have for development. India is a pioneer in a number of ICT for development initiatives such as land records, service delivery, telemedicine, and disaster mitigation. State Governments in India and NGOs have been important actors in these initiatives.

However, there are also some important challenges for the use of ICT for human development in India. The Study emphasizes that use of ICT for development with the aim of realising the country's development goals is constrained in particular by India's socio-economic context. Although expansion of connectivity has been significant, availability of ICT services is still limited, and there is a need for encouraging public-private partnerships to ensure greater equality through full coverage for all and to reduce rich-poor, urban-rural inequalities.

This Study traces ICTs in India and highlights initiatives in the field by referring to the most recent data. The Study not only illustrates the successes of ICT initiatives, but more importantly also attempts to identify gaps and constraints in the implementation of ICT strategies through analysis of concrete initiatives at the ground level. The Study highlights that multi-stakeholder partnerships need to be encouraged for successful e-initiatives that can ensure the use of ICT for increasing access to information, improving service delivery and promoting greater transparency and accountability. Using ICTs in poverty reduction is a relatively new approach, and therefore it is important that lessons are drawn from failures and successes, so that the potential of ICT for human development is fully harnessed.

Maxine Olson
UN Resident Coordinator &
UNDP Resident Representative

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We hope this Study will contribute to a better understanding of the role, implications and impact of ICTs in development.

Abbreviations

AIIMS : All-India Institute of Medical Sciences
ANMs : Auxiliary Nurse Midwives
APSWAN : Andhra Pradesh State-Wide Network
ATMs : Automated Teller Machines
BSNL : Bharat Sanchar Nigam Limited
BSS : Behavioural Surveillance Survey
CAPART : Council for Advancement of People's Action and Rural Technology
CBOs : Community-Based Organisations
CCUs : Cardiac Care Units
CDMA : Code Division Multiple Access
CMR : Child Mortality Rate
CSOs : Civil Society Organisations
DBI : Digital Broadcast Initiative (UNDP)
DCM : Delhi Cloth Mills
DELs : Direct Exchange Lines
DISK : Dairy Information System Kiosk
DPEP : District Primary Education Programme
DSL : Digital Subscriber Line
DTP : Desktop Publishing
ECIL : Electronics Corporation of India Limited
FOOD : Foundation of Occupational Development
GDP : Gross Domestic Product
GSM : Global System for Mobile Communication
HCL : Hindustan Computers Limited
HIV/AIDS : Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HP : Hewlett Packard
IBM : International Business Machines
ICL : International Computers Limited
ICTs : Information and Communication Technologies
IDACs : Information Acquisition and Dissemination Centres
IMR : Infant Mortality Rate
INSAT : Indian National Satellite System
ISDN : Integrated Services Digital Network
ISRO : Indian Space Research Organisation
IT : Information Technology
KMVS : Kutch Mahila Vikas Sanghatan
LCD : Liquid Crystal Display
MACTCS : Mutually Aided Cooperative Thrift and Credit Societies
MANAGE : National Institute for Agricultural Extension Management
Mbts/sec : Megabits per second
MDGs : Millennium Development Goals
MEERP : Maharashtra Emergency Earthquake Rehabilitation Project
MROs : Mandal Revenue Offices
MSSRF : M.S. Swaminathan Research Foundation
NACO : National Aids Control Organisation
NFHS : National Family Health Survey
NGO : Non-Governmental Organisation
NSS : National Sample Survey
NSSO : National Sample Survey Organisation
OECD : Organisation for Economic Cooperation and Development
OGL : Open General License
PCL : Pertech Computers Limited
PCOs : Public Call Offices
PCOs : Personal Computer
PDA : Personal Digital Assistant
PMP : Phased Manufacturing Programme
PWN+ : Positive Women's Network of South India
RASI : Rural Access to Services through the Internet
READ : Rural Education and Action Development
SAATHII : Solidarity and Action Against the HIV Infection in India
SEWA : Self-Employed Women's' Association
STD/ISD : Subscriber Trunk Dialing/International Subscriber Dialing
TB : Tuberculosis
TVSE : TVS Electronics
UNAIDS : Joint United Nations Programme on HIV/AIDS
UNDP : United Nations Development Programme
UNICEF : United Nations Children's Fund
VPTs : Village Public Telephones
WHO : World Health Organisation
YASHADA : Yashwantrao Chavan Academy of Development Administration

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Executive Summary

1. Like all new technologies that are not just incremental, but revolutionary in their impact, the spread of information and communication technologies (ICTs) have received a mixed response. While fears of a widening digital divide have been rightly expressed in many quarters, there is considerable interest in the prospect of using those technologies for alleviating poverty and advancing human development goals in developing countries.

2. That interest is reflected in the many experiments with the actual application of ICT for development purposes. While a few of these are relatively large in scale and some others have the potential for being scaled up from their current pilot status, most are of relatively recent origin and are yet to establish themselves as being viable and/or economically sustainable. An analysis of those experiments is a prerequisite for any effort aimed at replicating and scaling up these pioneering, pilot projects, with a view to ensuring that the technology makes a difference from a human development point of view.

3. Human development involves expanding people's choices so that they can improve the quality of their lives. While this objective is large in scope, the Millennium Development Goals (MDGs) identified by the declaration adopted by the Millennium Summit of the United Nations General Assembly have helped focus the challenge facing developing countries and their development partners. The MDGs provide a time bound road map for achievement on the human development front. This study adopts the MDGs as the framework for assessment of advance on the human development front and, in keeping with the requirements of that road map, it seeks to examine ways in which ICTs can be used in India to realise the stated, time-bound goals in different sectors.

4. The promise that the ICT revolution holds for development in poor countries takes three forms. First, it is expected to result in the growth and diversification of the ICT sector itself, leading to the rapid expansion of output and employment. Second, the use of ICTs in the agricultural, non-ICT manufacturing and services sectors is expected to fundamentally transform the nature of production in these sectors with major implications in terms of labour productivity, growth and employment. Third, the penetration of ICTs into activities outside of production is expected to reshape the way work, markets and leisure will be organised and the way in which individuals and communities can trade and access information and services, leading to changes in the structure of markets, improvements in the quality of life, a deepening of democracy and major advances in terms of human development indicators.

ICT Diffusion

5. Crucial to the realisation of these benefits is a more widespread and deeper diffusion of the technology. Unfortunately, in areas other than television, while diffusion is on the increase, the reach of the technology in a country like India is still very limited. Telephone density, which was 0.03 lines per 100 people in 1951 rose to 1.39 in 1994, when a more liberalised telecommunications policy was put in place. Since then, the telephone density figure has risen quite rapidly, but it only touched 2.86 on March

31, 2000. Subsequently, expansion has been rapid, with teledensity touching 3.64 lines per 100 people on March 31, 2001, 4.4 on March 31, 2002 and 5 as on March 31, 2003. However, because of a high degree of urban concentration, teledensity in rural India in 1999 was just 0.4 lines per 100 people. Rural and urban teledensity were 0.93 and 10.16 respectively on March 31, 2001. Rural teledensity, which crossed one per hundred in 2002, stood at 1.49, when urban teledensity was placed at 15.49. Inter-regional variations were also substantial. As on March 31, 2003 while total teledensity in the state of Delhi was 26.85, that in Bihar was as low as 1.32.

6. With telephones yet to reach all of India's villages, internet spread is also limited. The International Telecommunications Union estimates that in 2001 India had a total of 3.2 million internet subscribers and 7 million internet users. In terms of internet spread or the number of users per 100 inhabitants, India with 0.7 was behind China (2.6) and way below Hong Kong (38.5), Korea (52.1) and Singapore (36.3). The number of internet users in 2002 was estimated by the National Readership Survey at close to 7 million. However, users are geographically extremely concentrated.

Ensuring Connectivity

7. This limited and uneven spread makes the diffusion of the new technology an important element of the ICT for Development agenda. There is considerable work underway to increase access, so as to permit the realisation of the potential that ICT holds for development. The principal objectives of such work include cutting the cost of connectivity, reducing hardware costs and developing software in the Indian languages so as to overcome the barrier that language creates.

8. Consider, for example, the Warana "wired village" project jointly implemented by the National Informatics Centre (acting on behalf of the central government), the Government of Maharashtra and the Warana *Vibhag Shikshan Mandal* under the educational department. The estimated cost of the project of around $600,000 (Rs.2.6 crores) was also jointly financed by the central government (50 per cent), the Government of Maharashtra (40 per cent) and the *Warana Vibhag Shikshan Mandal* (10 per cent). If costs remain where they were in schemes like the Warana project, which the government's IT Task Force has recommended should be replicated across India's villages, the effort to accelerate penetration would of course be impossibly expensive. The Warana project, which connected and computerised a cluster of 70 villages, was estimated to have cost $600,000. There were, at the time around 550,000 villages across India. If the cost of replicating the experiment across these villages remains the same, the total would work out to around $4.7 billion. This amounts to a little more than 1 per cent of India's GDP in 2000. However, when extended to cover dispersed villages across the country the actual cost would be substantially more. We must recall that public expenditure on elementary education as a proportion of GNP stood at 1.5 per cent in 1995-96. Whether resources should be drawn away to wire India's villages when most children are not in school is a question that is bound to be asked.

9. New technological experiments as with the corDECT WLL technology are indeed promising substantial cost reductions. The technology, which was originally developed and is still being improved upon by the TeNet group at the Indian Institute of Technology, Chennai, seeks to substantially reduce the cost of telephone and internet access in the rural areas of the country, using wireless technology that can sit on top of the extensive (25,000 strong) rural exchange network of the Bharat Sanchar Nigam Limited. With seventy per cent of that network connected on fibre, the TeNet group argues that a wireless system with a 10 kilometre range, if installed at an existing fibre connected exchange, can help reach a telephone and internet connection to 80-85 per cent of India's villages.

10. Besides connectivity costs, another area of concern is the cost of hardware. While tariff and excise duty reduction has helped bring down the cost of the PC, it still is unaffordable from the point of view of reaching IT to the mass of the population in a poor country like India. This makes a second set of initiatives aimed at reducing hardware costs quite crucial as well. One acclaimed example of such initiatives is the Simputer project of Picopeta Simputers Private Limited.

11. The third set of initiatives aimed at increasing access is reducing software costs and developing software in the Indian languages. A crucial component of the effort at reducing costs is the open source software movement. It is now widely accepted that initial software costs and costs of upgrading software can be substantial if ICT for development projects depend solely on proprietary software. This has generated some interest in using open source software which though not "free" can be much less expensive. At least one Indian state government, the government of Madhya Pradesh, has publicly announced its decision to use Linux software in its official IT programme, which includes its e-governance (Gyandoot) and computer-enabled school education (Headstart) initiatives.

12. Significant progress has been made with regard to developing software packages in Indian languages. An example of a successful effort is that of Chennai Kavigal (Sood 2002), which is a software company based in Chennai, Tamil Nadu that has developed a range of products such as an advanced word processor (*Padhami*), a business suite (*Shakthi*) and an accounting and billing package (*Vanigam*) in Tamil. Both the Simputer and the iStation are loaded with software in local languages, and there is a range of organisations making advances on this front.

Experiments with ICT4D

13. While work along these directions progresses, the degree of penetration of the new technology or the level of its diffusion is still hardly adequate to implement large scale projects aimed at using ICT for human development purposes. Thus what we have is a set of experiments that are more in the nature of pilot projects. The number of experiments is indeed large. An ongoing database being collated by IT for Change, Bangalore already recorded 144 projects in 2003, and many more await inclusion. These projects provide the blueprints for programmes whose full realisation must await the creation of the requisite infrastructure.

14. These experiments fall into different categories. The first category of experiments aims at exploiting the information collation, storage and transmission facilities that the technology offers to increase access to information, enhance transparency and encourage the sharing of information needed for wider mobilisation and strengthened advocacy. A second category of initiatives seeks to increase the productivity and efficiency of projects designed to improve the conditions of the disadvantaged, so as to improve the quality and reduce the costs of programmes seeking to advance human development, thereby enhancing their impact and rendering them sustainable. Finally, there are experiments seeking to use the interactive, information transmission capabilities of the technology to ensure remote delivery of crucial services such as education and health. Needless to say, there are projects which fall in more than one of these categories.

Transmission Mechanisms

15. There are many routes through which this direct impact on human development is expected to occur, once access to the technology is provided to the people, independent of their social and economic standing, and to decision-makers concerned with furthering human development goals. First, since the ICT revolution allows for collection, collation, storage and transfer of information, diffusion of the technology can:

    - Help the disadvantaged to access services that increase their productivity and income.

- Ensure that the disadvantaged obtain better returns for their produce.
- Reduce the vulnerability of the disadvantaged to shocks.
- Allow the disadvantaged to remotely access online education and training programmes to increase their capabilities.
- Strengthen the ability of the disadvantaged to access information on government policies and programmes, official and community-based support systems, and on their rights as citizens, all of which help increase their participation in the shaping of a better social and political order.
- Empower the disadvantaged and those advocating their cause through using the technology and its outcomes, such as the internet, to share information, forge alternatives, organise and lobby with and against the powerful.

Second, ICTs allow the government and civil society organisations (CSOs) to obtain, collate, store and analyse information in ways that improve decision-making and facilitate implementation of policies that improve the quality of life of the people at large and the disadvantaged in particular.

Finally, the government, CSOs and private agencies can use ICTs to deliver a range of services such as agricultural extension services and health services. This not only improves the efficiency of service delivery, but it also in many instances increases the transparency in government-citizen transactions that help improve the quality and effectiveness of services delivered.

ICT for Poverty Reduction

16. Direct and indirect impacts of this kind are sought to be achieved through projects in areas that are covered by the goals and targets that the Millennium Declaration specifies. The persistence of widespread poverty and hunger are among the principal disappointments with the post-Independence development experience in India. As a result, more than five decades later, when the government claims that a change in regime that affords a larger role for markets and a smaller role for the State in development would place India on a new growth trajectory, the importance of public action to deal with poverty and vulnerability has only increased. Even official estimates, widely regarded as overly optimistic, estimate the number of poor in India at 260 million. No other indicator of performance can neutralise the critique that figure provides of the development process.

17. A brief survey of the literature on the incidence, determinants and routes to alleviation of poverty suggest that poverty reduction is predicated on (i) a relatively egalitarian path of growth; (ii) increases in agricultural productivity that help raise wages and keep food prices under control; (iii) expansion of non-agricultural employment, including in rural areas; and (iv) direct public action in the form of poverty eradication programmes aimed at generating productive employment for the poor.

18. ICTs direct contribution to poverty reduction can come either through the employment generating effects of ICT diffusion into poor rural and urban areas or through its effects on enhancing returns from economic activities undertaken by poorer households. Its indirect contribution can come through facilitating and reducing the costs of delivery of services that either promote wage- and self-employment or help overcome structural constraints to the realisation of the poverty alleviation effects of particular projects. It could also contribute by improving the quality of employment generating and poverty alleviating programmes being implemented by the government.

19. There are, indeed, reasons to believe that by facilitating decentralised and (entrepreneur-wise) distributed or diffused growth, the technology can bundle income increases with reduced inequality that can have poverty alleviating consequences. Further, as mentioned earlier, besides increased wage employment at higher wage rates in the

agricultural sector, an expansion of non-agricultural employment is crucial to reducing poverty even in rural areas. The effort to use ICTs in poverty alleviation must thus focus on the new opportunities for micro-entrepreneurship that information technologies offer.

20. The second direct contribution to poverty alleviation that ICTs can make is by increasing the magnitude and reducing the vulnerability of returns earned by small producers from their economic activities. Though structural constraints like indebtedness can work to neutralise benefits, access to information that helps obtain better prices for their produce, identifies the location of fish shoals, warns fisher folk of storms at sea and facilitates the prevention or treatment of crop or animal disease are all examples where such benefits can be delivered by the technology.

21. The direct effects of ICTs on poverty reduction can also come through a reorganisation of economic activity that allows producers increase their returns. A striking case of such effects is the introduction of ICT devices into the management of operations of the National Dairy Development Board in Gujarat.

22. Besides the direct contribution that ICTs can make to alleviating poverty, it can contribute indirectly in two ways: (i) by facilitating and reducing the costs of delivery of services that either promote wage- and self employment or help overcome structural constraints to the realisation of the poverty alleviation effects of particular projects; and (ii) by smoothing the process of delivery and by improving the monitoring of both the delivery and effects of projects being implemented by the government through e-governance.

23. There are a few over-arching lessons that are being derived from experiments with ICT for poverty reduction. It appears that ICT applications developed by or in collaboration with local staff are more likely to suit local conditions and to be sustainable. Outside control and top-down approaches, by contrast, often waste resources. Some state-sponsored e-governance programmes have been inadequately successful because centralised planning did not take into account local conditions. Further, illiteracy and knowledge only of local languages are as expected major obstacles to the use of information and communications technology. To be relevant, applications must be available in local languages and, to the extent possible, be visually oriented and use voice interfaces. Finally, content provided through information and communications technologies should not be limited to knowledge from outside sources, but extended to draw on knowledge from the local community, especially the poor.

ICTs in Education

24. Human development has been defined as *the process of expanding people's capabilities, the set of choices people have available and ultimately the freedoms people enjoy to determine their overall well being*. Key instruments for providing people those capabilities, choices and freedoms and advancing human development are literacy and education. Central to the Millennium Development Goals therefore is (i) the need to universalise a full course of primary schooling; (ii) the need to substantially increase the literacy rate amongst the population as a whole; and (iii) the need to reduce gender disparities at all stages of education.

25. School enrolment ratios show a significant increase across India, although there is a substantial amount of evidence from micro studies and other surveys that these are typically overestimates. According to National Family Health Surveys (NFHS) of 1992-93 and 1998-99, the proportion of children in the 6-14 age group attending school rose between these two dates from 62.6 to 75.7 per cent in rural India and 82.4 to 87.6 per cent in urban India. But this implies that in the latter year more than one in every five children in the 6-14 age group was not attending school.

26. Further, the proportion of pupils starting grade I who reach grade 5, or persistence to grade 5 (measured as percentage of cohort reaching grade 5) is estimated at a virtually stagnant 59 per cent in 1993 and 60 per cent in 1998. Official figures of the drop-out rate for 1997-98 in the Class I-V category was 39.38 per cent, in the Class I-VIII category was 54.14 per cent and in the Class I-X category was 69.33 per cent. Thus there appears to be little progress towards achieving the goal of a full course of primary schooling for children by 2015.

27. A number of schemes for increasing access to and improving the quality of primary education have been introduced by both Central and State Governments in India over the 1990s. Of these, the DPEP launched in 1994 with support from the World Bank is seen by the government as reflecting a more holistic approach to universalising access, increasing retention, improving learning achievement and reducing disparities amongst gender and social groups. Further, the programme stresses community participation (through village education committees, parent-teacher associations, mother-teacher associations, and so on), with the community facilitating participation, achievement and effectiveness.

28. Though the evidence does suggest that early participants in the DPEP programme have shown positive results in terms of enrolment and achievement there are some disconcerting trends. Principal among these is that the programme has been used to segment the schooling structure in terms of teacher inputs and in terms of school status. This tendency has taken two forms; (i) "teacher proliferation" through appointment of "para-teachers" of various kinds, whose appointments are contractual, salaries are as low as a fourth or fifth of regular teachers and whose qualifications too are often much below that required of regular teachers; and (ii) "pluralisation" or the creation of multiple schooling environments such as formal government and private schools, alternate schools and non-formal schools of various kinds. The basic thrust, in the name of realising crucial targets within a short timeframe and within a restricted budget, is to downplay institution building in the name of access and untested claims of minimal quality. A 1999 study suggests that while classroom transactions in surveyed schools were uniformly low, they were even more so when conducted by para-teachers. Contractual employment and poor pay combined to demotivate these teachers, who often are not even trained enough. This suggests that the process may not be sustainable.

29. When assessing the way in which ICTs are being used in education, it is, therefore, necessary to assess whether they strengthen the quality of the institutional system, or serve as a partial "quick-fix" for problems created by the lack of adequate resources and are more in the direction of replicating solutions of the kind represented by the tendencies towards "teacher proliferation" and "pluralisation". The use of ICTs in education takes many forms including: use of ICTs as learning tools, use in capacity building for teachers, use in remote learning, use in technical education, and use for dissipation of information on best practices in a range of areas. Of these, use of ICTs in capacity building and in technical education projects being implemented by the government is clearly aimed at strengthening the institutional system. Needless to say, the use of ICTs as learning tools, as remote learning instruments and as sources of information can supplement and strengthen the institutional system since it can encourage self-dependence and creative learning, besides providing new tools for enriching the student-teacher interface. On the other hand, the latter uses of ICTs can occur in a non-institutional framework, which while better than no education at all is a poor substitute for what can be dismissed as a conventional education.

30. Besides diverse experiments to use ICTs to strengthen the regular schooling system, there are a number of programmes aimed at using ICT for informal education or for

supplementing the formal educational framework. The most obvious example is the *Gyan Darshan* TV network set up by IGNOU involving 70,000 hours per year of TV time devoted to distance learning for various subjects and levels. IGNOU is also in the process of developing a network of FM Radio channels with a total capacity of 3500 hours per year exclusively devoted to education. The widespread, remote access this provides to formal, structured programmes supported by 40,000 functionaries including faculty members from different universities of the country makes this an extremely valuable resource.

Redressing gender inequalities

31. There are two ways in which ICTs are used to empower and improve the status of women: directly, by the affected women themselves, who exploit the benefits of the technology to improve their status; indirectly, by those who are exploiting the technology to improve the delivery of services to women, to increase awareness about the status of women and to advance their advocacy activities. The latter could consist either of women's groups or of those not specifically targeting women, but whose activities have a positive fall-out for women as a group who are specially disadvantaged. Given the gender divide, it is the second that is likely to be more important in the early stages of the effort.

32. The evidence of worsening sex ratios in richer pockets also suggests that economic development does not preclude the misuse of technological changes to undertake tests to determine the sex of the foetus and encourage the associated rise in female foeticide. In fact, access to more modern medical practices and higher incomes to meet the costs of sex determination tests in richer regions appears to increase the extent to which such tests are used. This makes clear that social perceptions of the status of women and the relative desirability of girl children do not automatically change and keep pace with income and the level of development, resulting in the fact that growth accentuates the consequences of some forms of gender discrimination. The solution, therefore, can only be greater public attention to the task of changing social perceptions and consciousness.

33. Fortunately, ICTs are being sought to be used to combat this menace as well. In New Delhi, the Datamation Foundation in collaboration with the Nari Raksha Samiti, has launched an initiative titled Save the Girl Child Campaign to use ICTs to generate and record complaints against members of the medical community indulging in selective sex determination tests and selective abortion of female foetuses.

34. The principal task in dealing with forms of gender discrimination is advocacy in campaign mode to correct for the mindsets that lead to these kinds of problems. This has to be combined with efforts to educate parents and the community on the need for adequate sanitation, timely immunisation and adoption of appropriate nutritional practices (assuming the economic means to do so exist). In both these cases, ICTs can play a useful role.

35. The relevance of special ICT initiatives relating to women's employment depends on their ability to carry such employment opportunities to the more disadvantaged among the women themselves. There are a number of experimental initiatives underway aimed at increasing the range of and returns from occupational activities for such women. Some of these are facilitating ventures, such as use of IT in micro-credit activities that render them sustainable. Others aim to strengthen marketing of goods produced by women through the internet. Yet others seek to improve production practices and upgrade technology in activities engaged in by women.

ICTs in health

36. With public and private expenditure combined on health in India estimated at 5.2 per cent of GDP, India spends more of its income on health than most other developing countries and almost as much as many developed countries. However, just 17 per

cent is expenditure by the state, pointing to the predominance of private expenditure in total health expenditure. Despite these private outlays, the government accepts that while morbidity due to common communicable diseases and nutritional deficiency is still extremely high, that due to non-communicable diseases is on the increase.

37. A major cause of morbidity is, of course, malnutrition. Nearly one out of every two children was malnourished on both a weight-for-age and height-for-age basis. More than a third of women were undernourished as per the Body Mass Index and over a half of ever-married women and three-fourths of children suffer from anaemia. Add to this the problems of inadequate access to safe drinking water and reasonable sanitation facilities, and high morbidity is substantially explained. Dealing with these problems, using ICTs or otherwise, requires dealing with causes which are not directly in the health area.

38. After hunger, the principal health threats stem from some old diseases such as cholera, tuberculosis, malaria, *kala azar* and, more recently HIV/AIDS. Some of these have staged a comeback because of insecticide resistance among vectors, resistance to antibiotics and poor public health practices. Inadequate public expenditure on health is an obvious problem here.

39. As a highly information intensive industry, virtually every area of health care management and delivery is potentially capable of being supported to some degree by modern information management technologies. Health care information technology is now established as being capable of reducing the cost and/or increasing the quality of care delivery. The core themes of modern health care information technology are the increasing automation of the financial/administrative and clinical aspects of care (e.g. scheduling systems; laboratory test results; access); the provision of additional clinical feedback at the point of care, provision of medical assistance remotely e.g. thorough telemedicine and analysis of clinical data from multiple locations to assist in the formulation of improved treatment programmes etc.

40. The main applications of health care information technology are:

- Automation of basic processes of care, to make them more efficient, cost effective and reliable.
- Capture of critical clinical information, and automation of its interpretation (such as automated notification of potential adverse drug reactions).
- Provision of tools for decision support and information analysis, to support clinical research and clinical quality improvement programmes.
- Extensions to the scope and reach of clinical services through telemedicine.

ICTs and HIV/AIDS

41. The United Nations General Assembly's Declaration of Commitment on HIV/AIDS identified four areas for action: (i) Prevention of new infections; (ii) provision of improved care and services for those infected and affected by HIV/AIDS; (iii) Reduction of vulnerability, especially among groups which have high or increasing rates of infection; and (iv) Mitigation of the social and economic impact of HIV/AIDS.

42. ICTs can be used to further goals in these areas in a number of ways:

- They can be used as tools for advocacy, awareness raising, and education aimed at prevention of transmission of the disease. There are many features of the technology that make it most suitable for the purpose: it is low cost, it allows for information to be made available from global and local sources and it can be interactive while allowing for the anonymity of the user.
- They can be used as means for information provision and networking aimed at empowering stakeholders and encouraging consultations on policy

formulation. They can also support the sharing of information among medical practitioners and researchers working in the area.

- They can be used both for monitoring the HIV/AIDS situation in the country as well as the efficacy of policies aimed at limiting the spread of disease.
- They can be used as a means of building communities of those affected by HIV/AIDS and can serve as an online source of mutual support.

ICTs and sustainable development

43. What role can ICTs play in the effort to *monitor* and *reverse* the trends of deteriorating air and water quality, prevent further deforestation and increase the area under forest cover? They could improve the devices to measure, record, collate and transmit information on water and air pollution needed to decide on the necessary action. They could use remote sensing and GIS mapping techniques to monitor the state of forest cover. They could help educate individuals/households, commercial enterprises and agencies of the State regarding the best practices to be adopted to keep down pollution. They could support networks of organizations, communities and agencies involved in improving the environment and ensuring sustainability, by allowing for easy and fast sharing of information, facilitating advocacy work and providing an instrument for mobilization of public opinion.

The need for partnership

44. From our assessment of the challenges and opportunities that ICTs offer for development, it should be clear that this is an area where partnership is inevitable. The overall project requires combining the appropriate technology with capital intensive infrastructure and the knowledge and experience required to deal with development challenges at village, block, district, state and national levels. It must therefore draw on the strengths of government, civil society, the private sector, technologists, development theorists and practitioners and the international development community (including donors and international civil society organizations).

45. The State has a major role to play in ensuring better and wider connectivity, even if it is the case that the high costs of extending that infrastructure in a large country like India requires public-private partnerships to finance and manage the venture. But even here, given the fact that very often private incentives are not the best signals for creating the infrastructural base for putting ICTs to use for development, State regulation of the partnership is quite crucial. The need for a universal service obligation for private licensees for provision of telecommunications services and the difficulties of ensuring compliance with that obligation illustrates the role that the government would be called upon to play.

46. But the government's role does not end with being a facilitator of the process through the provision of the necessary infrastructural base and the appropriate regulatory environment. In practice, the government is and will remain the most important actor in the field of human development. Large scale projects at the national and state levels for employment, food distribution, education, health and environmental protection are best undertaken by the government, its deficiencies notwithstanding. Thus, in substantial measure, the government has a major role to play in inducting ICT for developmental processes. This it does in many ways: by using ICTs as tools for e-governance that increases participation, transparency and efficiency, by using ICTs as an instrumentality in the implementation of development projects and by using ICTs as means of service delivery.

47. However, government alone cannot ensure that ICTs plays their designated role in development. To start with, the effort of developing the appropriate technology and innovation aimed at reducing the costs of that technology is most often best undertaken by individuals, autonomous institutions, private

firms and civil society organizations, that have the requisite knowledge and the flexibility to ensure success. Partnerships between these entities and the government which serves as facilitator and financier and international organizations that provide technological and financial support for the process would be necessary to accelerate the process of technology development.

48. Even assuming cheaper technology becomes available, ensuring the connectivity that allows for the potential of hardware and software innovations to be exploited requires substantial effort and investment. Since the State can access only a part of the national/social surplus within the country's mixed economy framework, it would be hard put to finance the outlay in full, necessitating private participation and a public-private sector partnership. That partnership lies not just in sharing costs, but also in the State taking up necessary coordination and regulatory functions. The capital intensive nature of the industry makes it prone to market failure of different kinds, requiring a strong regulatory presence of the State. Atomistic decision making can and does result in unnecessary duplication of expensive infrastructure, which given resource constraints may not be optimal. Further, profit considerations would prevent network expansion into less densely populated, poor and remote areas. This not only goes against any commitment to provide universal connectivity and service, but inasmuch as connectivity and development are related, it reinforces differentials in the spread of development in the first place.

49. Developing technology and ensuing connectivity does not exhaust the requirements for use of ICTs in development. It requires working out the points at which ICT use can facilitate and advance the development agenda and designing special projects to exploit the technology for development purposes. This defines the third area of partnership. The State is not the only actor in the development arena. Civil society organizations have played and do play a major role in development and have the knowledge, the experience and the grass-roots organization required to induct ICTs into existing projects and design projects aimed at utilizing ICTs in innovative ways. Private firms have entered the area with the growing recognition of the need for corporate social responsibility and are well placed to experiment with the utilization of ICTs as illustrated by the activities of Datamation, for example. And international donors and NGOs, with their long track record in supporting development activities, collating international experiences and scaling up small experiments, cannot but be involved in this emerging area.

50. Thus a range of domestic and international partnerships (public-private, government-CSOs, and private sector-CSOs) are both inevitable and necessary in the area in keeping with the goal of promoting such partnership incorporated in the Millennium Declaration. From a policy point of view, it is crucial that each of the actors consciously seek to build such partnerships, since this would help both coordinate micro-experiments and scale them up in order to realize the full benefits of the technology.

1. Introduction

Like all new technologies that are not just incremental but revolutionary in their impact, the spread of information and communication technologies (ICTs) has received a mixed response. While fears of a widening digital divide have been rightly expressed in many quarters, there is considerable interest in the prospect of using those technologies for alleviating poverty and advancing human development goals in developing countries. Discussion on the ways in which these technologies can be harnessed for furthering these goals has advanced considerably, and there are now many experiments with their actual application for development purposes. One ongoing database compiled by IT for Change, a non-governmental organisation located in Bangalore, already includes more than 150 such experiments and the actual number is likely to be much higher. While a few of these are relatively large in scale and some others have the potential for being scaled up from their current pilot status, most are of relatively recent origin and are yet to establish themselves as being viable and/or economically sustainable. An analysis of those experiments is a prerequisite for any effort aimed at replicating and scaling up these pioneer, pilot projects, with a view to ensuring the technology makes a difference from a human development point of view.

The Millennium Development Goals (MDGs) incorporated in the Declaration of the United Nations Millennium Summit held in September 2000 clearly define the distance that countries must travel on different fronts, within a pre-specified time frame, to meet internationally accepted human development indicator targets. This time bound road map for achievement on the human development front helps build and widen the constituency of those committed to advance human development and renders the task for developing countries and their development partners more focused. In keeping with the requirements of that road map and the lessons yielded by experiments with the use of ICT for development, this study examines the ways in which ICTs can be used in India to realise the stated, time-bound goals in different sectors, the constraints to using ICTs as an instrumentality for the purpose and the dangers involved in any excessive emphasis on ICTs as means for realising the MDGs.

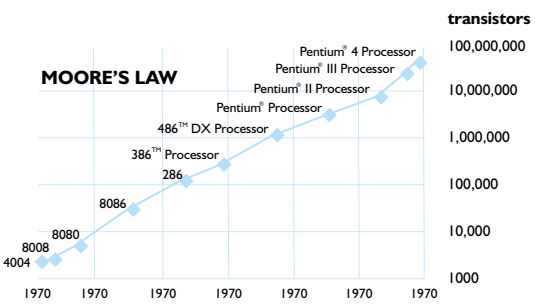
The Potential

Developments in information and communication technologies during the last quarter of the 20th century are widely seen as having heralded an information age in which economic and social activity has been widened, deepened and transformed. Optimistic projections would have it that a computerised and networked world would not only change work practices, attitudes to leisure and life styles, but also allow for a more widespread and rapid growth of employment, productivity and output. That is, these technologies are seen as having both the potential to advance human development as well as spread the capabilities to benefit from that potential.

At the core of this perceived transformation lies the dramatic increase in computing power ensured by the emergence and rapid evolution of microprocessor technology. The pace of this increase is captured by the oft-quoted observation made by Gordon Moore as early as 1965 that newer chips that entered commercial production every 18-24 months incorporated twice the number of transistors as their predecessor. That

trend has since persisted (see Chart 1.1) and has been given the status of a law – termed Moore's law – by industry observers. As a result, in the three decades starting 1971 the number of transistors on a chip increased from 2,250 on the 4004 to 42 million on the Pentium 4 processor and the cost of a Mhz of computing power has fallen from $760 in 1970 to 17 cents in 1999 (Chart 1.2). This has helped PC makers and those incorporating computer chips into their products deliver far more powerful systems at the same or declining prices.

Chart 1.1

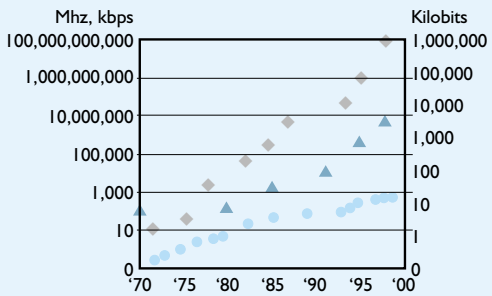


Source: *http://www.intel.com/research/silicon/mooreslaw.htm* Accessed December 21, 2003.

Chart 1.2

a. Processing, Storing and Sending Information

	'70	'80	'90	'99
Microprocessor Speed (Mhz)	11	8	50	800
DRAM Storage (Kilobits)	4	64	4,000	1,000,000
Bandwidth (Kilobits per seconds)	50	56	46,000	9,600,000



b. The Price of Power and Speed

	'70	'80	'90	'99
Cost of 1Mhz	$7600.82	$103.40	$25.47	$.17
Cost of 1Megabit Storage	$5256.90	$614.40	$7.85	$.17
Cost of Sending 1trillion bits	$150,000.00	$150,000.00	$90.42	$.12

Source: *Federal Reserve Bank of Dallas, Annual Report 1999.*

The growth in computing power has triggered a veritable race at developing digital devices that can exploit that power and offering peripherals that extend that capability. These devices acquire, record, organise, retrieve, display and disseminate information. Here too technological change has reduced costs substantially. The cost of a megabit of storage has fallen from $5257 in 1970 to 17 cents in 1999. Computing devices also help manipulate and modify stored information, by searching through the information, displaying them in a chosen format, performing simple and complex scientific and engineering calculations and solving a range of non-numerical problems. The power that this offers is considerably enhanced by the growing possibility of linking computing devices and allowing them to communicate with each other based on some common protocol. This process has been aided by improvements in communication technology that have reduced the cost of transmitting a trillion bits of information from $150,000 to 12 cents over the last three decades.

ICTs and development: The promise

The wide availability of enhanced computing power and the consequent ability of networked individuals, households, organisations and institutions to process and execute a huge number of instructions in imperceptible time spans can have revolutionary implications. *First, it has the potential of creating and massively expanding industries catering to the market for a range of computing devices*, especially personal computers, that have now become accessories in the home and not just at the work place. This has already led to the burgeoning of the industry that produces the hardware and software needed to allow individuals, organisations, small businesses and corporations to directly exploit the benefits of the dramatic expansion in computing power.

Second, it paves the way for changes in the nature of a whole range of products varying from televisions and microwave ovens to automobiles and aircraft, as well stimulates many new product innovations, such as cellular telephones and palm-sized personal organisers. The stimulus to innovation in sectors completely outside the computing business itself, resulting in the emergence, creation and servicing

of a host of new needs, makes the employment consequences of the new technologies virtually impossible to calculate.

Third, it can substantially transform industrial processes, since firms can now use the capacity to store information and execute instructions to automate and change the manner in which they conduct and manage their operations. Information technology is in part revolutionary because it ensures and necessitates the transformation of productive capacity in almost all sectors. The most obvious impact of the computing revolution is in the workplace. Computers with word-processing packages that have rendered the creation, modification and manipulation of design-wise, versatile documents extremely easy, have replaced the typewriter. They have also allowed the creation and manipulation of databases that render a range of activities such as accounting, inventory management and the like most simple. These changes have substantially enhanced the efficiency and productivity of office work, so long as the cost of acquiring and routinely upgrading the required hardware and software and training workers to use the new technology is borne.

In manufacturing too, processes are increasingly computer-aided, through the incorporation of the chip into equipment of various kinds and the application of various developments in computer science to support manufacturing activities. Computerisation helps integrate design and production at the shop floor allowing for greater flexibility in responding to variations in demand. It allows firms to link inventory information to the real time consumption of intermediates and production of outputs, thereby reducing inventory levels and reducing costs. It permits firms to automate inspection and ensure better quality. It supports systems that can track production processes, diagnose bottlenecks and breakdowns and reduce downtime. In principle, therefore, costs can be reduced and quality improved substantially, even while production is speeded up.

Finally, the computing revolution leads to a dramatic expansion of the size and scope of the services sector (across a wide spectrum including finance, banking, trade, entertainment and education). This results partly from associated technological developments that find new uses for the massive computing power that is cheaply available, partly from the huge market that developments in communications and networking technology create, and partly from the fact that the increasingly ubiquitous PC becomes the vehicle to deliver a range of services, besides being a device in its own right. The microprocessor is not just the core of the IT revolution, but stands at the centre of the convergence of the information, communication and entertainment sectors.

When all of these benefits are combined with developments in communication, individuals, organisations and corporations are able to both secure a presence on the web as well as easily traverse cyberspace. This creates the basis for establishing links between individuals, individuals and government agencies, individuals and business, business and government and business and business. The full consequences of this ***compacting of economic space*** resulting from the internet's transformation from a channel of communication between a few scientists to a web linking economic and social agents of different kinds are even now only being absorbed and analysed. One area where the effects are tangible is electronic commerce, which allows for trading in virtual space, reduces transaction costs, cuts down on retail infrastructure and slashes retail margins.

Human development implications

Our concern here is with the possible human development implications of the ongoing ICT revolution. Overall, the promise that the ICT revolution holds for human development in poor countries takes three forms. First, it is expected to result in the growth and diversification of the ICT sector itself, because of the rapid pace of product innovation in this sector. This process of growth, it is argued, would lead to the rapid expansion of output and employment in the production of currently available ICT products as well as myriad new products the technology is expected to deliver. The human development implications of such output and employment increases are likely to be positive.

Second, the use of ICTs in the agricultural, non-ICT manufacturing and services sectors is expected

to fundamentally transform the nature of production in these sectors with major implications in terms of labour productivity, growth and employment.

Third, the penetration of ICTs into activities outside of production is expected to reshape the way work, markets and leisure will be organised and the way in which individuals and communities can trade and access information and services, leading to changes in the structure of markets, improvements in the quality of life, a deepening of democracy and major advances in terms of human development indicators.

Needless to say, each of these routes through which ICTs are expected to affect development is predicated on a certain kind and degree of diffusion of the technology. The first, presumes a process of *cross-country* diffusion, whereby the technologies and the industries that constitute the ICT sector move from early to late entrants. It is here that India's success has indeed been noteworthy for two reasons. To start with, the pace of ICT-sector growth has been rapid, albeit from a low base, tallying with the dynamism seen as typical of the industry and captured by the oft-quoted Moore's Law. Thus, according to data provided by Dataquest (Table 1.1), over the 13-year period 1990-91 to 2002-03, the annual compound rate of growth of output was 36.6 per cent. That is, output was doubling every 2.2 years.

Secondly, this rapid growth has essentially been the result of a rapid expansion of exports. During the period 1990-91 to 2002-03, exports have been growing at 50 per cent per annum or doubling every 18-24 months. There has been a trend shift in the rate of expansion of IT sector output in 1996-97, driven by exports. While the trend rate of growth of output valued in dollars rose from 23.7 per cent during 1990-91 to 1996-97 to 35.7 per cent during 1995-96 to 2002-03, the rate of growth of exports rose from 32.5 per cent to 51.9 per cent during these two periods. As a result, the share of exports in IT industry output, which rose from 20 to 28 per cent between 1990-91 and 1995-96, touched a remarkable 64 per cent in 2002-03[1]. The net result has been that the ratio of gross IT sector output to GDP rose from 0.38 per cent in 1991-92 to 1.88 per cent in 1999-00 and 3 per cent in 2001-02.

Table 1.1: Dataquest's Estimates of India's IT Industry Output (Rs. Crore)

	Domestic	Export Segment	Total
1990-91	1762	452	2214
1991-92	2041	676	2717
1992-93	2524	931	3455
1993-94	3356	1405	4761
1994-95	4959	1882	6841
1995-96	7032	2681	9713
1996-97	8587	4847	13434
1997-98	10835	7180	18015
1998-99	13204	10752	23956
1999-00	17002	16050	33052
2000-01*	24670	29896	54566
2001-02*	24738	37846	62584
2002-03*	26952	47834	74787

Source: Dataquest, Vol XVIII No 13, July 15, 2001; Vol XIX No 13, July 15 2002; and Vol XX No 15, August 15, 2003

Note : * ITeS included in software exports

The second route by which ICTs are expected to impact on growth and human development is predicated on a *horizontal intra-country* diffusion process, whereby ICT begins to be used (i) in the manufacturing sector, transforming the production process and the organisational structures of firms, and raising productivity, investment, growth and employment; and (ii) in the services sector, changing the structure of markets and the extent and ease of access to and delivery of a range of services. It is here that India's progress has been limited, even negligible. This is not surprising because even in the developed countries, including the original

[1] *This includes exports of IT enabled services (ITeS) in the values for 2000-01, 2001-02 and 2002-03.*

home of the new economy, the US, the penetration of ICTs into sectors outside the ICT sector itself has been gradual and unsatisfactory. Nothing captured this better than Robert Solow's (1987) observation that the computer age was visible everywhere (in the US), except in the productivity statistics.

The third route by which ICTs are expected to impact on development is crucially dependent on a *vertical intra-country* diffusion process that results in an increase in the level of penetration of the technology, leading to increased community and individual access to the benefits of the technology, which affects human development by making these devices the means of service delivery, of ensuring transparency and of enhancing participation.

In fact, though the first two kinds of diffusion could result in employment and income growth that can have some positive human development consequences, the ICT for development literature has tended to focus on the gains in the form of directly facilitating human development that could come through the third kind of diffusion process. There are many routes through which this direct impact on human development is expected to occur, once access to the technology is provided to the people, independent of their social and economic standing, and to decision-makers concerned with furthering human development goals. First, since the ICT revolution allows for collection, collation, storage and transfer of information, diffusion of the technology can:

- Help the disadvantaged to access services that increase their productivity and income. Thus, for example, fisherman can access remotely sensed information on the location of fish shoals, allowing for more successful fishing expeditions.
- Ensure that the disadvantaged obtain better returns for their produce. For example, the availability of online information on market prices can help farmers strike a better bargain when transacting with local traders.
- Reduce the vulnerability of the disadvantaged to shocks. One instance is access to information from digitally designed early warning systems about storms at sea or earthquakes on land.
- Allow the disadvantaged to remotely access online education and training programmes to increase their capabilities.
- Strengthen the ability of the disadvantaged to access information on government policies and programmes, official and community-based support systems, and on their rights as citizens, all of which help increase their participation in the shaping of a better social and political order.
- Empower the disadvantaged and those advocating their cause through using the technology and its outcomes, such as the internet, to share information, forge alternatives, organise and lobby with and against the powerful.

Second, ICTs allow the government and civil society organisations (CSOs) to obtain, collate, store and analyse information in ways that improve decision-making and facilitate implementation of policies that improve the quality of life of the people at large and the disadvantaged in particular. This they can do by:

- Increasing the scope and the quality of the data that is analysed when designing policy. Remote sensing and geographical information systems, for example, can play a major role in designing an appropriate drought-proofing plan in an arid region.
- Permitting the close and continuous monitoring of the outcomes of policies so as to ease bottlenecks and improve implementation. For example, information on the health status of the population in an area can be continuously monitored to assess the impact of a public health program.
- Using ICTs to design and implement disaster management programmes in disaster-prone areas.

Finally, the government, CSOs and private agencies can use ICTs to deliver a range of services such as agricultural extension services, health services, user

charge collection services, services such as provision of documents relating to land ownership and rights delivered from computerised land records databases, etc. This not only improves the efficiency of service delivery, but it also in many instances increases the transparency in government-citizen transactions that help improve the quality and effectiveness of services delivered.

ICTs in India

Needless to say, the discussion in India on the effects that the ICT revolution can have for development has been influenced by the performance of India's ICT sector, which is interpreted as being suggestive of the benefits that the technology can bring in terms of growth and human development. Thus, because of the high rates of expansion of output and exports in the industry noted earlier, domestically, the ICT revolution is expected to have both direct and indirect growth-inducing effects. Directly, the IT sector's contribution to GDP is expected to grow to about 8 percent and its share in exports to about 30 per cent by 2008. These effects are of crucial importance. First, ICT sector growth may be one of the few viable ways to raise employment in labour-surplus countries such as India, where labour absorption in many non-ICT sectors (agriculture and organized manufacturing) appears to have reached saturation levels within the current growth trajectory. Second, the export growth (of hardware, software and IT-enabled services) accompanying ICT sector growth is an effective means to reduce balance of payments vulnerability, which remains a challenge in our increasingly globalised world.

Besides these direct effects in the domestic economy, ICTs are expected to indirectly impact on growth as well. The new technologies and the accompanying falling costs of computing power, data storage and information transmission are expected to transform productive capacities and organisational structures in almost all sectors, in the process raising productivity, increasing investment and hence spurring GDP growth.

Domestic gains on these counts are expected to combine with external benefits as well, in as much as the growth of the industry is targeted at external markets. The rapid expansion of IT, especially software, exports from India, it is argued, suggests that the ICT sector can be the basis for a redistribution – at the margin – of the benefits of globalisation to the developing countries. ICT growth could make the distribution of world income more egalitarian, especially since there are reasons to presume that the technological barriers to entry by small firms and, in particular, small firms in developing countries are low. Entry barriers into large segments of the ICT area are argued to be low compared to non-ICT sectors because:

- In downstream hardware production entry is facilitated by the facts that: (i) the knowledge base for innovation is in the public domain and can be easily transmitted across countries; (ii) levels of investment are lower and less "lumpy" than in non-ICT manufacturing sectors; (iii) products are more heterogeneous, and are assembled using varying combinations of sub-systems, components and peripherals.
- In software production as well: (i) knowledge is easily acquired; (ii) innovations are easily replicated; and (iii) capital requirements are small.

Furthermore, it is argued that there are factors which stimulate the spread of ICTs (and of software development and services in particular) to developing countries, including: (a) the availability of cheap skilled labour in developing countries such as India; and (b) the outsourcing of a range of activities by firms in developed countries because of the need to reduce costs and because of the acute shortage of software professionals in the OECD countries.

The third noteworthy feature of the IT sector's growth is that it has been driven largely by the private sector on both the supply and demand sides, though government support in terms of IT infrastructure investments, duty free access to hardware for software exporters and low or zero taxation of export profits played a role. Almost all IT firms producing for the domestic and international markets are private firms, and the private sector has accounted for a dominant and rising share of domestic IT spending since 1995-96

and contributed as much as 73 per cent of the total in 2001-02, as compared with 15 and 12 per cent by the government and public sectors respectively. This it is presumed allows the government to focus on the use of IT for development and partner with the private sector to develop and deploy the relevant technology.

These features of the industry are expected to result in sustained rapid expansion of the ICT sector that, with governmental facilitation, would help build ICT capability in the country and ensure the horizontal and vertical spread of ICT use. In due course, it is argued, this would lead to the extensive use of ICT for human development purposes, through the scaling up and spread of the myriad experiments referred to earlier and discussed in more detail below.

2. The Connectivity Conundrum

The realisation of the potential and direct human development gains from ICTs requires, as noted earlier, the rather widespread diffusion of the technology through a vertical, multi-level process that delivers access to the technology to disadvantaged communities and individuals. Crucial to such diffusion, through which the full human development potential of the technology is realised, is connectivity. Unfortunately, India's communications infrastructure is still limited in size and spread, and though it is witnessing rapid growth in recent times, that growth is much less than in a country like China, which has the wherewithal to undertake huge public investments.

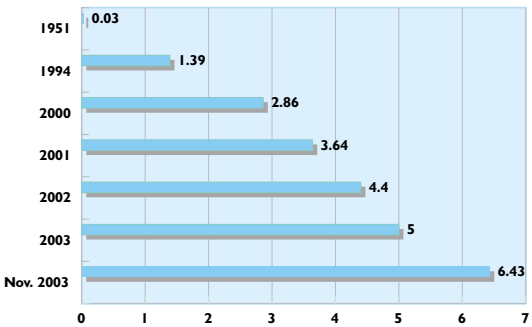
There are many who argue that the entry of private operators made possible by the implementation of the National Telecom Policy statements of 1994 and 1999 promises acceleration in telecommunications infrastructure growth based on private initiative. This view has been influenced by the experience with television penetration, driven in significant measure by private investment. Till 1991, the spread of even television in India was limited, with broadcasting reach ensured by the much lower cost radio. Television programming, delivered through terrestrial channels, was dominated by the state-owned Doordarshan. A combination of factors such as the government's decision to relax availability of television sets in time for the Asian Games in the early 1980s, the availability of a number of free-to-air, private channels in English and the Indian languages beamed out of foreign locations such as Hong Kong and Singapore, and the rapid and unregulated growth of local cable operators, helped increase the demand for and reach of television. Yet the progress achieved must not be overstated. In 2001, only 31.5 per cent of rural Indians and 74.1 per cent of urban Indians had access through home-based or community TV sets to Doordarshan's network. Figures on cable television access in 1999 indicated that less than 10 per cent of rural India's television viewers had access to cable television and the percentage of rural homes with cable television was less than 1 per cent. In urban areas figures for cable television access varied from 10 to 50 per cent depending on location (Franda 2002: 107).

In the case of ICTs, since connectivity is a core element of the new technology, a simple measure used to assess the degree of such diffusion is tele-density or the number of telephones per hundred inhabitants in the country. Going by that measure, there is evidence that suggests that India may be on track to realise the required degree of diffusion even if at a slow (but accelerating) pace. Recently released figures indicate that telephone density has touched 6.07 per 100 inhabitants as on September 30, 2003, compared with only 1.39 at the end of March 1994, when the shift to a new, more liberal telecom policy began, and 2.33 on April 1, 1999. Since then the rate of expansion of connectivity has indeed been rapid, with tele-density touching 2.86 lines per 100 people on March 31. 2000, 3.64 on March 31, 2001, 4.4 on March 31, 2002 and 5 as on March 31, 2003 (Chart 2.1). This growth in connectivity is expected to substantially increase interactive communication between distant centres, permit improved governance through the more efficient delivery of information and a range of social services in rural areas as well as expand access to the internet and the benefits it can provide. Assuming that the government is able to put in place the information technology (IT) infrastructure needed to exploit the benefits of such connectivity, it is argued, the country seems to be well on its way to realising its goal of delivering IT

to the masses, to supplement the benefits from the autonomous growth of IT-use in the urban areas epitomised by the burgeoning revenues from the 'production' and export of IT-enabled and software services.

The difficulty is that a closer examination of the data suggests that aggregate tele-density may not be a good measure of the extent of diffusion. To start with, the aggregate figure conceals the low penetration of telecommunications capacity (Table 2.1) and a high degree of urban and regional concentration. Tele-density in rural India in 1998-99 was just 0.5 lines per 100 people. Rural tele-density, which crossed one per hundred in 2001-2002, stood at 1.49 in 2002-03, when urban teledensity was placed at 14.32 (Table 2.2). Further, inter-regional variations were also substantial. As on March 31, 2003 while total teledensity in the state of Delhi was 26.85, that in Bihar was as low as 1.32 (Table 2.3).

Chart 2.1: Trends in Telephone Density (Lines per hundred people)



Source: Department of Telecommunications, Government of India at www.dotindia.com

Table 2.1: Indicators of Telecommunications Capacity in India

Description	As on March 31, 2001	As on March 31, 2002	As on November 30, 2003
Switching capacity in public sector (in million)	39.9	47.4	57.8
No of DELs (million)			
(1) Public sector	32.4	37.9	40.4
(2) Private sector	0.27	0.50	7.6
Cellular mobile phones (million)	3.58	6.40	20.7
Village public telephones (lakhs)	4.09	4.69	6.43
Rural DELs (million)	6.69	9.02	11.77
Public call offices (lakhs)	8.4	10.6	15.88
Internet subscribers (million)	2.97	3.20	3.5 on 31-3-2003

Source: Department of Telecommunications, www.dotindia.com/networkstatus.htm. Accessed 5/24/2003.and 1/27/04

Table 2.2: All-India Rural and Urban Teledensity

Years	Rural	Urban
1998-99	0.51	6.92
1999-00	0.68	8.33
2000-01	0.93	10.16
2001-02	1.21	12.20
2002-03	1.49	14.32

Source: Answer to Rajya Sabha unstarred question 1723, dated 18-12-2003.

Table 2.3: State-wise Teledensity as on 31 March 2003

Sl. No.	State	Teledensity		
		Urban	Rural	Total
1.	Andaman & Nicobar	14.98	7.71	9.60
2.	Andhra Pradesh	16.45	2.03	5.56
3.	Assam	11.54	0.50	1.94
4.	Bihar	9.30	0.48	1.32
5.	Chattisgarh	5.55	0.40	1.39
6.	Delhi	30.18	0.00	26.85
7.	Gujarat	17.81	2.48	7.44
8.	Haryana	16.46	2.32	6.06
9.	Himachal Pradesh	39.63	5.43	8.40
10.	Jammu & Kashmir	8.34	0.52	2.48
11.	Jharkhand	6.11	0.40	1.57
12.	Karnataka	15.84	2.37	6.45
13.	Kerala	23.70	7.85	11.13
14.	Madhya Pradesh	10.15	0.56	2.88
15.	Maharashtra	19.27	2.16	8.99
16.	North East	9.17	0.88	2.70
17.	Orissa	11.33	0.87	2.22
18.	Punjab	25.66	4.60	11.60
19.	Rajasthan	11.34	1.25	3.40
20.	Tamil Nadu	15.20	2.12	7.82
21.	Uttaranchal	12.57	1.30	3.95
22.	Uttar Pradesh	8.82	0.56	2.13
23.	West Bengal	11.53	0.89	3.72
	Total	15.16	1.49	5.00

Source: Ministry of Communications and Information Technology, "Tele-density reaches five as an 31st March 2003", Press Release date 23rd May 2003, accessed at http://pib.nic.in/archieve/lreleng/lyr2003/rmay2003/23052003/r23052003.html on 5/24/2003.

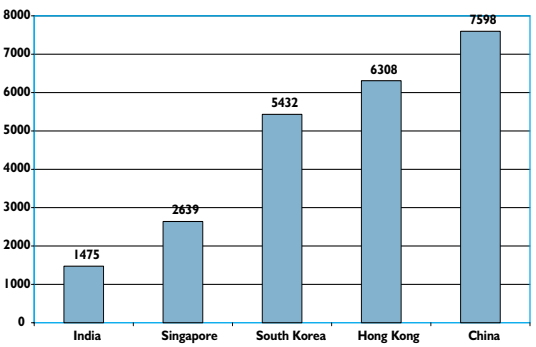
Besides the huge rural-urban divide and the substantial inter-regional variations in tele-density, the figures also appear to be substantially influenced by the recent growth of the mobile telephony sector. As of end-November 2003, while there were 40.4 million direct exchange lines (DELs) being provided by the public sector companies (VSNL and MTNL) and 7.6 million direct exchange lines by private operators, the number of cellular phone subscribers was placed at 20.7 million or close to 27 per cent of all DELs. Since a very large proportion of cellular phone subscribers were those who subscribed to the service in addition to holding a regular landline, so as to benefit from the mobility that cellular telephony allows, the rise in telephone density as a result of an increase in cellular telephone connections can hardly be taken as indicative of the diffusion of telecommunications technology among those who were thus far marginalised from the network.

To assess the latter we need separate indicators of mass access such as the presence of public call offices (PCOs) in rural and urban areas and direct exchange lines and village public telephones (VPTs) in rural areas. These indicators are by no means encouraging. The number of PCOs that could be converted into telecom kiosks or centres with internet connectivity stood at just 10.6 lakh at the end of March 2002. This figure amounted to less than 3 per cent of the total number of DELs in the country. Further, while the population in rural areas amounted to more than 70 per cent of the total, the proportion of rural DELs worked out to just 23.5 per cent of the total. However, there are rapid improvements occurring in some areas. Out of 6,07,491 villages, Village Public Telephones (VPTs) have been provided in 5,17,814 villages as on 31.10.2003. Of the remaining 89,677 villages, provision of VPTs in 33,365 villages is, according to the government, not feasible at present as a majority of these villages are populated by less than 100 and some of them are insurgency affected. Another 25,668 villages can only be covered using satellite media. Excluding the above categories, the remaining villages to be covered with VPTs are 30,644. With private licensees not having realized the targets in this area set for them, BSNL has fixed targets to cover its share of the remaining villages with VPTs during the year 2003-2004.[1] Overall, however, the picture is indeed one of a digital divide driven by asset and income inequalities, such that there a few at the top who are connected while the majority, preponderantly in rural areas, are marginalised from the communications network.

Internet connectivity

Even if connectivity in the form of a communications link is established, there is no guarantee that this can be viably expanded to connect India's villages to the world through the internet, if that were considered an advantageous route to take. Despite its large population, the success of its IT industry and the government's stated intent of wiring India's villages, India today lags far behind many other developing countries in terms of the bandwidth (or the pipe) necessary for people to simultaneously access information flow through the internet. In 2001, the International Telecommunications Union estimated bandwidth availability in India at 1475 megabits per second (Mbits/sec), as compared with 2639 in Singapore, 5432 in South Korea, 6308 in Hong Kong and 7598 in China (Chart 2.2).

Chart 2.2: International Internet Bandwidth 2001 (MBits/sec.)



Source: National Readership Survey 2002

This, however, was not a problem because internet spread is also limited. The International Telecommunications Union estimates that in 2001 India had a total of 3.2 million internet subscribers

[2] *Figures are based on the answer to Rajya Sabha starred question No. 949 provided on 11.12.2003.*

and 7 million internet users (Table 2.4). In terms of internet spread or the number of users per 100 inhabitants, India with 0.7 was behind China (2.6) and way below Hong Kong (38.5), Korea (52.1) and Singapore (36.3) (Chart 2,3). However, users are geographically extremely concentrated. In August 2000, when there were an estimated 1.6 million subscribers and 4.8 million users (0.37 per cent of the overall Indian population), more than three-fourths (77 per cent) of these users were from New Delhi and the capitals of Indian states. Two cities – Delhi and Mumbai – alone accounted for more than one-third of all users. Maharashtra, with 453,000 accounted for 28 per cent of the total. On the other hand, two of India's most populous states – Uttar Pradesh and Bihar – had only 20,000 and 8,000 respectively (Franda 2002). Even by the end of March 2003, the disparity persisted with Maharashtra and Delhi accounting for 27 per cent and 18.5 per cent respectively of the total number of internet subscribers (Table 2.5). Clearly, the inadequate spread of connectivity, the perceived benefits of connectivity and the cost at which it is available are working against as rapid a spread of the internet as seen in the case of radio.

A useful source of information on internet usage is the National Readership Survey conducted by the National Readership Survey Council, a body of media providers and advertisers. NRS 2002 figures indicate that, besides the urban concentration noted earlier, there is a high degree of geographical concentration even among urban internet users. Close to one half of them (48.6 per cent) were located in the top 8 metros, with smaller towns accounting for the remaining (Chart 2.4). Interestingly, however, while towns with a population of more than 10 lakhs and 5-10 lakh accounted for 13.1 per cent and 8.5 per cent of internet users respectively, those with populations in the 1-5 lakh range and less than 1 lakh range were home to 18.8 per cent and 11 per cent respectively. That is, these are signs of some diffusion of internet use among smaller Indian towns, providing a glimmer of hope to those who see in an opportunity in the new technology.

Table 2.4: Asia-Pacific Internet Economy (2001)

	Number of ISPs	Number of users		No. of subscribers (000s)		International Internet Bandwidth (Mbit/s)
		Total (000s)	Per 100 inhab	Total	Broadband	
Australia	603	7200	37.1	4181	123	7000
Bangladesh	60	250	0.2	100	–	40
China	936	33700	2.6	17364	203	7598
Hong Kong, China	258	2601	38.5	2631	623	6308
India	90	7000	0.7	3200	50	1475
Indonesia	60	4000	1.9	600	15	343
Japan	4000	55930	43.9	24062	3835	22705
Korea (Republic of)	99	24380	52.1	8956	7806	5432
Malaysia	6	6500	27.3	2115	4	733
New Zealand	80	1092	28.6	660	17	1900
Pakistan	70	500	0.3	200	–	225
Philippines	51	2000	2.6	600	10	237
Singapore	42	1500	36.3	927	151	2639
Sri Lanka	29	150	0.8	62	–	18
Taiwan, China	185	7820	34.9	6316	1130	7228
Thailand	18	3536	5.8	1500	2	642
Vietnam	4	1010	1.2	252	–	34
Asia-Pacific	6654	160217	4.6	74290	13979	64955

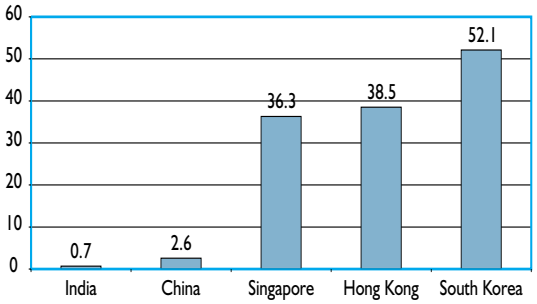
Source: ITU, ITU Telecommunication Indicators Update
available at http://www.itu.int/itunews/issue/2002/10/indicators.html
Accessed: May 22, 2003

Table 2.5: State-/Union territory-wise incidence of internet subscribers

Sl. no.	State/UT wise	As on 1.3.2002	As on 31.3.2003
1	Andaman & Nicobar	703	1112
2	Arunachal Pradesh	380	1010
3	Andhra Pradesh	234571	219218
4	Assam	9899	14440
5	Bihar	11999	18895
6	Chandigarh	60228	38458
7	Chattisgarh	7827	9275
8	Goa	17494	19449
9	Gujarat	153515	195072
10	Haryana	12116	17015
11	Himachal Pradesh	3483	6410
12	Jammu & Kashmir	-	10235
13	Jharkhand	11386	14199
14	Karnataka	263020	259121
15	Kerala	109170	136458
16	Mizoram	743	959
17	Manipur	630	1026
18	Meghalaya	1455	5285
19	Madhya Pradesh	65307	89501
20	Maharashtra	770634	948264
21	Nagaland	452	2536
22	Orissa	17303	22343
23	Pondicherry	8984	14275
24	Punjab	69499	69938
25	Rajasthan	102588	121322
26	Tripura	816	1194
27	Tamil Nadu	331840	329624
28	Uttaranchal	10902	19801
29	Uttar Pradesh	96828	120006
30	Sikkim	928	965
31	West Bengal	132013	142663
32	Delhi	732962	650209
	TOTAL	3239675	3500278

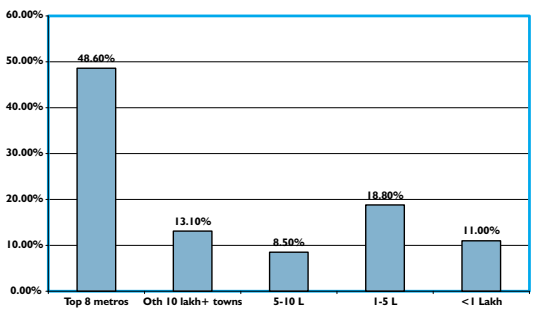
Source: Answer to unstarred question in Rajya Sabha, 18-12-2003

Chart 2.3: Internet users per 100 inhabitants 2001



Source: National Readership Survey 2002

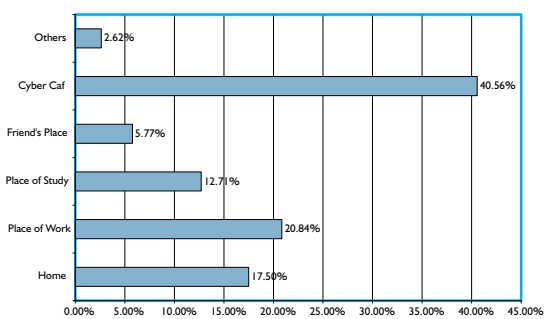
Chart 2.4: Distribution of urban internet users by category



Source: National Readership Survey 2002

Such signs of diffusion at the "lower-end" of the user spectrum are visible elsewhere as well, as in the figures on the place of access (Chart 2.5). While 17.5 per cent of urban users accessed the internet from their homes, 20.84 per cent had access from their place of work and another 12.7 per cent from their place of study. What is noteworthy was that a huge 40.56 per cent accessed the net through cyber-cafes. This lends credence to the view that the conversion of public call offices and STD/ISD booths, that are indeed ubiquitous across India now, into internet kiosks could help expand internet use over time.

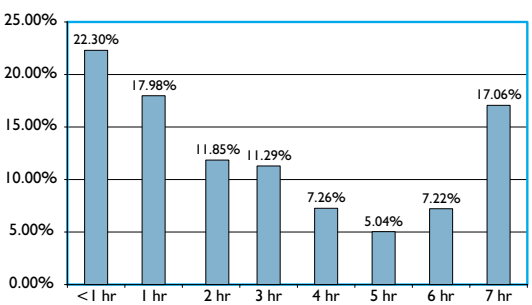
Chart 2.5: Distribution of users by place of internet access



Source: National Readership Survey 2002

This picture of a combination of extreme concentration at the top accompanied by a more diffused access to the technology among users at the "lower-end" is supported by figures on the distribution of users in terms of hours of usage (Chart 2.6). Those who had used the internet for 5 hours or more in a week accounted for 29.3 per cent of the total of internet users, whereas those who used it for one hour or less accounted for as much as 40 per cent. That is, there were a large number of users who were using the net to a limited extent, principally for email and restricted surfing. It is likely that this large chunk of low-frequency users belonging to the "lower-end" of the user spectrum restricted use to what were seen as absolutely necessary operations. That is, the internet is not just concentrated among those who surf the net for entertainment, besides information and communication. It shows signs of diffusion among those whose usage pattern suggests that their use is much more purposeful, even if limited in terms of time.

Chart 2.6: Distribution of internet users by hours of access per week



Source: National Readership Survey 2002

Thus, while the use of the new technology is indeed still extremely limited in India, and diffusion of the benefits of IT that can make a difference to the quality of life must wait, there are signs of change. Besides being concentrated among a set of top-end users, the technology does seem to be in the process of diffusion among a set of lower-end, low-frequency users.

This dual nature of the diffusion of the technology suggests that there are two routes through which the technology can impact on the quality of life. Elite users, who use the technology to share information and analysis in crucial areas such as the

environment, health, corporate practices and labour conditions, can debate, develop and contribute to creating international best-practice standards in the relevant area, which provide the basis for national policy and for mobilization of public opinion nationally and internationally to change policy regimes. This would be the top-down, trickle-down means for the technology to influence human development. The other would be for the technology to be diffused leading to use by and participation of the disadvantaged in the formulation and implementation of policies as well as to the direct provision of improved services that affect the quality of their lives. This is the more democratic face of the technology and the best manner in which it can be used to advance human development goals. Unfortunately, the current extent and pattern of diffusion of the technology in the country is such that it is the first of these that overwhelmingly predominates and is likely to continue to do so in the foreseeable future.

3. Shaping ICT for Development

Given the fact that the level of diffusion is hardly adequate to implement large scale projects aimed at using ICT for human development purposes, what we have is a set of experiments that are more in the nature of pilot projects. The number of experiments is indeed large. As reported earlier, an ongoing database being collated by IT for Change, Bangalore already records around 150 projects, and many more await inclusion. These projects provide the blueprints for programmes whose full realisation must await the creation of the requisite infrastructure. As the spread of ICTs in the country increases, it is expected that the best of these would be replicated and/or scaled up, allowing for the potential that ICTs hold for human development to be realised.

However, since these experiments are in the nature of pilot projects undertaken by a variety of institutions ranging from government bodies to NGOs and private sector firms and since many of them are of recent origin, there is not much information on their financial profile, their sustainability or of their actual impact. As a result this analysis can only use them as instances or illustrations of the possible use of the technology, without reference to the actual possibility of scaling up these experiments and creating projects that are financially viable and sustainable.

The experiments fall into different categories. Of those, a crucial set of experiments are those which aim at recasting information and communication technologies, so as to ensure diffusion, increase access and make them suitable for advancing human development. The principal aims of such work include cutting the cost of connectivity, reducing hardware costs and developing software in national and local languages so as to overcome the barrier that language creates. The second category of experiments aims at exploiting the information collation, storage and transmission facilities that the technologies offer, to increase access to information, enhance transparency and encourage the sharing of information needed for wider mobilisation and strengthened advocacy. A third category of initiatives seeks to increase the productivity and efficiency of projects designed to improve the conditions of the disadvantaged, so as to improve the quality and reduce the costs of programmes seeking to advance human development, thereby enhancing their impact and rendering them sustainable. Finally, there are experiments seeking to use the interactive, textual and visual information transmission capabilities of the technology to ensure remote delivery of crucial services such as education and health. Needless to say, there are projects which fall in more than one of these categories. Our concern in this chapter is with initiatives of the first kind, since without them the others would remain mere pilot initiatives..

Costs of diffusion

Till recently the costs of diffusing the technology were extremely high even for the government. This is illustrated by the "wired village" project implemented around Warana Nagar in the Kolhapur and Sangli districts of Maharashtra (Vijayaditya 2000); a decentralised, village level project aimed at carrying computers to the rural and semi-urban areas. The Warana Nagar project was designed as a pilot project aimed at demonstrating, in a limited way, the contribution an IT infrastructure can make to the socio-economic development of a cluster of 70 contiguous villages. The project aims to:

- increase the efficiency and productivity of the existing cooperative enterprise by setting up a communications network;

- provide agricultural, medical and educational information to villagers at facilitation booths in their villages;
- provide communication facilities at these booths to link the villages to the Warana Co-operative Complex;
- provide villagers access to the internet via the National Informatics Centre Network (NICNET);
- provide distance education facilities to both primary and higher educational institutes; and
- establish a Geographical Information System of the 70 villages and facilitate and render transparent their administration, especially in matters relating to land.

The Warana project is jointly implemented by the National Informatics Centre (acting on behalf of the central government), the Government of Maharashtra and the Warana *Vibhag Shikshan Mandal* under the education department. The estimated cost of the project of around $600,000 (Rs.2.6 crores) was also jointly financed by the central government (50 per cent), the Government of Maharashtra (40 per cent) and the *Warana Vibhag Shikshan Mandal* (10 per cent).

If costs remain where they were in schemes like the Warana "wired village" project, which the government's IT Task Force has recommended should be replicated across India's villages, the effort to accelerate penetration would of course be substantial. As mentioned earlier, the Warana project, which connected and computerised a cluster of 70 villages, was estimated to have cost $600,000. There were at the time around 550,000 villages across India. If the cost of replicating the experiment across these villages remains the same, the total would work out to around $4.7 billion. This amounts to a little more than 1 per cent of India's GDP in 2000. However, when extended to cover dispersed villages across the country the actual cost would be substantially more. We must recall that public expenditure on elementary education as a proportion of GNP stood at 1.5 per cent in 1995-96. Whether resources should be drawn away to wire India's villages when most children are not in school is a question that is bound to be asked.

Reducing diffusion costs: The corDECT initiative

However, new technological experiments as with the corDECT WLL technology are indeed promising substantial cost reductions. The technology, which was originally developed and is still being improved upon by the TeNet group led by Ashok Jhunjhunwala at the Indian Institute of Technology, Chennai, seeks to substantially reduce the cost of telephone and internet access in the rural areas of the country, using wireless technology that can sit on top of the extensive (25,000 strong) rural exchanges network of the Bharat Sanchar Nigam Limited. With seventy per cent of that network connected on fibre, the TeNet group argues that a wireless system with a 10 kilometre range, if installed at an existing fibre connected exchange, can help reach a telephone and internet connection to 80-85 per cent of India's villages. The problem is that for the technology to spread, the cost of a telephone line must be brought down substantially. Till two years back, according to Jhunjhunwala (2002), the telephone infrastructure used to cost Rs. 30,000 (around $600) per line. Since the finance charges (15 per cent), depreciation reserve (10 per cent) and operation costs (10 per cent), must be met annually if the investment is to just break even, the revenue needed to render a line feasible is around Rs. 12000 ($240) a year. This makes the technology too expensive, even though it can be reached to the 2-3 per cent households who can afford it. TeNet's goal is to bring costs down to about Rs. 10,000 a line, which would render the technology accessible to an estimated 50 per cent of households. According to Jhunjhunwala, they have already managed to reduce the cost to Rs. 16,000 per line and have started promoting its use on a commercial basis.

The optical fibre pathway

Though the direct costs of ensuring connectivity still remains high, the physical potential for near nation-wide connectivity, some argue, is fast developing. According to official sources, the optical fibre length laid out by public and private

operators in the country has increased from 0.65 lakh kilometres on 1 April 1999 to 4.12 lakh kilometres on 30 September 2003.[3] Much of this has been laid by private operators, and involves the duplication of high bandwidth infrastructure, so that the actual degree of connectivity may be geographically less widespread than suggested by figures on length of optical fibres laid. Yet a substantial degree of broadband connectivity seems to have been established.

However, as has been the experience in many other parts of the world, including in the developed industrial countries, the expected demand for bandwidth has not materialized (Arunachalam *et. al.* 2004). While in India this has not yet resulted in bankruptcies among private operators, it has indeed meant that "thousands of kilometres of buried optical fibre cables remain unlit, and a few are used as one would use copper wires for mere telephony." Utilising this bandwidth, the government can put to work projects that have positive human development and growth consequences. Hence, "the state should lease fibres from telecom companies and make the bandwidth freely available" to those implementing such projects. If not, capacity that can deliver substantial social benefits would remain unutilised because of the lack of private incentives.

Hardware costs

Besides connectivity costs, another area of concern is the cost of hardware. While tariff and excise duty reduction has helped bring down the cost of the PC, it still is unaffordable from the point of view of reaching IT to the mass of the population in a poor country like India. This makes a second set of initiatives aimed at reducing hardware costs quite crucial as well. One acclaimed example of such initiatives is the Simputer project of Picopeta Simputers Private Limited. Aimed at providing hardware access to a large number of poor users at low cost, the Simputer was designed in 2001 as a simple, easy-to-use and inexpensive device with multi-lingual software. Priced at less than $200, the Simputer is one example of a high-technology device targeted at non-elite consumers. It is currently being produced in small proto-type batches and is being field-tested in selected ICT for development projects. Another example of such an innovative device is the iStation, which was launched in 2002 by iNabling Technologies Pvt. Ltd. It is a device which is not a full-fledged PC but which offers e-mail connectivity by plugging in a phone line, and connecting through proprietary software to a linked E-mail service. With servers set up in Bangalore, Mangalore and Dharwad, e-mail services are available throughout Karnataka. The technology is now being used in experiments promoting a government-citizens interface in Karnataka and is being tested in other states as well.

Software costs

A third set of initiatives is aimed at reducing software costs, prime among which is the open source software movement. It is now widely accepted that initial software costs and costs of upgrading software can be substantial if ICT for development projects depend solely on proprietary software. This has generated some interest in using open source software which though not "free" can be much less expensive. At least one Indian state government, the government of Madhya Pradesh, has publicly announced its decision to use Linux software in its official IT programme, which includes its e-governance (Gyandoot) and computer-enabled school education (Headstart) initiatives. According to newspaper reports, former Madhya Pradesh Chief Minister Digvijay Singh told Microsoft chief Bill Gates that in the choice between a closed platform like Windows and an open source, free software programme like Linux, the latter has won out both because proprietary software is not the best way to put out public information and because of cost considerations. This is a different position from that taken by some other state governments like those in Karnataka and Andhra Pradesh and even by the central government, which are not planning to make the transition from Windows to Linux.

The difference between proprietary and free software needs to be clarified. The 'free' feature attributed to the latter does not imply that the

[3] *Figures are based on the answer to Rajya Sabha starred question No. 41 provided on 4.12.2003.*

software is necessarily distributed or made available at zero cost. Rather, as the free/open source software movement defines it, a programme is free software if a user has the freedom to run the programme, for any purpose; has the freedom to modify the programme to suit his needs; has access to the source code to exercise the freedom to modify the programme; and has the freedom to redistribute copies of the original or modified programme, either gratis or for a fee. While this is the technical definition of "free software", in practice free or open source software is in most instances available either free of cost or at extremely low prices relative to commercial software.

Programmes distributed by commercial firms such as Microsoft, including the Windows operating system, neither provide access to the source code nor permit modification. Further, with the practice of providing software patents, there are now units of code that cannot be used as part of other programmes that are being written by third parties without a licence and payment of a royalty. Combine these commercial conditions with the dominance over the operating system market that Microsoft possesses and we are faced with unreasonably high prices for any current version of the software and exceptionally high prices for upgrades that very often become imperative to use new versions of applications software or new software products.

This makes cost an important issue. According to R. Gopalakrishnan, former Secretary to the Chief Minister of Madhya Pradesh and Coordinator of the Rajiv Gandhi Missions in the state, who is a senior civil servant advocating the use of open source software wherever possible, "even after accounting for training and installation costs of open source software, it may still cost anywhere between one-half to one-tenth of commercial software depending on the application." Further, in his view, "the ocean of unnecessary features in commercial software makes hardware expensive and obsolescence cycles shorter."

The open source path, Gopalakrishnan argues, not only costs less, but that expenditure has many more spin-offs, since it is invested in training that creates a competence in the state that will become a long term asset. Further, there are larger issues involved. The technology framework of a government cannot be based on proprietary standards. And, "inherent in the debate on open source software are issues of freedom, monopoly and choice of the buyer."

The vocal advocacy of use of open source software for IT-enabled service delivery and governance by the government of Madhya Pradesh, is in keeping with trends in other developing countries including China and many Latin American developing countries, like Mexico, Brazil, Argentina and especially Peru. They are increasingly seeking to exploit the opportunity offered by the free software movement, the GNU project, and favouring the use of free as opposed to proprietary software in the government's computerisation programme. Their motivation is clear: the bread and butter issue of cost; and the more lofty ideals such as ensuring free information access, permanence of public data and security.

In these countries the attraction of open source software lies in the fact that its use by government and a large public could encourage local software professionals to provide software support in the form of add-on applications that are written at a cost much smaller than that required to buy multi-featured packaged software. This would decentralise software production, challenging the large transnational producers of packaged and boxed-software, who have been able to convert the software industry from a service industry to one with characteristics typical of large scale manufacturing.

The debate had gone the furthest in Peru as a result of a Bill (Number 1609) spearheaded by Congressman Edgar David Villanueva Nuqez, which specifies that software used by state institutions should satisfy free software conditions. This includes freedom to use, freedom to modify and freedom to publish without restriction. Among the specified reasons motivating the bill is the belief that "government use of proprietary software is a national security risk; that hidden code could contain "back doors," programs that allow remote control of computers and reveal sensitive state information open to prying eyes."

Software in the Indian languages

The fourth set of initiatives aimed at increasing access is developing software in the Indian languages. One example is Chennai Kavigal (Sood 2002), which is a software company based in Chennai, Tamil Nadu that has developed a range of products such as an advanced word processor (*Padhami*), a business suite (*Shakthi*) and an accounting and billing package (*Vanigam*) in Tamil. Both the Simputer and the iStation are loaded with software in Indian languages, and there is a range of organisations making advances on this front.

These initiatives aimed at reducing the cost at which access to the technology can be ensured are crucial, inasmuch as they help the effort to overcome the connectivity barrier to the use of ICT for development. This alone, however, does not guarantee success in scaling up ongoing experiments to realise the promise that ICTs hold for development and exploit that potential to achieve the targets set by the international community in the form of the Millennium Development Goals. That task, as we shall see requires substantial advance in a range of areas and complementary initiatives in the ICT and social spheres.

4. The Socio-economic Context

Besides the problem of "technical access", the use of ICT for human development in India pose a challenge because of the socio-economic characteristics of the country. India is indeed a large developing country with an area in excess of 3 billion square kilometres and a population in excess of 1 billion. The country is predominantly rural and agriculture still is the principal source of livelihood of a majority of the population. Even though agriculture's share in GDP has fallen from 38.1 per cent in 1980 to 31 per cent in 1990 and 24.7 per cent in 2001, 72 per cent of the population resides in rural India and agriculture accounted for 57 per cent of total employment in 1999-2000 (CSO 2002).

The country, divided into 28 states and 6 Union Territories, is also extremely diverse, being multicultural, multi-religious and home to 15 major languages that are statutorily recognised and listed in the Eighth Schedule of the Constitution, 14 of which are designated as national languages. In 1982, seven of these languages were counted among the top 20 languages of the world (Muthiah et al 1987) measured in terms of the number of native speakers of the languages. Besides the recognised languages, the 1971 Census listed 89 non-scheduled languages and 1652 mother tongues, which include a large number of dialects.

This diversity is a feature of a country that is poor by international standards, with a per capita income of just $232 in 1999-2000. Even measured in Purchasing Power Parity terms ($2,358), India's per capita income in 2000 ranks 123rd among countries covered by the Human Development Report 2002. The country is one rank lower at 124 in terms of the Human Development Index.

What is more, it now appears that after the launch of a more liberal, new economic policy in 1991 that emphasises decontrol and deregulation, the pace of economic growth that initially picked up has slackened significantly. Further, though the government argues to the contrary, there are strong grounds to believe that the 1990s have witnessed a slowing down of the pace of poverty reduction. Finally, with "fiscal correction" or a substantial reduction in the fiscal deficit being a declared objective of the reform, there has been a reduction in real budgetary allocations for subsidies on food and to the social sectors, which is adversely affecting the task of improving indicators of the quality of life. If these perceptions are valid, it could be argued that the period since 1991 was characterised by a setback in the move towards improving the various quality of life indicators for which concrete targets were set by the Millennium Declaration. This larger context makes the role that ICTs can play in advancing human development that much less significant, since the complementary and more fundamental conditions for advance have taken a turn for the worse.

Recent growth performance

It is now accepted that after a period of deceleration in industrial growth during the late 1960s and 1970s, widely considered a period of "stagnation", India moved from a path characterised by a slow 3 per cent "Hindu rate of growth" on to a rather creditable growth trajectory involving GDP growth of around 5 and 6 per cent per annum compound in the years beginning with the 1980s. There were a number of weaknesses characteristic of this otherwise creditable rate of growth. First, growth was far less pronounced in the commodity producing sectors than in services. In fact, during

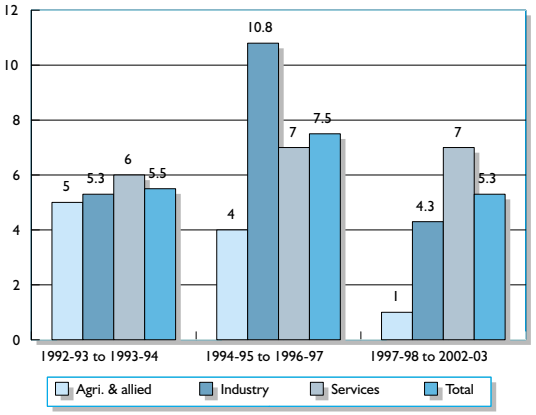
the 1990s, the rate of growth of per capita food production in the country was at its lowest level for decades.

Second, there were signs that this growth was accompanied by increased vulnerability inasmuch as it exploited the benefits for developing countries associated with the rise of finance internationally. Especially during the 1980s, growth was driven by debt financed public expenditure, which was supported with debt creating inflows from the international system that resulted in a doubling of India's external debt to GDP ratio and led to a crisis in 1991 when a loss of investor confidence resulted in a freeze in such flows. Though during the 1990s non-debt creating inflows and remittances from migrant Indian workers abroad (particularly in Gulf countries) helped shore up the balance of payments, financial liberalisation has encouraged volatile capital flows that imply that vulnerability is still a problem.

Finally, very recent trends in the economy suggest that economic activity not only shows signs of deceleration but is far below potential. Chart 7 shows that there is clear indication of deceleration in aggregate growth of GDP, despite fluctuations, in the past three years. This has been led by the poor performance of agriculture and allied sectors, but industrial growth also appears to be low over the recent period. Indeed, only the services sector shows relatively high growth rates, and even those have decelerated over the past three years.

This deceleration in growth is related to the deceleration in investment ratios. There has been a long run tendency for savings and investment rates (as shares of GDP) to increase reflecting the usual pattern in industrialising economies, with the rate of gross domestic capital formation averaging 21.8 per cent in the 1980s and 23.3 per cent during 1994-95 to 1996-97. However, this tendency appears to have come to a halt by the mid 1990s, and the rate of capital formation fell to an average of 23.9 per cent between 1997-98 and 2001-02 (RBI 2003).

Chart 4.1 : Recent Growth Trends

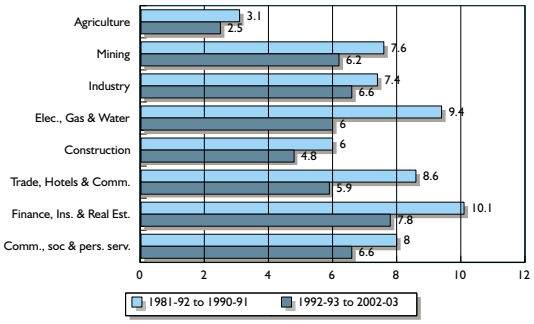


Source: Reserve Bank of India (2002)

A trend analysis of GDP growth prior to and after the reforms confirms the picture of deceleration, especially over the most recent period. The RBI has calculated semi-logarithmic trend rates of growth for the relevant periods. While the trend growth rate of aggregate GDP is estimated to have increased from 5.6 per cent over 1981-82 to 1990-91 to 6.1 per cent in the period 1992-93 to 2002-03, this masks substantial differentials in performance across sectors. In fact, both the primary and secondary sectors, as well as some important tertiary sectors have experienced deceleration of growth along with much greater volatility of growth.

The sharpest deceleration is of course to be observed for agriculture, as apparent from Chart 4.2. It is worth remembering that the primary sector's long run trend rate of growth since Independence has been 3 per cent, and the post-reform period marks the first period when it has actually fallen well below that. That period also saw a sharp deceleration in the growth of food grain production.

Chart 4.2 : Rates of Growth Before and After Reforms



Source: Reserve Bank of India (2002)

For several decades before the 1990s, the Indian economy experienced a secular growth rate of food grain production of around 2.5 percent per annum, which was a little higher than the population growth rate. Over the 1980s, there was an acceleration of the growth in output, with all food grains except coarse cereals showing relatively high rates of growth, led by yield increases rather than acreage expansion. Over the 1990s, the growth rate of food grain production dropped to 1.66 per cent per annum, which was lower than the population growth rate of 1.9 per cent in the same period. This was not only the lowest average rate since the mid-1950s, but also amounted to a dramatic drop when compared with the earlier decades. Meanwhile, in the last three or more years, per capita total agricultural production (including non-food grain crops) has also fallen.

The fall in production cannot be blamed on lack of area expansion, because the 1990s actually experienced a more rapid rate of area expansion than the 1980s, for most crops. Rather, it was the collapse in yield growth that explained the deceleration in output growth. To some extent this reflected the easing of the process of spread of Green Revolution techniques to other regions (particularly the eastern region) that had marked the 1980s.

The available data taken together suggest that overall agricultural production probably grew at around 3.5 and 2.2 per cent per annum during the 1980s and 1990s respectively, and, adjusted for terms of trade, farm real income growth was around 4.5 and 2.5 per cent per annum during these two periods. This implies that in terms of per capita of rural population, annual growth of income and output during the 1990s was around 1 and 0.5 per cent respectively. In addition, there has been virtually no growth in per capita agricultural output and incomes after 1996-97, according to any series. Rates of growth of farm business incomes, according to official Cost of Production estimates, declined from 3.6 per cent per annum in the 1980s to 1.5 per cent per annum in the 1990s. (Abhijit Sen, 2002) Therefore it is likely that per capita agricultural real incomes have actually declined after 1996-97 due both to very low yield growth for most crops and substantial terms of trade loss for non-cereal crops. This implies a significant shift in income distribution in the economy away from agriculture. Nevertheless, agriculture continues to account for nearly two-thirds of the working population in the rural areas, and 70 per cent of rural women's employment.

Manufacturing has been crucial for the growth of the Indian economy, and therefore it is disturbing to see from Chart 4.2 that this sector has also witnessed a substantial deceleration in growth. Deceleration of output growth has been accompanied by increased fluctuations, and this is related to the even sharper slowdown in manufacturing in the latter part of the period.

In sum, despite the initial optimism generated by the economic reforms of the 1990s, the evidence suggests that growth has tended to decelerate in recent years in the commodity producing sectors. We must recall that the growth directly delivered by the ICT sector itself is predominantly in services, especially IT-enabled services. This in itself cannot correct for the emerging weaknesses in the economy, even though it partially compensates for the adverse consequences of those weakness. Thus it is crucial if ICTs are to contribute to development, that its use must also be targeted at improving growth in the commodity producing sectors, especially in agriculture.

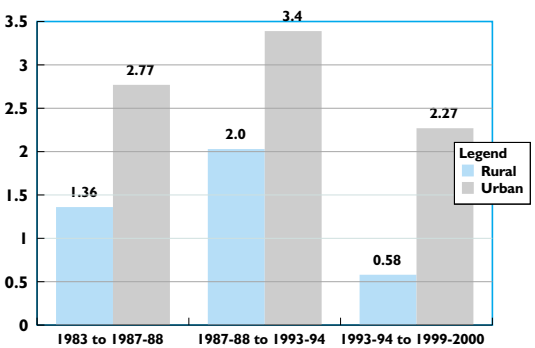
Employment trends

But that is not all. Even to the extent that growth did occur in different sectors during the 1980s and

early 1990s, the available evidence suggests that the impact of this growth on employment was limited. When the first results of the 55th Round of the National Sample Survey (conducted in 1999-2000) were released, it was already apparent that there had been some major shifts in patterns of employment, especially in the rural areas. The 55th Round indicated a substantial decline in the share of agriculture and a rise in the share of non-agriculture in employment. In itself this could be a positive sign of progress and diversification, but it was associated with a fairly large drop in work participation rates of both men and women, which indicated a deceleration in aggregate employment growth.

Such a deceleration has now been confirmed by data emerging from the 2001 Census. When the estimated population is used to estimate the total number of those in some form of employment in 1999-2000, it yields results which show an even sharper drop in the rate of growth of rural employment generation than was previously supposed, although the fall in urban employment growth is less severe (Chart 4.3). Thus, the combined estimates suggest an average annual rate of growth of aggregate rural employment growth of only 0.58 per cent over the period between 1993-94 and 1999-2000. This makes it not only as low as around one-fourth of the previous period's rate, but also the lowest such rate of increase observed since the NSS first began recording employment data in the 1950s.

Chart 4.3: Growth Rates of Employment (Per cent per annum)



Source: Based on NSS employment data and Census population figures

Note: Employment here refers to all (principal and subsidiary status) workers

Going by data from the Censuses alone, the evidence points to a collapse in the rate of growth of employment as main workers (that is, those involved in economic activity for more than half the year) over the decade of the 1990s. The rates of growth of employment as "main workers" is substantially less than the rate of rural population growth which was around 1.7 per cent over this period.

The decline in the overall rate of growth of employment was largely due to the stagnation of employment in agriculture, that earlier had been a major source of incremental employment. Thus the improved aggregate growth performance of the 1990s was accompanied by a decline in the elasticity of employment with respect to output. With a substantial part of employment in the unorganised sector being reflective either of a process of agricultural "involution" or of a distress-driven spill-over into low-paid, casual and insecure employment, it appears that the ability of the current process of growth to adequately impact on poverty and deprivation is indeed limited. The need therefore to rely on direct public action to deal with poverty and make a difference to human development remains. ICT for development projects should, therefore, not only be concerned with enhancing output but also employment growth, and once again especially in the rural areas.

Poverty reduction

The inadequate growth of employment even in periods when output is growing at creditable rates implies that poverty tends to persist despite high growth. Poverty and deprivation are also aggravated by the inequality of asset and income distribution in the country. Underlying India's low per capita income level is a high degree of inequality in income distribution, as a result of which a large proportion of the population is below the nationally defined poverty line. At last count (1999-2000), estimates of the proportion of the population below the national poverty line varied between 27 and 34 per cent for rural India and 24 and 29 for urban India, depending on the definition and method adopted. These differences arise because of a change in methodology discussed later.

However, even going by the official estimates, there were 260 million poor people in the country in 1999-00, 193 million of whom resided in the rural areas. Poverty is associated with a lack of access to productive resources, physical goods and income, which results in deprivation, vulnerability and powerlessness. It has various manifestations including hunger and malnutrition, ill health, and limited or no access to education, health care, and safe housing and (paid) work environments. It can also include the experience of economic, political and/or social discrimination, or features that are currently captured in the term "social exclusion". This description accepts that poverty is a multidimensional phenomenon, which is at best only partially captured in data based on estimates of income or consumption expenditure.

Nevertheless, the most common definition used in developing countries refers to material consumption, and grounds the definition of a poverty line in terms of expenditure necessary for the fulfilment of a nutritional requirement of a certain minimum calorific intake. Indeed, poverty in developing countries is a far more comprehensive state of being, which encompasses not just material want but also powerlessness and marginalisation. Therefore, estimates based on income poverty alone tend to underestimate not only the lower quality of life of the really poor, but also the multifaceted nature of effective poverty among groups of people who may be living above the "poverty line" based simply on the food consumption norm.

Not surprisingly, therefore, associated with persisting income poverty is the evidence that India's progress towards improving a range of social development indicators has been disappointing. One way of assessing this inadequate progress is to compare recent "achievements" with the goals and targets set by the Millennium Declaration of the United Nations. Table 4.1 provides such a comparison in a number of areas, and the overall picture that emerges is by no means encouraging. Efforts to move in the direction of realising the MDGs within the targeted period need to be substantially strengthened.

Challenge and opportunity

This report is concerned with focusing on ways in which Information and Communication Technologies can be used to strengthen the effort to realise those goals. But a caveat is necessary here. ICTs are not always benign. If initial conditions are characterised by deep economic and social divisions, its effects can even be adverse. The nature of India's economic divisions has been alluded to above. Further, given India's caste system, which is a system of social stratification that results in differential access to economic opportunities for different castes, the most depressed castes and the scheduled tribes tend to preponderate among the poor and the deprived.

Since these economically and socially ordained divisions result in differential access to opportunities and differences in literacy and educational standing, there is a real danger that access to and the benefits from information technology can be differentially distributed as well. That is, not only is the task of ensuring ICT access to the vast majority daunting, the danger of a worsening of inequality because of a widening digital divide is also real.

Yet, ICTs offer an opportunity. As mentioned earlier, it promises to help sustain and accelerate employment and income growth. It also promises to facilitate direct public action aimed at alleviating poverty and advancing human development. The latter is important given the conclusion drawn from evidence that while growth is a prerequisite for rapid human development, growth alone is an inadequate means to achieve the extent of poverty alleviation and human development advance necessitated by the extreme incidence of deprivation in India.

In India, by the late 1960s, it became clear that the pattern of growth, given asset and income inequality was such that growth in itself was a poor instrument to deal adequately with poverty and deprivation. Given the pressure to resolve these problems set by the framework of parliamentary democracy, the government had to shift to an agenda in which, at least in rhetoric and to a certain extent in practice, direct public action to deal with obvious signs of deprivation, such as poverty, lack

of safe drinking water, poor sanitation, inadequate primary education and primary health care facilities and the like, was to be resorted to. As part of this agenda a variety of programmes such as employment generation programmes, integrated rural development programmes, basic needs programmes, programmes to universalise primary education and enhance adult literacy, programmes to ensure access to primary health care, and so on were devised and significant, even if inadequate, budgetary allocations were made.

It cannot be denied that varying degrees of progress have been registered in alleviating different kinds of deprivation through these policies. But it can hardly be argued that in a country where more than 200 million people live in abject poverty, that progress has been adequate. As Table 4.1 indicates, while according to official estimates India has made considerable progress in some areas such as poverty reduction and is therefore on the way to achieving the goals set by the Millennium Declaration, in many other areas such as literacy, education, gender equity and combating malnutrition, the progress has indeed been slow and India is not on track to realising the MDGs..

It is in this background that we need to examine the prospects of utilising ICT for furthering the MDGs. Inadequate progress in the past poses a challenge in a double sense. It encourages the search for ways in which the new technology can be applied to accelerate the pace of improvement of a number of indicators and realise the MDGs. It constrains the ability of large sections of the population to exploit or benefit from the benefits of the new technology. It is the nature of this two-fold challenge and the means to deal with it that is the concern of this study.

Table 4.1: Millennium Development Goals: Selected progress indicators for India

Goals and targets from the Millennium Declaration		*Indicators of progress*
Goal 1. Eradicate extreme poverty and hunger		
Target 1.	Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	1. Official poverty estimates based on a nationally defined poverty line point to a decline in the incidence of poverty from 38.9 per cent in 1987-88 to 36 per cent in 1993-94 and 26.1 per cent in 1999-00. However the last of these figures is controversial, because of a change in survey methodology relating to the reference period used. Some analysts place the estimate for 1999-00 at around 33 per cent. The latter makes the pace of poverty reduction the same during the two five year periods 1987-88 to 1993-94 and 1993-94 to 1999-00. Taking the rate as indicated by the official poverty figures, India is well on the way of realizing the millennium development goal in this area. Poverty would have stood at 35.06 per cent in 1990-91 and would fall to just 3.06 per cent by 2015-16, which is way below half. The goal of halving poverty would be achieved as early as 2004-05. On the other hand if the rate of reduction suggested by the independent estimate is taken into consideration, poverty would touch 22.38 per cent in 2015-16, which

		is close to 4 percentage points "short" of the MDG target. Proportion of population below $1(PPP) per day (World Bank) in 1997 was 44.2.
Target 2.	Halve, between 1990 and 2015, the proportion of people who suffer from hunger	3. The incidence of malnutrition as measured by the height for age of children below 5 years of age fell from 62 per cent in 1990 to 46 per cent in 1999. As measured by the weight for age of children under 5 years it fell from 64 to 47 per cent. If this rate of reduction persists, India is on the way of achieving the target of halving malnutrition by the years 2006-2007. However, the disconcerting feature is that World Bank figures suggest that the incidence figures having fallen sharply from 62 and 64 per cent respectively in 1990 to 52 and 53 per cent in 1993, experienced a deceleration in the rate of decline so that they touched 43 and 45 per cent respectively only in 1997. Distressingly, they subsequently rose to 46 and 47 per cent respectively in 1999.
Goal 2. Achieve universal primary education		
Target 3.	Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	4. Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. This was close to or at 100 per cent throughout the 1990s. However, what matters is the net enrolment ratio, which is the ratio of the number of children of official school age (as defined by the national education system) who are enrolled in school to the population of the corresponding official school age. 5. However, the proportion of pupils starting grade 1 who reach grade 5, or persistence to grade 5 (percentage of cohort reaching grade 5) given by the share of children enrolled in primary school who eventually reach grade 5 is estimated at a virtually stagnant 59 per cent in 1993 and 60 per cent in 1998. Thus there appears to be little progress in achieving the goal of a full course of primary schooling for children by 2015.

6. Age specific enrolment ratio

6-11 years	
1981	1991
Boys : 55.3	Boys : 56.6
Girls : 38.5	Girls : 45.4
Children :47.2	Children : 51.2
11-14 years	
1981	1991
Boys : 62.0	Boys : 71.1
Girls : 36.7	Girls : 52.2
Children : 50	Children : 62.1

7. The illiteracy rate among 15-24-year-olds fell from 36 per cent in 1990 to 31 per cent in 1996 and 27 per cent in 2000. Progress towards eradicating illiteracy among the youth by 2015 is far too slow for successful achievement of the target.

Literacy Rate

1981	1991	2001
43.57%	52.20%	65.38%

8. **Literacy Rate (15+)**

	1981	1991
Rural Male	47:39%	54.89%
Rural Female	17.60%	24.92%
Rural Person	32.79%	40.34%

Urban Male	76.29	80.14
Urban Female	51.90	59.86
Urban Person	65.11	70.68

Comb. Male	54.92	61.89
Comb. Female	25.72	34.09
Comb. Person	40.83	48.54

9. **Literacy 7-14**

1981	1991
Boys : 60.58	Boys : 71.49
Girls : 41.57	Girls : 56.25
Children : 51.49	Children : 64.16

Goal 3. Promote gender equality and empower women

Target 4. Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015

10. Percentage of females among pupils at the primary education stage rose from 41 in 1990 to 43 in 1992, stagnated at that level till 1996 and rose to 45 in 1998. This is a pace of change

wherein the likelihood of realisation of the target is close to nil. The proportion of females among secondary school pupils stagnated at 37 per cent between 1992 and 1995 and then rose marginally to 38 per cent in 1998, where it remained even in 1998.

11. Ratio of illiterate females to males 15-to-24-year-olds: Remained stagnant at 1.6 from 1990 to 2001

Percentage of women in the 15+ age group and above who were either working on a casual, principal and secondary status or seeking or available for work:

	1983	1993-94	1999-2000
Comb.	44.4%	42%	38.5%
Rural	51.0%	48.8%	45.6%
Urban	23.5%	23.4%	20.9%

Men

Comb.	:87.1%	85.4%	83.5%
Rural	88.7%	87.6%	85.4%
Urban	82.5%	79.9%	78.6%

12. Overall sex ratio (Females per 1000 males)

	1981	1991	2001
Rural	952	939	946
Urban	880	894	901
Combined	934	927	933

13. Sex Ratio in Proportion 0-6

1981	1991	2001
978	955	927

Goal 4. Reduce child mortality

Target 5. Reduce by two thirds, between 1990 and 2015, the under-five mortality rate

14 Under-five mortality rate: Fell from 112 per 1,000 live births in 1990 to 107 in 1992, 98 in 1994, 95 in 1997 and 88 in 2000.

15. Infant mortality rate: Fell from 80 per 1,000 live births in 1990 to 79 in 1992, to 74 in 1993, 72 in 1996, 70 in 1999 and 69 in 2000.

16. Proportion of 1-year-old children immunized against measles: Declined from 56 per cent in 1990 to 43 per cent in 1991 and then rose to

51, 59, 67 and 72 per cent in 1992, 1993, 1994 and 1995 respectively. The proportions then fell to 66, 55, 51 and 50 per cent respectively over the next four years.

17. Fully vaccinated children 12-28 months (BCG, Measles, 3 doses of DPT, & Polio Vaccinations)

	1992-93	1998-99
Rural	30.9	36.6
Urban	50.7	60.5
Combined	35.4	42.0
Not Vaccinated		
Rural	34.0	16.7
Urban	16.4	6.4
Combined	30.0	14.4

Goal 5. Improve maternal health

Target 6. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio

18. Maternal mortality ratio: 437 per 1,00,000 live births in 1992-93 and 407 in 1998 (NFHS)

19 Proportion of births attended by skilled health personnel stood at 44 per cent in 1990 and and 49 per cent in 1993. (UNICEF – WHO)

Birth attended by health professionals (% age from NFHS)

	1992-93	1998-99
Rural	25.0	33.5
Urban	65.3	73.3
Combined	34.2	42.3

Goal 6. Combat HIV/AIDS, malaria and other diseases

Target 7. Have halted by 2015 and begun to reverse the spread of HIV/AIDS

20. HIV prevalence placed at 3.7 million in 2001.

21. Condom use rate or the contraceptive prevalence rate : 41 per cent in 1993. Couple protection rate rose from 44.1 per cent in 1991 to 48.2 per cent in 1998-99.

Target 8. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases

22. Prevalence of malaria: 2.7 million in 1981 and 2.2 million in 2000.

Goal 7. Ensure environmental sustainability

Target 9. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

23. Proportion of land area covered by forest: 21.4 per cent in 1990 and 21.6 per cent in 2000.

24. Ratio of area protected to maintain biological diversity to surface area: 6.8 per cent in 1991 and 1999

25. Carbon dioxide emissions (per capita) : 0.79 metric tones in 1990, 0.98 in 1995 and 1.08 in 1998.

Target 10. Halve by 2015 the proportion of people without sustainable access to safe drinking water

26. Proportion of population with sustainable access to an improved water source, urban and rural: In urban areas the proportion was constant at 92 per cent in 1990 and 2000. In rural areas the proportion rose from 73 to 86 per cent between 1990 and 2000. Average figure at 62 per cent (81 urban and 56 rural) according to 1991 Census. NSS 54R: 50 per cent of rural households served by tube well/ hand pump, 26 per cent by a well and 19 per cent by taps.

Population with access to safe drinking water:

	1981	1991
Rural	26.50%	55.54%
Urban	75.06%	81.38%
Combined	38.19%	62.30%

Target 11. By 2020 to have achieved a significant improvement in the lives of at least 100 million slum dwellers

27. Proportion of urban population with access to improved sanitation: Rose from 53 to 78 per cent from 1990 to 2000. As per Census 1991, less than one-fourth of households in the country have toilet facilities within the premises, the proportion being less than 10 per cent for rural and around 64 per cent for urban households. According to NSS 54 R 1999, 43 per cent of households in urban areas either had no latrines or no connection to a septic tank or sewerage.

Households with access to toilet facilities

	1981	1991	1997
Urban	58.15	63.85	
Rural		9-48	
Combined		23.70	49.32

	SC	ST
Urban	38.28	40.68
Rural	5.15	4.10
Combined	11.16	7.22

28 Proportion of households with access to secure tenure (owned or rented)

HHs with Pucca Houses		
	1981	1991
Rural	22.53%	30.59
Urban	64.70%	72.85
Combined	32.67%	41.61%
HHs with Semi Pucca Houses		
Rural	36.93%	35.65%
Urban	21.80%	17.69%
Combined	33.29%	30.95%
HHs with Kutcha Houses		
Rural	40.55%	33.76%
Urban	13.50%	9.56%
Combined	13.04%	27.44%

Goal 8. Develop a global partnership for development

Target 12. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

29. Telephone lines per 100 inhabitants: 1.29 in 1995 and 3.98 in 2002. 1.22 cellular subscribers per 100 population in 2002 (ITU)

30. 0.58 personal computers in use per 100 population in 2002 (ITU) and 159.14 internet users per 10, 000 population in 2002 (ITU) No of internet users rose from 1000 in 1992 to 250000 in 1995, to 16,580,000 in 2002.

5. ICTs Policy and Diffusion

Since the use of ICT for human development presumes the widespread diffusion of the technology and substantially enhanced connectivity, policies influencing the growth of ICT production have an important role to play. The nature of diffusion is influenced by: (i) the ease of access to and the cost of IT hardware and software based on domestic production and imports; (ii) the extent to which and the means through which the creation of a domestic communications infrastructure is promoted; (iii) the regulatory framework that is adopted with regard to different segments of the ICT sector; and (iv) the emphasis that is placed on government initiatives aimed at bridging the digital divide and reaching the power of information and communication technology to as large a proportion of the population as possible.

Hardware access

Before 1970, the domestic electronics industry in India was small and relatively unsophisticated, and firms like International Business Machines (IBM) and International Computers Ltd. (ICL) overwhelmingly dominated domestic electronics production. The decision to promote an indigenous industry was taken on the basis of the Homi Bhaba Committee report, submitted in 1965, which called for eliminating reliance on foreign players in the electronics industry within a ten-year time frame. The Committee recognised that since the country's needs for very large computer systems were small, the focus of the indigenous effort must be the manufacture of small- and medium-sized systems.

To implement this strategy, the Department of Electronics was created in 1970, and the Information Planning and Analysis Group and the Electronics Corporation of India Limited (ECIL) in 1971. Even though ECIL had an initial monopoly, by 1975 the government opened up the minicomputer sector to private operators, but restricted through licensing the imports of complete systems. Import restrictions applied to imports of raw materials and components required by the industry as well. The intention, clearly, was to support the growth of an electronics production complex within the country. However, the focus was on end-product manufacture with restrictions on imports of components, parts and raw materials being less stringent and tariffs on such imports lower.

By the late 1970s, a number of private investors had entered the industry. The next stage in the evolution of policy was to relax the access to imported raw materials and components for these producers. A number of these were placed on OGL and actual producers were permitted to automatically import even restricted items to an extent determined by usage in the previous year. However, this was accompanied in 1983-84 by a phased manufacturing programme (PMP), which required the share of imported inputs used to fall to 70-80 per cent in two years time and 40-50 per cent after the third year.

Despite these developments the spread of IT hardware use in India was limited. Multiple producers of hardware operating with uneconomic scales, high duties and lack of intervention in domestic pricing meant that the cost of hardware was extremely high, resulting in the slow growth of domestic demand, production and availability. The acceleration in domestic production based on imported parts had to wait for developments in technology that heralded the arrival of the personal computer.

Even when the domestic production of personal computers gathered pace in the latter half of the

1980s, prices were at levels that restricted the growth of domestic demand. This was largely the result of the fragmented structure of the industry. Initially the Indian hardware sector, which was more or less limited to domestic firms, consisted of three segments. Premium producers like Wipro, which controlled the market consisting of quality-conscious customers, who demanded a large and reliable after-sales service network and were willing to pay a higher price for these features. Large volume retailers like Sterling Computers and HCL, which kept prices down by pushing volume sales while limiting overhead costs and accepting lower per-unit margins. And a large number of assemblers with low overheads, a small employee-base and virtually no after-sales service, who catered to price-conscious customers willing to take quality risks. According to International Data Corporation (India), vary small assemblers selling less than 200 units annually accounted for close to 50 per cent of the market for assembled PCs in 1998-99.

These small producers most often used inputs obtained from suppliers who had managed to evade customs duties. This reduced their costs substantially. Besides, these firms were satisfied with extremely low margins. As a result their prices were much lower than that of the large domestic suppliers. Not surprisingly, the market catered to by the assemblers as a group was by no means small. For example, during the first six months of 1998-99, PC assemblers accounted for a 53 per cent share of units sold in the Indian market and 45 per cent of that market in terms of value.

The large premium producers defended their prices on the grounds of being technologically superior, of offering better quality and of providing far more reliable after-sales service facilities. In practice, having invested much in marketing to build their brand images, these large suppliers used the protection afforded by the government to garner large margins on their sales, but did little to build brand loyalty in the domestic and international market. Neither did the government intervene to ensure that the period of protection was used to build technological capability and viable sales volumes.

When the domestic market for PCs and peripherals is relatively protected and component imports are highly taxed, the few large players coexist with the large number of smaller suppliers. It should be obvious that all segments of the domestic industry benefited substantially from the quantitative restrictions on PC imports, with premium producers garnering high margins and the lower-end assemblers surviving despite high costs and poor service support. Needless to say, the small assemblers with low margins were in no position to use the opportunity afforded by protection to build capabilities of a kind that would allow them to compete with large international suppliers as and when protection was withdrawn. On the other hand, with the government not enforcing R&D based competitive production in the premium segment, and premium producers choosing to encash the large margins rather than plough them back into production, even they did not concentrate on developing indigenous sources of supply of components and accessories and on reducing costs and developing significant product innovation capabilities.

This structure of production proved inadequate from the point of view of the government when in the 1990s cheap software skills and Silicon Valley connections triggered the growth of software and services exports. Influenced, in part, by the overall shift away from a policy emphasising import-substitution and intervention to one focusing on a freer trade regime and a greater role for market forces in determining investment, production and prices, the government chose to liberalise access to imported hardware as well as permitted international producers to market branded products in the domestic tariff area.. Combined with duty reductions driven by India's accession to the international trade agreement relating to IT products, this has set off a boom in hardware production, import and sales in the country.

The first casualty of the new policy regime were some producers in the premium segment who when faced with the abolition of quantitative restrictions and the reduction of duties on a range of PC products, decided they could not face up to the competition. Some chose to become domestic sales agents for international brands. But almost all leading producers have substantially diversified out of PC production into software-generation.

As a result, in the wake of liberalisation the industry has seen significant changes in structure. Liberalisation has resulted in the gradual conversion of some premium producers into domestic sales agents for international firms. Wipro for example had virtually discontinued its own range of products and has become a supplier of Apple and Acer products. It has also resulted in the closure of at least some large volume retailers such as Sterling, though some other large producers like HCL have remained in the PC business. Finally, as the volumes sold by multinational brands increase and duties on imported components and systems fall, there has been a growing threat of erosion of the market share of assemblers by these international suppliers.

In 1999-00, about a half of the top 15 PC brands in India were known international brands, there were only two major domestic players who were involved in retailing volumes larger than 50,000 PCs a year, and these producers were falling behind in the competition with transnational producers. To quote Dataquest: "Gone are the days of PCL, DCM and ECI – the erstwhile heroes of the domestic IT market have long vanished or have been relegated to history books. Today's domestic market is run by MNCs. Look around at any of the IT segments in India and the frontrunners are likely to be MNCs. Think servers and you think Sun, IBM, Compaq and HP. Think printers, you have little option but to think HP, Epson and Samsung. Think networking products and who can you think of but Cisco and 3Com? Sure, there are some lone Indian rangers, for instance HCL Infosystems in desktops and TVSE in impact printers, but even their numbers are fast dwindling. This is a domestic scene that is nearly monopolised by MNCs."[4] The tendency for these transnational suppliers to source virtually knocked-down kits from production facilities abroad is known, resulting in a high and growing import intensity in the industry. This implies that the output and employment implications of the rapid growth of domestic hardware spending would be far less than suggested by the gross revenue figures. It also implies that the foreign exchange outflows associated with ICT diffusion would be greater than would have been the case if policy had managed to foster a strong hardware production base. This, however, is a fact that goes relatively unnoticed because of the large foreign exchange revenues being generated by the software sector of India's IT industry. India massive and creditable export success in the software export area has unfortunately resulted in a form of the Dutch disease, which adversely affects hardware sector growth.

There are two other features of the structure of the ICT industry that affect the nature and the pace of diffusion. These are: (i) private sector dominance in IT investment and spending; and (ii) export dominance in IT revenues. Private sector dominance in IT investment and spending suggests that the nature of the capital stock and infrastructure generated and the pricing of most services that are offered would be largely governed by profit considerations. This would mean that infrastructure generation for provision of e-governance and IT-enabled social services delivery is not likely to result from the current dynamic of the IT sector, but would need substantial state intervention. Evidence from other countries such as South Korea, which leads to world in terms of the spread of broadband connectivity, point in two directions: (i) the need for substantial state investment or state support for private initiative; and (ii) the existence of a "killer application", (in this case gaming), if private initiative is likely to deliver such connectivity, even with state support. Since the level of per capita income and the experience with cable penetration suggests that such a killer application is unlikely to emerge in India in the near future, state investment becomes crucial if widespread diffusion is to occur at all.

The setback to domestic diffusion is all the greater because of the fact that India's IT sector growth has been characterised by the dominance of export revenues over domestic revenue growth. This does make the development of the sector take on an enclave-like character, with limited even if not negligible domestic linkage effects. It is not just that exports account for more than 60 per sent of IT sector revenues today, but the fact that exports

[4] *"Multinationals in India: Domestic Champions", Dataquest, July 31, 20001, p. 194.*

from software technology parks account for 70 per cent of software exports from the country. This would suggest that ICT expenditure would be concentrated in a few locations, rendering the diffusion effects of ICT growth limited. In fact, an examination of the adoption of IT by Indian industry based on ASI data indicates that only 35 per cent of factories covered in 1997-98 claim to use computers in offices, only 1.1 per cent have networked computer systems, just 3.7 per cent were connected to the internet and a meagre 1.8 per cent used robotics or computerised processes in production.

Communications policy

Fortunately, there are areas in which state policy has helped neutralise the inadequate diffusion benefits from the growth of the IT industry in India. Till the late 1980s, communications policy in India was predominantly geared to extending the domestic communications infrastructure and building a domestic information and communications technology industry so as to reduce dependence on imported equipment. The essential ingredients of that strategy were public monopoly over broadcasting and communications services, the creation of a communications technology industry in the public sector, an emphasis on the universal service provision objective, protection of the domestic communication technology industries, controls on foreign investment and foreign technical collaboration in these sectors and an emphasis on domestic R&D as a means of developing the industry.

By the late 1980s, the government's attention was focused on the inadequacies associated with this policy regime, rather than its achievements. On the one hand, the spread of communications infrastructure was impressive, especially into the semi-urban and rural areas. In the mid-1990s India had a significantly higher telephone density than was warranted by its per capita GDP and it had a better record of rural penetration than other more advanced developing countries of smaller size. However, the urban areas where the density of demand for these services was high were characterised by major backlogs in service provision relative to demand. Similarly, while there had been substantial growth of the electronics and IT industry, in which public sector companies had played a major role, technologically India was indeed way behind relative to trends in the international industry. Among the factors that contributed to this situation were the financial crunch faced by the government and the lack of adequate autonomy for the managements of the production and R&D units that were under state control.

Dissatisfaction with the state of affairs, however, did not lead to adequate efforts to accelerate investment growth, adopt appropriate technology choices and restructure the public sector and provide it greater autonomy in mobilising resources, making investments and undertaking routine activities. When an attempt was made around the mid-1980s to remedy the situation, the thrust was not on correcting the inadequacies associated with the early regime of intervention, but on market-based reform. The overall ethos of liberalisation that came to pervade policy-making at that time ensured that policy moved in a number of directions involving substantial decontrol and deregulation. The set of policy initiatives that reflected this shift included:

i) Allowing for the entry of private sector firms into the telecom equipment manufacturing area: The Industrial Policy Resolution of 1956 had reserved telecom equipment manufacture for the public sector, leading to the creation of a number of public sector companies such as Indian Telephone Industries, Hindustan Teleprinters Limited and Hindustan Cables Limited to service the demand for telecommunication equipment. It was in 1984 that private entry was first permitted into the limited area of telephone cables and subscriber premise equipment such as telephone instruments, PABXs and teleprinters. Since then liberalisation was extended quite rapidly leading to the complete delicensing of the industry in 1991.

ii) Liberalising the import of information technology equipment and software both for software exporters with special concessions

and for others at declining rates of import duty.

iii) Permitting the entry of foreign firms and international brand names into both the hardware and software segments of the industry.

iv) Providing software and IT-enabled service exporters with tax concessions amounting to a virtual tax holiday and supporting the industry with software technology parks and investment in infrastructure.

v) Opening up the basic services sector to private telecom operators: The National Telecom Policy of 1994, threw open the basic services sector by allowing for bidding for licences to operate in circumscribed telecom circles consisting of the metros and regions co-terminus with the state. The ostensible objective was to supplement the efforts of the public sector to ensure telephone provision on demand and a telephone in every village at affordable prices.

vi) Permitting the entry of both private and public sector companies into the mobile telephony area using both GSM and CDMA technology.

vii) Corporatising the public sector telecommunications network by creating separate corporations to cater to the principal metros and to the rest of the country, and converting the Department of Telecommunications into a policy-making entity.

viii) Creating a statutory Telecom Regulatory Authority of India to recommend policies to increase competition, fix tariffs and mediate between different service providers regarding interconnection, etc.

ix) Restructuring the National Telecom Policy 1994 through the New Telecom Policy of 1999 to deal with some deficiencies in the 1994 policy.

x) Opening up National and International Long Distance Telephony to private operators.

In terms of the availability and cost of telecom services the competition introduced by these measures has had tremendous consequences. However, there is concern in some circles on two counts. First, with the increased competition and the presence of many private players, it is argued that the objective of universal service provision would take a back seat, despite the existence of a Universal Service Fund financed by a Universal Service Levy amounting to 5 per cent of the licence fees of the telecom operators. These operators can bid for funding from the Universal Service Fund to offer services in remote areas. Second, it is argued that the duplication of the expensive network by competing providers in different circles would result in the differential distribution or incidence of the tariff benefits of competition. It is likely, it is argued with some supporting evidence, that low intensity users and rural users would over time face an increase in tariffs, whereas high intensity users in high-density, urban areas would benefit from a reduction in tariffs.

If these outcomes are realised, the implications for access and therefore for exploiting the human development benefits of the technology are no doubt partially adverse. This is not to say, however, that the government's ICT policy ignores the possibility of using these technologies for human development purposes. The 1999 Telecom Policy calls for a balance between 'universal service to all uncovered areas' and 'high level services capable of meeting the needs of the country's economy'. It sets the following targets:

- Ensure a situation of telephone provision on demand by 2002, and sustain it thereafter so as to achieve a telephone density of 7 by 2005 and 15 by 2010.
- Encourage the spread of telecommunications to rural areas by making it more affordable, by making rural telecom provision mandatory for all fixed service providers and by providing reliable transmission media in all rural areas so as to increase rural teledensity from 0.4 to 4 by 2010.
- Achieve telecom coverage of all rural villages and provide reliable media to all exchanges.
- Provide internet access to all district headquarters by 2000.

- Provide high-speed data and multimedia capability (using technologies such as ISDN) to all towns with a population greater than 2 lakh by 2002.

A National Task Force on IT and software development[2] was set up in the Prime Minister's office in May 1998. The Task Force made significant recommendations in three human development-related areas, among others. These were: IT in government; IT spread and IT awareness; and Citizen-IT interface. With regard to IT in government the task force recommended complete computerisation ("up to viable limits") of government in five years. The objective of such computerisation was to reach service delivery as close to the citizen as possible, with minimal intermediation and at affordable cost. The argument was that unless computerisation progressed significantly in government it could not spread adequately outside. To that end, it recommended that 2 per cent of the budget in every government department should be earmarked for the introduction and use of information technology, including training.

In the area of IT spread and awareness the task force besides recommending reaching computers and the internet to every school and college within five years, called upon the government to launch a range of value added network services. The committee argued: "While providing delivery of services, use of a variety of technologies and solutions could be explored. These could include home-based computers, ATMs, electronic kiosks, telephones, smart cards, etc. Such networks could substantially promote government's efforts to provide a `one-stop non-stop' interface with the public." The task force also felt that for at least about two decades it will not be possible to provide either telephones or internet or other information services universally i.e. to more than 90 per cent of households, since many would not be able to afford private subscriptions. It, therefore, recommended that these should be made available on a public access basis, just as long distance services are now available through STD/ISD booths. Since there are more than 600,000 of these booths at present, with more half of them located in villages, it suggested that as many of these as possible should be converted into Public Tele Info Centres.

Finally, the committee called for use of the Freedom of Information Act to make available all official databases online to intensify democracy and increase transparency.

As a follow-up to the work of the Committee, the government set up a Working Group on Information Technology for Masses, on May 10, 2000. The working group was mandated to: (i) review various schemes and major initiatives taken by various Government agencies for taking IT to masses; (ii) identify potential areas and applications for deployment of IT for masses; (iii) recommend development schemes/ programmes for citizen participation for taking IT to masses; and (iv) prepare a comprehensive plan for taking IT to masses.

The Working Group examined four areas: Infrastructure and Services, Electronic Governance, Education and Mass Campaign for IT Awareness and came up with a range of detailed recommendations in keeping with the thinking outlined earlier. Thus, it is clear that at least at the level of policy formulation and statement, a range of human development concerns do enter into the policy framework of the government. Further, there is a substantial degree of recognition of the constraints on ensuring the reach of ICTs to the extent needed for them to be major instruments of development, so that policy does take account of the need for reducing costs and mobilising resources. But the thrust is indeed quite recent and it remains to be seen whether policy would actually be translated into practice.

E-governance

The concern of government at national, state/ provincial and local levels to incorporate ICTs into its development agenda is also visible in the large number of "e-governance' projects that have been initiated in the country. These projects constitute

[5] *The full report of the task force is available at http://it-taskforce.nic.in/bg.htm.*

by far the most numerous, among the largest and the most noticed of ICT for development projects in the country.

The aim of most e-governance initiatives fall under one of the following heads: (i) use of ICTs to ensure greater information access for the ordinary citizen; (ii) use of ICTs to deliver a range of services varying from online submission, processing and tracking of applications and complaints to delivery of education and health services; and (iii) use of ICTs as data gathering and warehousing devices to increase the quality of decision-making and governance.

An early and relatively large-scale example of an e-governance project is the computerisation of the *Mandal* Revenue Offices (MROs) in the State of Andhra Pradesh. As part of the project all the MROs (totalling 1124), the revenue divisional offices (78), the collectorates (23), the office of the commissioner of land revenue, and the directorate of economics and statistics at Hyderabad were computerised. This involves data collection, development and implementation of appropriate databases and developing human resources through intensive training. A substantial part of the funding came from a World Bank Hazard Mitigation and Emergency Cyclone Recovery Project, "which supports the government's efforts to improve data collection and communication of relevant hazard and vulnerability reduction information from the district and mandal level to citizens." (Kumar 2000)

The system is expected to automate and facilitate:

- The maintenance of statistical information on population, landholding, cropping patterns, weather and climate, livestock, irrigation facilities, housing and a range of other economic information needed for design and management of development schemes.
- The issue of integrated certificates (detailing caste, place and date of birth), birth and death certificates, income certificates, pensions and ration cards.
- The maintenance of village records, including records relating to transfer of land rights, revenue demands, and allocation of government/surplus lands.
- The monitoring of public grievances, welfare schemes, hazard mitigation plans and rescue operations.
- The monitoring the performance of every employee of the state government.
- The provision of a government-citizen interface in which complaints can be registered directly by the affected party and grievances redressed in a transparent manner with substantial saving of time.

The system sits on the Andhra Pradesh Statewide Area Network (APSWAN), which uses an optic fibre link to connect the state secretariat with 23 district headquarters. Voice, video and data services made possible by this backbone are expected to ensure better coordination between state headquarters and district offices and improve the efficacy of the different regulatory, developmental and hazard mitigation programmes of the state government.

The storage of a wide range of information, including documents relating to property rights in computerised databases and providing public access to these databases is seen as promoting transparency of a kind that strengthens democracy, empowers people and speeds up decision-making when compared with a situation where information was sealed into files bound with red tape that were accessible only to a bureaucracy sworn to secrecy on all matters.

Two other noted e-governance projects are Gyandoot and Bhoomi. The Gyandoot project, located in Dhar district of Madhya Pradesh, has been operative since early 2000 and has as its primary motive the provision of easy and cheap access to government information and documentation including caste income and domicile certificates needed for a variety of purposes related to employment and the use of economic and business opportunities. While this is the primary motive, the scheme requires the establishment of intranet/internet kiosks that are run on a commercial basis, with the operator obtaining a share of the minimal fee charged as revenue for undertaking the investment. In many places the village panchayat paid for the kiosk (*soochanalaya*)

and equipment, which was operated by a *soochak* who was an educated unemployed youth from the village trained for the purpose. To quote Sood (2002): "The Gyandoot Project in Dhar has developed an important e-governance protocol, in the form of the *shikayat* or complaint, For a fee of INR 10, rural citizens may select from a predetermined menu of 30 different kinds of complaints, which together cover a wide range of citizen-consumer to government interactions in rural areas. These include for example: the absence of a school teacher; the death of cattle that may require a government veterinarian's inspection; the malfunction of a public hand-pump that must be repaired, and so forth."

Similarly, the Government of Karnataka launched the Bhoomi initiative in 1998, which has been described as "a major initiative to computerise land records to ensure more secure title and decrease rural graft" (IT for Change, 2002) According to reports, all of the 177 Talukas in the state have already been computerised, and the information transferred from the pre-existing manual registers to a computerised database. Besides providing access to land records, that database is expected to be used for a number of other developmental applications including better agricultural and financial planning for farmers in collaboration with the Centre for Knowledge Societies, Bangalore.

An example of an e-governance project that has a more targeted objective, but infrastructure from which can support many other activities, is the disaster management project, developed as part of the Maharashtra Emergency Earthquake Rehabilitation Project (MEERP), being implemented in the state of Maharashtra, aimed at minimising the adverse effects of natural disasters (Vatsa 2000). Complete with a disaster management centre located at the Yashwantrao Chavan Academy of Development Administration (YASHADA), computerised control rooms across the state, a VSAT- and VHF-based communication network and area-specific, Geographical Information System (GIS)-based, disaster-management plans, the system provides critical support for the disaster management functions of the administration. It would help plan exit and evacuation activities in case of natural or man-made disasters, locate resources that could be easily and quickly deployed in the affected areas and identify potential disaster management facilities in case of need. Supported by the World Bank, the DFID and the UNDP, the project is now reportedly complete in all districts across the state.

These projects are indicative of the nature of e-governance projects being implemented by central ministries and state governments across the country. Given the resource availability with government, the international support for these projects and the government's own desire to computerise operations, these are the projects that are relatively large in scale and are likely to be sustained. There can be little doubt that these do provide the necessary interface for more citizen-friendly and transparent governance. But unless practices and mindsets in the bureaucracy and the state administration themselves change, the difference this interface can make would be marginal.

6. ICTs and the Eradication of Poverty and Hunger

The persistence of widespread poverty and hunger are among the principal disappointments with the post-Independence development experience in India. As a result, more than five decades later, when the government claims that a change in regime that affords a larger role for markets and a smaller role for the State in development would place India on a new growth trajectory, the importance of public action to deal with poverty and vulnerability has only increased. Even official estimates, widely regarded as overly optimistic, estimate the number of poor in India at 260 million. No other indicator of performance can neutralise the critique that figure provides of the development process. It is for this reason that, in response to democratic pressures, successive governments in India have added their contributions to the plethora of national anti-poverty plans and programmes and set time-bound goals and targets to substantially reduce overall poverty and eradicate extreme poverty.

Conventionally, the incidence of poverty is assessed using some measure of income poverty. This measure focuses on the lack of monetary means to meet a specific set of needs, and usually takes the form of identifying consumption poverty. Within that definition, absolute poverty is identified as an income or expenditure level below which the food component of expenditure is inadequate even to meet the physiological needs for survival. That is, the poverty line is defined "as the total consumption expenditure at which one can expect a person to be adequately nourished." The identification of "needs" being subjective, the latter definition, which ties the required need down to a calorific requirement essential for subsistence, is seen as having an element of objectivity about it. Many "national" poverty line figures derive from such a notion of poverty. In India the calorific requirement considered as being adequate for an adult male engaged in moderate activity in rural areas is 2400 calories.

Once need and its relevant monetary equivalent are arrived at, a number of measures on the incidence of poverty can be worked out. The most widely used is the head-count ratio, which estimates the numbers below the poverty line and their proportion to the relevant total population. The problem with poverty lines tied to a specific calorific requirement is that they presume that at the point when expenditure is adequate to meet that requirement, the non-food component of expenditure is adequate to cover required "basic needs". In reality, of course, it does not. In as much as a decent subsistence requires that other "basic needs" such as clothing, shelter, safe drinking water, adequate sanitation, and access to health and educational facilities are also met, over time the definition of poverty was expanded to include these, even though this involved some loss in measurability in the form of a single number capturing incidence. Poverty now was reflected not just in the per capita income of households being inadequate to meet specified consumption needs, but also in the inadequate access to a range of services that impacted on crucial indicators of health and morbidity.

Seen in this background the Millennium Declaration's goal of halving between 1990 and 2015 the incidence of poverty defined as the proportion of the population earning less than $1 a day, which is in general higher than poverty line incomes used in national estimates, is of relevance. That level of income would come closer to ensuring that besides minimum calorific requirements, the poor are able to afford access to a range of supportive basic needs as well. The Declaration also

targets halving the proportion of people who suffer from hunger over the same period.

The experience with income poverty reduction in India

As noted earlier, till the release of the estimate for the incidence of poverty in 1999-2000, based on the National Sample Survey Organisation's 55th round survey, the evidence from the National Sample Survey (NSS) suggested that the declining trend in the incidence of rural poverty during the 1970s and 1980s had been halted during the 1990s. Estimates made at the World Bank (Refer Gaurav Datt 1999) showed that the incidence of poverty, which between 1972-73 and 1989-90 fell from 55.4 per cent to 34.3 per cent in rural India and from 54.3 to 34.1 per cent nationally, had in subsequent NSS rounds up to 1997 (when the incidence was 34.2 per cent national and 35.8 per cent rural) never gone below the 1989-90 level and had in fact risen to much higher levels in individual years.

This lack of any further progress on the poverty reduction front was in itself a matter of concern, but in the context of official national income figures pointing to rather robust growth during the 1990s, it was also a puzzle. Datt, for example, stated that "the 1990s appear to have been a decade of missed opportunities as far as poverty reduction is concerned."

However, proponents of the economic policies of the 1990s suggested that since these conclusions were based for all years excepting in 1993-94 on "thin samples", since large consumption surveys were undertaken only once in five years, the data simply did not allow for such conclusions, and that nothing could be said about rural consumption or poverty until the next large sample results were available. It was also argued by proponents of the official economic reform strategy, that the NSS consumption expenditure estimates from the thin samples were out of sync with those yielded by the CSO estimates of GDP. Thus they maintained that the association of higher GDP growth rates with the persistence of rural poverty in particular was not a real fact that needed to be understood and addressed, but the reflection of a failure of the statistical system to capture the actual consumption in rural areas.

The controversial 55th round and the MDG target

Interestingly, when the 55th Round survey results relating to 1999-2000 were finally released, they did point to a substantial decline in poverty relative to 1993-94. The figures pointed to a 10 percentage-points reduction in poverty nationally from 36 per cent in 1993-1994 to 26.1 in 1999-2000. This was not only much larger than the 2.9 percentage-points reduction during the previous five-year period from 38.9 per cent in 1987-88 to 36 per cent in 1993-94, but also meant that while the number of poor had increased from 307 million in 1987-88 to 320 million in 1993-94, that number had fallen sharply to 260 million by 1999-2000.

The other notable trend yielded by the 55th Round survey results was a reduction in the gap in the rate of decline of poverty incidence between the rural and urban areas. Thus rural poverty was shown to have declined from 39.1 per cent to 37.3 per cent between 1987-88 and 1993-94 and further to 27.1 per cent in 1999-2000. On the other hand, urban poverty, which fell from 38.2 to 32.4 per cent in the first period, making it a much larger fall in percentage point terms, fell to 23.6 per cent in 1999-2000, which was similar to the reduction in rural India.

However, the 55th Round rather than leading to unanimous recognition of the major gains registered on the poverty reduction front, has led to controversy with some arguing that a change in methodology adopted in that Round had substantially contaminated the data. According to Abhijit Sen (2002): "Although it is now the official position that poverty declined very substantially between 1993-94 and 1999-00, this is a claim which is vitiated by serious problems of comparability. Different recall periods were used in the 50th (1993-94) and 55th (1999-00) rounds of the National Sample Survey and this has led to two sources of non-comparability. First, the 55th round used only a 365 days recall for clothing, footwear, durable goods, education and institutional medical care, whereas the available 50th round results for these items are by a 30 days recall. Secondly, while estimates of consumption of food, *paan*, tobacco and intoxicants had been collected using only a 30 days recall period in the 50th round, all respondents

were asked both the 30 days and 7 days questions in the 55th pound. Since a 7 days recall is known to elicit a substantially higher consumption estimate for food etc., the presence of this question in the 55th round Consumption Survey might have affected responses to the 30 days question." Though there are many who still hold that the large 1999-2000 sample yields a better indicator of poverty reduction trends, there is substantial agreement with regard to the fact that, at the least, the 55th Round results exaggerate the extent of poverty reduction. The failure of the higher, average trend rate of growth during the 1990s to prove an adequate antidote to poverty remains.

In sum, official poverty estimates based on a nationally defined poverty line point to an overall (rural and urban) decline in the incidence of poverty from 38.9 per cent in 1987-88 to 36 per cent in 1993-94 and 26.1 per cent in 1999-00. However, following the controversy reported above, some analysts place the estimate for 1999-00 at around 33 per cent. The latter makes the pace of poverty reduction the same during the two five year periods 1987-88 to 1993-94 and 1993-94 to 1999-00. Taking the rate as indicated by the official poverty figures, India is well on the way to realising the millennium development goal in this area. Poverty would have stood at 35.06 per cent in 1990-91 and would fall to just 3.06 per cent by 2015-16, which is way below half. The goal of halving poverty would be achieved as early as 2004-05. On the other hand if the rate of reduction suggested by the independent estimate is taken into consideration, poverty would touch 22.38 per cent in 2015-16, which is close to 4 percentage points "short" of the MDG target.

Thus, even though the official estimates point to a substantial reduction in poverty that makes the realisation of the millennium development goal in this area a certainty in India, there are many who are sceptical of that trend. In their view the reduction of poverty is far less than suggested by the 55th Round – more like 3-4 rather than 10 percentage points, making the puzzle about the lack of adequate poverty reduction despite high growth a real one. In particular that lack of correspondence requires that efforts must be made to *directly* deal with the problem of poverty, rather than rely on growth alone to deliver results.

The Problem of hunger

The other issue of concern resulting from the NSS consumer expenditure surveys is the evidence that despite the low average level of calorie intake in India relative to the developed industrial countries, the average calorie intake has fallen substantially. Thus, in 1983 average calorie intake was less than 2400 in all but six of 16 major states in India. By 1999-00, intakes had declined in all states except Kerala, Orissa and West Bengal.

The incidence of malnutrition as measured by the height for age of children below 5 years of age fell from 62 per cent in 1990 to 46 per cent in 1999. As measured by the weight for age of children under 5 years it fell from 64 to 47 per cent. If this rate of reduction persists, India is on the way to achieving the target of halving malnutrition by the years 2006-2007. However, the disconcerting feature is that World Bank figures suggest that the incidence figures having fallen sharply from 62 and 64 per cent respectively in 1990 to 52 and 53 per cent in 1993, experienced a deceleration in the rate of decline so that they touched 43 and 45 per cent respectively only in 1997. Distressingly, they subsequently rose to 46 and 47 per cent respectively in 1999.

Determinants of poverty

Thus, the question remains: Why was there not more progress in reducing poverty? Rising inequality could have played a role. As the World Bank on its web page focussed on inequality[6] argues: "Countries with high levels of initial inequality have reduced poverty less for given rates of growth than countries with low initial inequality, and if growth is accompanied by increasing inequality, its impact on poverty will be reduced." The proximate role of inequality in worsening poverty or limiting gains in terms of poverty reduction has conventionally been situated in arguments that point to a complex combination of influences on poverty in predominantly rural communities. The early

[6] *http://www.worldbank.org/wbp/data/trends/inequal.htm*

literature attempted to focus on two kinds of variables: those that capture movements in agricultural production or productivity and those that capture movements in prices that are seen as impacting directly or indirectly on real income and poverty. Poverty analyses tended to focus on the relative significance of each of these sets of variables as well as the best way in which their effects can be captured. Thus, as noted above, even though movements in agricultural production would obviously impact on poverty, the significance of that impact would depend on whether agricultural growth is accompanied by an increase in inequality or whether there is a simultaneous increase in sources of non-agricultural income in the rural areas.

As for prices, what needs to be looked at is not the nominal price level of food, but the relative price of food and the rate of increase of nominal food prices. A faster rate of increase of agricultural prices can have two contradictory effects on poverty. First, to the extent that agricultural growth is stimulated by a shift in terms of trade in favour of agriculture, and assuming that inequality does not increase, the rise in agricultural prices would contribute to a reduction in rural poverty to some extent. Second, since a large part of the rural population consists of agricultural labourers, small farmers and non-farm workers, who are all net purchasers of food, a sharp increase in the price of food would squeeze real incomes and worsen poverty.

Agricultural growth, non-agricultural activity and poverty

If inequality is increasing, we should expect that the effect of any increase in per capita agricultural output on poverty would be weaker. However, there have been a number of experiences to the contrary. In India, for example, the Green Revolution of the 1970s and 1980s, while leading to some increases in agricultural output per capita, was characterised by some increase in concentration of operated area and marketed surpluses, as well as a substantial increases in regional inequalities in agricultural production. Yet, the incidence of poverty during these years was declining significantly, forcing researchers to look to other factors that could explain the decline in rural income poverty.

This decline was all the more surprising because evidence indicated that the output increases during the Green Revolution years and later were accompanied by a decline in the output elasticity of the demand for labour in agriculture. There seemed to be one factor that was neutralising the effect of these trends, viz. a rise in agricultural wages, which was then seen as an important influence on poverty. But why were real agricultural wages rising if employment in agriculture was inadequately responsive to agricultural growth? The empirical answer seemed to lie substantially in an increase in rural non-agricultural employment. Over the 15-year period from 1972-73 and 1987-88, the share of rural male non-agricultural employment in total rural male employment rose by 9 percentage points and that of female non-agricultural employment in total rural female employment by 5 percentage points. This seemed to make the growth of rural non-farm activities and rural non-farm employment an important cause for reduction in rural poverty – a conclusion supported by experience in other Asia-Pacific countries, especially China.

This brief survey of the literature on the incidence, determinants and routes to alleviation of poverty suggest that poverty reduction is predicated on (i) a relatively egalitarian path of growth; (ii) increases in agricultural productivity that help raise wages and keep food prices under control; (iii) expansion of non-agricultural employment, including in rural areas; and (iv) direct public action in the form of poverty eradication programmes aimed at generating productive employment for the poor.

Role for ICTs

The question that concerns us here is whether and in what ways can ICTs contribute to the task of alleviating poverty and combating hunger and malnutrition? Our discussion above has suggested many routes through which this could occur. ICT's direct contribution to poverty reduction can come either through the employment generating effects of ICT diffusion into poor rural and urban areas or through its effects on enhancing returns from

economic activities undertaken by poorer households. Its indirect contribution can come through facilitating and reducing the costs of delivery of services that either promote wage- and self employment or help overcome structural constraints to the realisation of the poverty alleviation effects of particular projects; and through improving the quality of delivery of employment generating and poverty alleviating projects being implemented by the government.

There are, indeed, reasons to believe that by facilitating decentralised and (entrepreneur-wise) distributed or diffused growth, the technology can bundle income increases with reduced inequality that can have poverty alleviating consequences. Further, as mentioned earlier, besides increased wage employment at higher wage rates in the agricultural sector, an expansion of non-agricultural employment is crucial to reducing poverty even in rural areas. The effort to use ICTs in poverty alleviation must thus focus on the new opportunities for micro-entrepreneurship that information technology offers.

In India, thus far the experience with micro-entrepreneurship has been restricted to the lower end of the technology, principally cable and pay phone operators. The experience with local entrepreneurship/self-employment resulting from the diffusion of the lower end of the technology, in the form of cable television and pay phone (International Subscriber Dialling and Subscriber Trunk Dialling) booths has been widely commented upon. With migration within and outside the country being a widespread phenomenon, the latter services are much in demand. But even here, success has been greater in urban rather than rural areas, because the higher costs of diffusing the technology to remote rural locations. According to the World Bank (2002): "In urban India a telephone connection costs $650 for phone booth operators, and operators must earn $190 a year to break even. Telephones are more expensive in rural areas: a line can cost $1,500–1,700, so operators must earn $425 a year to break even." However, the spread of STD booths and cable television must not be underestimated. In 1987, when STD booths were first introduced, only one per cent of homes had telephones. The booths, operated by small entrepreneurs who retain 20 per cent of call revenues, helped 30 per cent of the population access long and short-distance telephony. The effect was that today 25 per cent of telephone revenues come from these booths. Similarly, while in 1992 there was no cable television access in the country, the activities of small cable operators has helped reached cable television to more than 50 million homes.

Thus developments in two directions are necessary if information and communication technologies are to contribute to employment increases. First, the costs of investing in the technology by micro-entrepreneurs need to come down substantially. Second, the opportunities for self-employment through such entrepreneurship should arise in other areas of information and communications technology.

Experiments focusing on wage employment and micro-entrepreneurship

As discussed at the beginning of this study, reducing costs of hardware and connectivity in order to hasten diffusion and increase access is a frontline activity in the ICT for development area. If costs of diffusion are reduced there is a strong possibility of an increase in opportunities for wage employment and micro-entrepreneurship in new areas opened up by the technology. An example of such opportunities is offered by the model computer project Gyandoot in the state of Madhya Pradesh, which is revenue generating and is expected to become independent of state funding. Located in Dhar district, which is among India's poorest, the project involves young men who "have a franchise from the state to distribute daily crop prices and commonly needed state records. 22 villages have each bought a computer, a modem, a printer and a battery for $1500 with their own money and have agreed to provide a small booth to house the setup." (Dugger 2000)

"In each case, the state then picked a young person from the village with at least a 10th grade education to operate the computer and gave him a franchise to sell information from the state's computer network. For 25 to 35 cents, villagers buy printouts

of documents that they might have spent days trying to get from local bureaucrats: land records, caste certificates and proof of income, among others. For another 25 cents, any citizen can send a complaint to the state by e-mail – my pension didn't arrive, my child's teacher didn't show up, my village hand pump doesn't work – and the state guarantees a reply. And for 10 cents a farmer can get a printout listing the prices of any agricultural commodities sold at surrounding markets."

However, it has been noted that few of these kiosks located at points that ensure easy access have achieved commercial viability, even though the sunk cost of collating and digitising the information that sustains the project are subsidised by the government. What is encouraging though is that the scheme is not just a free service financed by the state, but provides a source of self-employment or means of micro-entrepreneurship

Raising economic returns and reducing vulnerability

The second direct contribution to poverty alleviation that ICTs can make is by helping raise the magnitude and reduce the vulnerability of returns earned by small producers from their economic activities. Though structural constraints like indebtedness can work to neutralise benefits, access to information that helps obtain better prices for their produce, identifies the location of fish shoals, warns fisher folk of storms at sea and facilitates the prevention or treatment of crop or animal disease are all examples where such benefits can be delivered by the technology. Experiments are on to provide computer access at the village level, which facilitates not merely extension services on technical matters relating to best agricultural practices or combating pest attacks, but also provides ready access to information on market conditions, opportunities and prices that allow small farmers to maximise incomes from their output.

A typical example of this route to use of ICT for human development is offered by the "information village" experiment being conducted by the M.S. Swaminathan Research Foundation in ten villages in Pondicherry. The experiment seeks to electronically deliver knowledge that can prove productive and improve earnings. The experiment uses a hybrid wired and wireless network that permits voice and data transfer – based on a combination of PCs, VHF radio devices, telephone lines and dial-up connectivity – to disseminate locally collected and/or collated information in the locally spoken language. Knowledge from external sources is selectively compiled and reformulated so that it can be integrated with local knowledge. Electronic Knowledge Centres are located in temples, local government (*panchayat*) offices, government buildings and even private premises. According to MSSRF personnel, "information provided in the village knowledge centres is locale specific and relates to prices of agricultural inputs (such as seeds, fertilizers, pesticides) and outputs (rice, vegetables), market (potential for export), entitlement (the multitude of schemes of the central and state governments, banks), health care (availability of doctors and paramedics in nearby hospitals, women's diseases), cattle diseases, transport (road conditions, cancellation of bus trips), weather (appropriate time for sowing, areas of abundant fish catch, wave heights in the sea), etc." (Senthilkumaran 2002). A unique feature is that the centres are operated by local volunteers and that most information is collected and fed in by the local community itself. According to reports, the impact of the project is quite visible.

To quote one such report, in Embalam, India, "a two-street village 22km west of Pondicherry, where 130 out of 210 families struggle below the poverty line", the village elders have allowed the M.S. Swaminathan Foundation access to one side of the temple to house two solar-powered computers that are used to give villagers a wealth of data, varying from the price of rice to weather conditions for fishermen and medical information for the sick. Embalam is one of four villages in which the M.S. Swaminathan Foundation is implementing the "information village" project. The project aims to use "science and technology to tackle poverty, with a $120,000 grant from the Canadian government. The foundation provides villages with free technology and information in exchange for the villages' promise to house the computers and staff their operation." Through the project "farmers have gained a better grip on their local markets as prices are more transparent. They get the right

seeds when they want them; they have catalogued over 350 different types of herbs that can grow in their area. Fishermen get information from satellite images on where the fish shoals are likely off the Pondicherry coast, and (from a United States Navy Web site) on wave heights and wind directions in the Bay of Bengal." (Venugopal 2000)

Using ICTs to reorganise economic activity

The direct effects of ICTs on poverty reduction can also come through a reorganisation of economic activity that helps producers increase their returns. A striking case of such effects is the introduction of ICT devices into the management of operations of the National Dairy Development Board in Gujarat (Bhatnagar 2000). The major advances made by the cooperatisation of milk production and processing at Amul Dairy in Gujarat have been widely recognised. Village level primary producers are organised under a supervisor from the district level Cooperative Dairy Union which owns a processing plant. Milk is sold only to the cooperative at local collection centres. ICT is being used to improve collection and payment, substantially improving the prices received by farmers. Earlier, the quality and quantity of the milk was computed through manual calculations made by the cooperative staff. This not merely led to allegations of underpayment, but resulted in substantial delays. The fat content in the milk supplied by the primary producers was calculated in a few hours after the milk was received and farmers were paid every 10 days or so. With the introduction of ICT, each producer is provided with a card that is read electronically at the collection centre and his ID sent to a personal computer. Milk is poured into a steel container on a weighbridge that displays the weight and transmits the information to the PC. An operator takes a small sample of the milk and a fat testing machine reads the fat content electronically in three seconds. With this information being displayed and transferred to the PC as well, the computer calculates the payment due to the producer and provides him with a payment slip using which he/she can immediately collect his/her payment. The milk vending system costs around $2,000 per centre. Two private manufacturers currently produce the equipment. Nearly 600 such systems are in operation in the Kheda district in Gujarat. There are 70,000 village societies in India, of which 2,500 have been computerised.

Once this facility was put in place the opportunities offered by computerisation could be exploited and the benefits further extended. Using the Dairy Information System Kiosk (DISK) software developed by IIM Ahmedabad, which connects to a dairy information portal, it is now possible to maintain and access a computerised database that includes all details of the cattle owned by the cooperatives members, historical information on milk production, information on the prices and availability of a range of commodities need by cooperative members and information on best breeding practices. In addition, the system can be used to deliver services such as inoculation alerts that can be printed onto the payment slip. The benefits that this transparent and efficient system delivers in terms of improved productivity and earnings should be obvious. Its effects on poverty are also an obvious corollary.

Indirect effects of ICT use on poverty

Besides the direct contribution that ICT can make to alleviating poverty, it can contribute indirectly in two ways: (i) by facilitating and reducing the costs of delivery of services that either promote wage- and self employment or help overcome structural constraints to the realisation of poverty alleviation effects of particular projects; and (ii) improving the quality of delivery of employment generating and poverty alleviating projects being implemented by the government by smoothing the process of delivery and by improving the monitoring of both the delivery and effects of the project through e-governance.

An example of the use of ICTs to realise the first of these indirect benefits from the point of view of poverty alleviation is the SKS smart cards project (Microfinance Gateway 1999). It is widely accepted that access to credit is crucial to sustained poverty alleviation. Lack of credit can prevent the growth of productive activities with poverty alleviation affects. They can also force the poor into a state of

indebtedness that prevents them from realising the full benefits of their economic activities, leads to bondage and work at extremely low wages, and very often pushes children from poor households into underpaid child labour.

It is also accepted that microfinance ventures organised through self-help groups is a useful complement to state provided credit, especially in a large country like India. The problem, however, is that microfinance ventures, even when successful from the point of view of reaching credit to the poor and ensuring high recovery rates, are characterised by high transaction costs and therefore extremely high interest rates. The *Swayam Krishi Sangam* (SKS) smart cards project is one example of using ICTs to reduce transactions costs and reduce the cost of credit provided by SHGs.

Located in Medak District in Andhra Pradesh in India, SKS is a micro-finance project catering to the needs of landless labourers and marginal farmers in this drought-prone area with a high incidence of poverty. Forced to borrow during emergencies at high rates of interest, many of the poor fall into a debt trap and end up "mortgaging" children into bonded labour. Committed to targeting the poorest, SKS encourages membership from women in households having annual incomes of less than Rs 20,000. SKS has a variety of loan products and provides general and seasonal loans at an interest rate of 20 per cent, consumption loans from group funds at zero interest rates and emergency loans, also at zero interest rates. SKS currently operates one branch in Narayankhed (Medak District), serving 998 poor women in 60 village *Sangams* (collectives) and reports a 100 percent repayment rate on loans, most of which are in the range of $50 in the first year of membership and $100 in their second year. These have reportedly been used primarily for land and livestock related enterprises, and activities such as vegetable vending and running tea-shops. SKS field staff are recruited locally; almost all from amongst the poor - *Dalit*, tribal, and other backward castes. The majority of the staff are women and have, at best, only a tenth grade education. SKS maintains that the loans have made a tremendous impact on member lives, raising their incomes, reducing seasonal out migration and preventing bondage of children as child labourers.

Smart cards: Technology for the poorest

Two years into its operation, SKS confronted two major obstacles threatening its financial sustainability. First, the cost of delivery of credit was high, because of the substantial time needed to be spent for the required staff-client interface when focusing on the poor. Considerable time was being spent completing paperwork, discussing loan terms and conditions, and counting money. Secondly, interest earning per client was low, as the loans to the poorest were extremely small. To deal with these problems cost reduction measures were crucial.

Realising that most meetings took place during a three-hour window of time early in the morning when poor clients were not preoccupied, the focus was on reducing the time spent on meetings with each group and client. The opportunity for cost reduction lay in reducing the time spent on copiously recording all financial transactions, so much so that only two meetings could be held in a day. Smart cards, it appeared, could be used to reorganise work: "Each staff member will carry a hand held computer to the group meetings. The computer will download collection information from the branch office computer so no manual collection sheet will be required. In the village each member will have a smart card that will electronically hold member information and a record of transactions. During the group meeting each member's smart card will be inserted in the computer and transactions will be updated both in the smart card and in the computer. At the end of the day the staff member will simply upload the information from the hand held computer to the branch office computer. All accounts will therefore be updated. Meanwhile a read only computer will be available in the village so that any member can check her accounts just as someone could in an automated teller machine." (Microfinance Gateway 1999). SKS has calculated that even with the additional costs of the cards and the terminals each branch will save about $2,000 per year in costs, reducing costs by a fifth. In addition the

computerisation of all financial records will minimize errors and will provide management with immediate client level information.

If the expectations regarding cost reduction are realised, this introduction of IT could render the SKS project financially sustainable and consolidate and expand an activity that can make a substantial difference to poverty by reaching credit to the poorest.

There are a few over-arching lessons that are being derived from these experiments with using ICT for poverty alleviation. To start with, projects that are likely to impact directly on the extent of poverty are those that directly or indirectly increase employment and enhance the returns from different economic activities. But, to be successful, it appears that ICT applications should be developed by or in collaboration with local staff, since they are more likely to suit local conditions and prove sustainable. Outside control and top-down approaches, by contrast, often waste resources. Some state-sponsored e-governance programmes have been inadequately successful because centralised planning did not take into account local conditions. Further, illiteracy and knowledge only of local languages are, as expected, major obstacles to the use of information and communications technology. To be relevant, applications must be available in local languages and, to the extent possible, be visually oriented and use voice interfaces. Finally, content provided through information and communications technology should not be limited to knowledge from outside sources, but extended to draw on knowledge from the local community, especially the poor.

7. ICTs in Education

Human development has been defined as *the process of expanding people's capabilities, the set of choices people have available and ultimately the freedoms people enjoy to determine their overall well being*. Key instruments for providing people those capabilities, choices and freedoms and advancing human development are literacy and education. Central to the Millennium Development Goals therefore is (i) the need to universalise a full course of primary schooling; (ii) the need to substantially increase the literacy rate amongst the population as a whole; and (iii) the need to reduce gender disparities at all stages of education. We focus on the first two in this section and deal more adequately with the third elsewhere in the study.

Literacy and education are, of course, of intrinsic importance, that is, they are important in and of themselves. But literacy and education are also of immense instrumental importance in social development. To take the impact of education in one sphere of social development, health and demographic change, it is clear that education, particularly female education, has a fundamental influence on health and health-seeking behaviour (and on socio-cultural consciousness that influences attitudes to health). There are strong correlations between life expectancy and literacy. Infant and child mortality are lower the higher the level of maternal schooling. At given levels of income, schooling increases the ability to improve nutrition; it contributes to the ability to initiate earlier and more effective diagnoses of illness and contributes to hygiene and the prevention of illness. Education also influences the reduction of survivorship differentials between males and females in a society.

India's record on the educational advancement front after five and a half decades of independence is indeed poor. The slow rates of improvement in literacy and education for both men and women remain major failures of the Indian development process. India still contains the largest number of illiterate people in the world, and also the largest number of illiterate women. The progress of improvement in literacy has been very slow, as evident from Table 7.1, which also shows that literacy among females remains substantially below that for males, and that even at the present time, nearly half the female population of the country remains illiterate.

Table 7.1: Literacy rates over time
(Per cent of population)

Year	Males	Females
1951	27.2	8.9
1961	40.4	15.3
1971	45.9	22.0
1981	56.5	29.9
1991	64.1	39.3
2001	75.9	54.2

Source: Census of India, various issues

Over the 1990s, the Total Literacy Campaigns and various Adult Literacy Missions have attempted to rectify the gap in terms of adult literacy, with varying degrees of success in different states. The attempt has been to establish district-level literacy committees with active people's participation, with follow-up schemes for providing access to reading material relevant for newly literates. There is no doubt that this has led to some improvement in the rate of increase of literacy in the past decade, but there are still very significant state-wise variations. Further there has been criticism of the literacy programmes on three grounds: (i) that the definition of literacy is so diluted that many literates do not have any additional capability of significance; (ii) that even those who are literate at the time of

survey are inadequately endowed to be able to retain the capability; and (iii) that substantial resources are diverted away from basic education that yields better and more robust capabilities in the effort to achieve high literacy rates in a short time.

Given the low level of literacy, the justification for the effort and the investment being made to extend the reach of computers across the country and provide access to all is indeed weakened. Even as late as 1997, NSS data revealed literacy among the population above 7 years of age was just 62 per cent. The literacy requirement is set so low that in most cases being literate would be inadequate to be competent enough to become digitally literate. A minimum of school education would be a prerequisite beyond a point. Here too the picture is dismal. To quote the Public Report on Basic Education in India (Probe Team 1999), "at the time of the 1991 Census and the National Family Health Survey (1992):

- Half of the country's population (61 per cent of women and 36 per cent of men, aged 7 and above) was unable to read and write.
- Less than 30 per cent of all adults had completed eight years of schooling.
- One-third of all children aged 6-14 years (about 23 million boys and 36 million girls) were out of school."

As we discuss below, while there has been progress since then, the record is still poor.

Education/education policies in India

At independence India inherited a system of education, which was relatively small and was characterized by large intra- and inter-regional as well as structural imbalances. Only 14 percent of the population was literate and only one child out of three was enrolled in primary school. Low levels of literacy and participation in education were exacerbated by acute regional and gender disparities. Working in this context, the Constituent Assembly highlighted the need to focus on education and elaborated the general principles governing educational development in India. Article 45 in the Indian Constitution declared that "the state shall endeavour to provide within a period of ten years from the commencement of this constitution, free and compulsory education for all children until they complete the age of fourteen years." Other than elementary education, special care of the economic and educational interests of the under-privileged were also laid down as obligations of the state.

In keeping with these goals, the following national focus areas and targets with regard to basic education have been identified by the government:

1. Early childhood education (ECE) for pre-school children aimed at enhancing enrolment and retention in primary schools. Additionally, the *Integrated Child Development Scheme* (ICDS) was designed to integrate early childhood education into its activities for children in the pre-school age group. It needs to be noted, however, that pre-school education in urban areas, which is fairly wide-spread and is continuously expanding, is largely in the hands of the private sector without much supervision or support from the Government.
2. Universalisation of elementary education has been accepted as a national goal since 1950. The Directive Principles of the Constitution of India envisage provision of free and compulsory education of satisfactory quality to all children. Well before this goal was achieved, the National Policy on Education (1986, modified 1992) sought to also emphasise participation and retention besides enrolment, "enlarging" the goal of universal elementary education to include provision of education of a satisfactory quality to all children. However, neither of these goals has been achieved in full, even though in 2001 the 93rd amendment to the Constitution has made right to education a fundamental right of an Indian citizen.
3. A third area of focus in policy has been universal retention. Though, the country has made significant progress in terms of

provision of access to basic education and overall enrolment figures have increased sharply, the number of children who participate in schooling regularly and complete the first cycle of education still needs to be improved substantially.

A number of schemes for increasing access to and improving the quality of primary education have been introduced by both Central and State Governments in India over the 1990s. These include Operation Blackboard, District Primary Education Programme, Education Guarantee Scheme, *Mahila Samakhya*, Mid-day Meal Scheme, *Lok Jumbish, Janshala and Sarva Shiksha Abhiyan* amongst others. Many of them were inspired by the "Education for All" slogan coined at the Jomtien conference of 1990, which in turn was the result of concern with the crisis in education across developing countries at that time, Of these, the DPEP launched in 1994 with support from the World Bank is seen by the government as reflecting a more holistic approach to universalising access, increasing retention, improving learning achievement and reducing disparities amongst gender and social groups. Further, the programme stresses community participation (through village education committees, parent-teacher associations, mother-teacher associations, and so on), with the community facilitating participation, achievement and effectiveness (Krishna Kumar *et. al. 2001)*. The programme, which covered 42 districts in seven states when it was launched, has been expanded geographically since then. During 2001-02, the programme was further expanded to 23 districts, thus, bringing the total coverage to 271 districts spread over 18 States.

The difficulty is that evidence to judge the success of the DPEP programme, when compared with non-DPEP districts, is not easy to come by. Though the evidence does suggest that early participants in the DPEP programme have shown positive results in terms of enrolment and achievement there are some disconcerting trends. Principal among these is that the programme has been used to segment the schooling structure in terms of teacher inputs and in terms of school status. According to Krishna Kumar *et. al.* (2001): "Though DPEP started with a considerable commitment that the real expenditure in primary education would be maintained, and regular teaching positions in formal schools would be filled up in line with formal procedures, the experience of actual operation in this area has been otherwise. While there may not have been a direct stimulus to withdrawal and cuts in the area of primary education, in actual practice, states have used the opportunity structure offered by DPEP to effect the move to dismantling the formal system of primary education and setting up convenient short cuts."

This tendency has taken two forms; (i) "teacher category proliferation" through appointment of "para-teachers" of various kinds, whose appointments are contractual, salaries are as low as a fourth or fifth of regular teachers and whose qualifications too are often much below that required of regular teachers; and (ii) "pluralisation" or the creation of multiple schooling environments such as formal government and private schools, alternate schools such as under the "*Maa Badi*" (my school) scheme in Andhra Pradesh and Education Guarantee Scheme (EGS) in Madhya Pradesh and non-formal schools of various kinds. The basic thrust, in the name of realising crucial targets within a short timeframe and within a restricted budget, is to downplay institution building in the name of access and untested claims of minimal quality. A 1999 study suggests that while classroom transactions in surveyed schools were uniformly low, they were even more so when conducted by para-teachers. Contractual employment and poor pay combined to demotivate these teachers, who often are not even trained enough. This suggests that the process may not be sustainable.

However, it appears that these trends are now becoming national policy. Thus the Education Guarantee Scheme has been endorsed for the whole country. And the *Sarva Shiksha Abhiyan* launched in 2000-01 to improve performance of the schooling system through a community owned approach sees alternative institutions as an essential part of the road map to increase enrolment and retention, bridge gender gaps and achieve quality elementary education for all children in the 6-14 year age group even as late as 2010.

Progress of elementary education in India

What has been the progress achieved within this policy framework? India's record on the education front, while indicating progress, shows that much remains to be done. School enrolment ratios show a significant increase across India, although there is a substantial amount of evidence from micro studies and other surveys that these are typically overestimates. Gross enrolment ratios measure the ratios of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. These were close to or at 100 per cent throughout the 1990s. However, what matters is the net enrolment ratio, which is the ratio of the number of children of official school age (as defined by the national education system) who are enrolled in school to the population of the corresponding official school age.

Here, though there have been some signs of improvement, the Education for All (EFA) goal is far away. According to National Family Health Surveys (NFHS) of 1992-93 and 1998-99, the proportion of children in the 6-14 age group attending school rose between these two dates from 62.6 to 75.7 per cent in rural India and 82.4 to 87.6 per cent in urban India. But this implies that at the latter date more than one in every five children in the 6-14 age group was not attending school.

Further, the proportion of pupils starting grade I who reach grade 5, or persistence to grade 5 (measured as percentage of cohort reaching grade 5) is estimated at a virtually stagnant 59 per cent in 1993 and 60 per cent in 1998. Official figures of the drop-out rate for 1997-98 in the Class I-V category was 39.38 per cent, in the Class I-VIII category was 54.14 per cent and in the Class I-X category was 69.33 per cent. Thus there appears to be little progress towards achieving the goal of a full course of primary schooling for children by 2015.

An encouraging sign is the evidence from the National Sample Surveys that there has been a substantial increase in "participation in education" for the age-group 6-11 years and 11-14 years in 1999-2000 compared to the earlier large surveys of 1987-88 and 1993-94, and the increases are more for girls and than for boys over this period. However, even with these data there is need for caution in interpretation. While the "usual status" category (which shows the response to the question "what do you usually do over the course of a year?") indicates substantial increase in education for these age groups, the daily status and weekly status categories show much lower participation in education, especially among girls. This suggests that even when children, especially girls, are formally registered in schools and therefore feel that is their usual activity, they may not be attending regularly for a variety of reasons and dropout rates remain high.

Role of ICTs in education

When assessing the way in which ICTs are being used in education, it is, therefore, necessary to assess whether they strengthen the quality of the institutional system, or serve as a partial "quick-fix" for problems created by the lack of adequate resources and are more in the direction of replicating solutions of the kind represented by the tendencies towards "teacher-category proliferation" and "pluralisation". The use of ICTs in education takes many forms including: use of ICTs as learning tools, use in capacity building for teachers, use in remote learning, use in technical education, and use for dissipation of information on best practices in a range of areas. Of these, use of ICTs in capacity building and in technical education are clearly aimed at strengthening the institutional system. Needless to say, the use of ICTs as learning tools, as a remote learning instrument and as a source of information can supplement and strengthen the institutional system since it can encourage self-dependence and creative learning, besides providing new tools for enriching the student-teacher interface. On the other hand, the latter uses of ICTs can occur in a non-institutional framework, which while better than no education at all is a poor substitute for what can be dismissed as a conventional education.

Globally, evidence yielded by research suggests that within the formal school framework:

- Computer based learning leads to better cooperation between students preparing them for a society that values and requires teamwork
- Introduction of technology into a learning environment makes learning more student-centred and encourages group learning
- Information technology has a positive side effect on student achievement in all subjects from pre-school onwards
- IT has a positive effect on student attitudes towards learning and on self-conception, specially when they direct their own learning

However, the question that is often posed in developing country environments where schooling is yet to be universalised, is whether the use of these technologies to support instructional and overall educational goals is a priority and whether they are mistakenly used as poor substitutes for the original. The principal question is whether large sums should be diverted to introducing information technology, when the tasks of putting children to school by investing in infrastructure and teachers and of increasing the literacy rate in the country to reasonable levels still remains incomplete.

Further, given its sources, the information economy transacts principally in the English language. This also means that much of the software needed to be a digital citizen requires, as of now, familiarity with English. This implies that non-English speaking countries should invest either in the generation of software in the local languages or in developing English language skills, or both. This makes the costs of "catching up" all the greater. A large part of this investment must be undertaken by the State, since the market is unlikely to service these needs.

This creates a dilemma. Not investing in ICT for education is to forego what happens to be a leading opportunity in modern economies. But excessive emphasis on IT could result in the diversion of resources away from the much more crucial expenditures on literacy and primary education, which are not just development goals in themselves but a must if the digital divide is not to widen rapidly.

Besides, there are still unresolved issues in areas such as integration of technology into educational settings, adoption of electronic resources by users, matching technological capacities with student learning needs, integrating technology into administrative activities such as assessment, administration, curriculum development etc.

The biggest challenge, as noted earlier, is to achieve equity in education, that is, to make education available to all, cutting across socio-economic backgrounds, physical location, gender and age boundaries. It is important to note that, while technology is a crucial player in making this happen, it is a part of a more complex process of change that cannot be accomplished by the installation of ICTs alone. ICTs need to work within a framework of a broader and sound policy framework if the true benefits of ICTs in education are to be realised. *Policy reforms and innovations in the education sector are preconditions for benefiting from any major investments made in technology.*

ICTs in education in India

The National Policy on Education (NPE) of 1986 and the Programme of Action documents initiated in 1986 and 1992 highlighted the emergence of ICTs and their possible role in the context of education and schooling. However, they failed to lay out a concrete plan of action in terms of suggesting strategies to be developed nor did they fully indicate the implications of ICTs within the educational system. A programme which can be seen as deriving from the NPE is the 'Computer Literacy and Studies in School' (CLASS) programme which envisions increasing digital literacy and using computers to make the teaching-learning process more efficient and effective and encouraging children to become more creative.

More recently (June 2003) the government has announced an ambitious programme, titled '*Vidya Vahini*', to connect 60,000 schools run or financed by it. The project envisages creating computer laboratories in these schools with facilities like internet access, an online library, academic services and webcasting. The launch came after pilot projects in seven districts in which 20 schools each were provided the facility. According to the government, the project was not meant to replace teachers but to enhance their teaching capabilities.

Drawn up by the Department of Information Technology, the project is being implemented by ERNET India and the software is being developed by the National Informatics Centre.

These projects, in terms of our earlier categorisation, fall within the scheme of using ICTs to strengthen institutional education and need to be supported, so long as they can be offered on a wide enough scale. However, efforts in this regard have been fairly limited with only a handful of private and a few state schools moving ahead in this area.

The first major statement on computers in school education was proposed in the IT Action Plan of the Government of India in July 1998. It made several recommendations for the education sector, of which the following were relevant to schools:

- Easy instalment bank loans and other measures to help students, teachers and schools to buy computers
- Use of IT to promote distance education
- Setting up of a National Council for IT education for developing IT courses for various levels of education and for training of teachers
- Making computers and internet connections available to all schools by 2003.

While the 2003 target is nowhere near realisation, there are efforts on to achieve the last of these goals at low cost as well. The Goa Computers for Schools Project is a community-based project attempting to improve the levels of computer literacy and computer access to students in Goa, while training teachers to use them to teach effectively. In addition, the project seeks to promote after-hours use of the computer facilities by adults in the community for email access, information and income generating schemes. The vision of the project is to help all secondary schools obtain a lab of at least eight internet ready computers with the help of the government, industry, and the community, relying on teamwork and networking among volunteers. Based on Linux, the software used in the project is freely distributable, moderately priced and legally copyable. Such a project is unique for India, where schools have been struggling with unaffordable software prices.

The project has its roots in 1995, when Goans in North America took the initiative to raise money for a number of schools in Goa. The Goan Government has provided about 750 PC's to Goa's 350 secondary schools, thus enabling every school in Goa to have at least 1 PC - the first state in India to achieve this goal. Simultaneously, GCSP has provided over 100 schools, with 450 mainly recycled PC's, which has reduced the PC to student ratio to 1:60. If successful, the project sponsors, Red Hat India plans to extend the project across the country, without any financial implications for the schools.

An even more cost-conscious experiment is that by "Rural Relations", a rural consumer relations organisation in Pune. The organisation is working towards taking second-hand computers to 28,000 village schools in India. In February 2000, 102 used computers had been installed, the first one being at the Mandardev village school in Maharashtra. Used computers are collected from donors and given to schools free of cost. The computers are not randomly distributed, but a team first reviews a request from a school and assesses the need for computers. Selection criteria include: a student population of at least 200, at least one teacher who has received computer training at a government workshop and that the school does not already own a computer. It then provides the computer for its secondary students, believing that children in this age group are more open to new information. The team works on the premise that after this initial introduction, the school will try and harness enough funds on its own to either upgrade the existing computer or buy a new one and initiate computer education in the school. Thus far, 37 of the 102 schools have been pushed into buying new computers or upgrading the systems by the students.

There are experiments where computer-literacy and computer-enabled education are sought to be reached at extremely low costs to schools through mobile classrooms. A typical example is a Mobile Classrooms project being piloted by the World

Bank. The project uses buses converted into mobile computing classrooms to spread IT literacy among rural school students. As part of the pilot, 20 buses were to be converted into mobile computing units by removing the seats and replacing them with battery-powered computers. The buses will travel from one school to another in rural Pune, teaching basic computer skills and local language typing. Other important examples of similar experiments are provided in Box 7.1.

Another instance of using ICTs to strengthen the schooling system with an eye to gender disparity is the *Indira Soochna Shakti*, or "Empowering a quarter million schoolgirls through ICT" programme, which is a project in Chhattisgarh, India whose goal is the provision of "seamless access to IT education for all girls in high schools". The project's mission is to work in all 1605 of the state's government high schools by delivering four years of IT instruction to girls through an innovative public-private sector partnership, where a private entrepreneur has been

Box 7.1: Computer-Skills and Computer-Based Education in Schools

- **Project Shiksha - Computer Literacy**

  Shiksha, is a project that aims to accelerate computer literacy by providing comprehensive software training for teachers and students in government schools across India. Over 80,000 school teachers and 3.5 million students will have an opportunity to strengthen their IT proficiency via the initiative over the next five years. There is evidence however that this programme would increase dependence on proprietary software, that would make it expensive to sustain and difficult to replicate on a mass basis. This is because as part of the project Microsoft plans to set up 10 Microsoft IT Academy Centres in partnership with state education departments in addition to collaborating with over 2000 partner-driven school labs. Microsoft will also be sponsoring teacher and student scholarships to recognise teachers committed to delivering effective IT education, and students for driving innovation through technology. But this effort of Microsoft will be based on its platforms. Hence the cost of subsequent expansion to be met by the state or other agencies would be high.

- **Karnataka's Computer Learning Centres in Schools Initiative**

  The project, a joint initiative between the government of Karnataka and the Azim Premji Foundation, aims to demonstrate that the use of software to reinforce teaching of mathematics, geography, environmental sciences and Kannada can have a positive impact on the interest levels of children and increase their learning achievement levels. Each CLC is equipped with five to eight computers and relies on trained volunteers, rather than taking Government school teachers away from classrooms.

- **Headstart**

  Based in the state of Madhya Pradesh, the project aims to provide computer-enabled education and development of basic computer skills for all students in primary and middle schools through the 7000 Jan Shiksha Kendras (cluster resource centres) located in middle school premises in 48 districts.

- **AP Schools**

  In 2002, the Andhra Pradesh government partnered with NIIT for setting up 663 modern computer classrooms with over 8,000 computers and implementation of computer education in high schools to educate over 300,000 students. The five-year project was worth Rs 155 crore (USD 30 million), averaging Rs 90 per student per month.

provided space in schools and permitted commercial IT use outside school timings.

ICTs in informal education

Besides these diverse experiments in the regular schooling system, there are a number of programmes aimed at using ICT for informal education or for supplementing the formal educational framework. The most obvious example is the *Gyan Darshan* TV network set up by IGNOU involving 70,000 hours per year of TV time devoted to distance learning for various subjects and levels. IGNOU is also in the process of developing a network of FM Radio channels with a total capacity of 3500 hours per year exclusively devoted to education. The widespread, remote access this provides to formal, structured programmes supported by 40,000 functionaries including faculty members from different universities of the country, makes this an extremely valuable resource.

There are instances, however, where computer-literacy and computer-based training is being experimented with as a means of circumventing the lack of access to formal schooling for a significant proportion of Indian children. A typical example is the NIIT's much-publicised 'Hole in the Wall' experiment. As part of the experiment, computer kiosks were located in the slums of New Delhi, and street and slum children provided access so that they can tutor themselves and each other in the use of computers. According to the NIIT, its follow-up studies among children so exposed suggest that these children with almost no education were not just keen to acquire computer knowledge but displayed rapid learning abilities. The International Finance Corporation, a World Bank subsidiary, is investing $1.6 million in the project that hopes to encourage underprivileged children in India to learn from a web-based curriculum through internet kiosks, which will be installed in more than 60 locations over the next three years. The aim is to improve education for poor children, ensuring equal access for girls and boys. The programme clearly does not see ICTs as facilitating the conventional education system with its teacher-student interface, but seeks to replace the teacher and substitute for the formal institutionalised school system. Thus, it has much in common with the alternative schools programme that has been received with scepticism in some circles. Care must be taken to ensure that this does not get seen by cash-strapped governments as an alternative to investing in providing universal access to the conventional school system.

Finally, ICTs are being used in many contexts as a means of non-formal adult education with regard to best practices in production, in hygiene and health, etc. An example is the Rural ICT Network project of the MSSRF being implemented in the state of Tamil Nadu, South India, in areas close to Pondicherry. Its goal is to provide access to ICT for rural families. The focus of the project is to link relevant information available on the internet to rural areas and users. There are two key parts to the system. At the local level, information shops or knowledge centres, operated by volunteers, act as a human interface between information and rural people by assessing local information needs and linking research to local people. A value addition centre acts as a hub for the village information shops. The centre gathers, translates into Tamil, and disseminates information from the internet, generating data, issuing bulletins and creating/maintaining locally specific databases of information, for example on hospitals, transportation, educational and government programmes, soil, agronomy, weather and cropping patterns. The project results indicate that information can be practical; for example, local workers have used market information on commodity prices to bargain for higher wages for agricultural labour; and increased knowledge of and access to government entitlements has benefited local residents.

While the southern and western states in India have been pursuing an aggressive ICT policy, the northeastern states have been slow in following suit. In this context it is significant that the Ministry of Information Technology is promoting a new Community Information Centres project in the northeastern states. The goal for 2008 is the establishment of 100 million internet connections and one million internet kiosks. The objective is to promote ICTs at the grassroots level, including exchange between government at the grassroots block (sub district) and district levels.

The project will support the establishment of a database of information on topics including drinking water, education, health, population statistics, and court decisions. Highlighted goals are computer awareness and literacy for government workers and a means of connectivity for research and educational institutions. The technical model is based on a combination of technologies such as wireless in local loop (WLL), VSAT (very small aperture terminal) and fibre optic cable. VSAT is considered to be best suited to the hilly eastern terrain where terrestrial options are too expensive and it combines high reliability, capacity and reach as well as central network management. The pilot has been implemented in 30 blocks of the northeastern states at a cost of US$ 3.3 million.

8. ICTs, Gender Equality and the Empowerment of Women[7]

It is now widely recognised that world over systemic or structural factors have played a role in perpetuating substantial gender disparities despite economic development. Needless to say, India is no exception to this tendency. Recognising the right to development of women as much as men, and the debilitating effects on overall growth and human development that gender disparities have been found to have, the UN's Millennium Declaration provided for special goals and targets in the area, which call for mainstreaming the gender problem into economic development. This section is concerned with delineating some of the principal challenges raised by the gender situation in India and examining how ICTs are being and can be harnessed to further this agenda.

Assessing the status of women

The fundamental problem from a gender-sensitised, human development point of view is evidence that economic growth need not necessarily generate improvements in the socio-economic status of women. There is indeed national and international evidence of a positive relationship in the long run between material progress and the socio-economic condition of women. However, this outcome does not reflect an automatic, monotonic relationship. Rather, it captures the results of women's struggles for equality and justice, which in turn are conditioned by extent of participation of women in the labour force in the course of economic expansion. As women's work becomes more socially recognised because it is paid, there are pressures to provide better conditions of work, enlarge the opportunities for women's participation and improve the overall freedom and status enjoyed by women.

A range of indicators have been used thus far to assess the extent to which this process has unfolded. To start with there are variables defining the basic conditions of life and survival, such as access to food and nutrition, water, shelter and basic consumption goods (including amenities such as electricity and sanitation). Second, there are variables defining capabilities, such as access to education and health services. Third, there are variables defining the nature of economic participation, such as the pattern of employment, division of time between paid and unpaid work, control over assets and control over own labour power. Finally, there are variables defining the extent of social inclusion and freedom, such as the degree of control in household decision making, freedom from violence, social involvement and autonomy of movement outside the household and political participation. As we had noted in the introductory section, almost all of these features are covered by the goals and targets set by the UN's Millennium Declaration.

It should be obvious that each of these can influence the degree of access to and the capacity to use the benefits of ICTs. Therefore, inasmuch as there is a gender divide that adversely affects the status of women, it also contributes to a digital divide, since women's access to and capacity to use the benefits of the technology is restricted. We must recall that in the South Asian region, internet users constitute less than 1 per cent of the population. And most women internet users belong to the predominantly

[7] *This section relies heavily on work undertaken by Jayati Ghosh (2004) on the gender situation in India and has benefited immensely from the database and drafts of ongoing work, especially Gurumurthy (2003) and IT for Change (2002), provided most generously by Anita Gurumurthy of IT for Change. The authors would like to gratefully acknowledge their contributions.*

urban, educated elite. According to one analysis: "Barriers of illiteracy, preoccupation with survival and constraints of time, inegalitarian and oppressive socio-cultural norms and practices, high costs and predominantly urban character of facilities, and bandwidth limitations are some of the key factors impacting women's access to ICTs in the region. Obstacles to access - a necessary condition for women's appropriation of ICTs - prevent the engendering of the design, content and use of ICTs." (Gurumurthy 2003).

This has important implications for the way in which ICTs are used to empower and improve the status of women. We can think of two ways in which such use can occur: directly, by the affected women themselves, who exploit the benefits of the technology to improve their status; indirectly, by those who are exploiting the technology to improve the delivery of services to women, to increase awareness about the status of women and to advance their advocacy activities. The latter could consist either of women's groups or of those not specifically targeting women, but whose activities have a positive fall-out for women as a group who are specially disadvantaged. Given the gender divide, it is the second that is likely to be more important in the early stages of the effort.

However, efforts are on to increase computer literacy among women, especially underprivileged women, so that they can directly benefit from the technology. For example, in partnership with *Nari Raksha Samiti* (NRS), Datamation Foundation has been attempting to create IT job opportunities for women from disadvantaged backgrounds. The first step towards that objective is a computer literacy programme, for which a computer-training centre has been established in a slum locality in Delhi Women who are otherwise underprivileged, abused, and/or destitute but have had at least school-level education are trained to acquire basic computer skills such as the use of applications like MS Word, Excel, and PowerPoint. Once these skills are acquired, it is expected that employment opportunities would increase for these women. In fact, Datamation itself has hired nearly 150 such women, amounting to about 10 per cent of its work force. Datamation's goal is to create more than 3000 full-time job opportunities in the next 2-3 years.

Similarly, the SITA initiative, in operation between 1999 and June 2001 as a sponsored programme, seeks to empower low-income women from rural, suburban, and urban areas, through training aimed at acquiring computer skills. Once skills are acquired, *Mitra Mandal*, a specially created cooperative in partnership with the UN's Asia-Pacific Center for Transfer of Technology works out income generation activities based on the skills acquired by the trainee. *Mitra Mandal's* Core Group of women is also supported by a network of partner institutions in its training, placement and income generation activities. It is expected that in time these centres can also serve as nodal points for delivery of a range of services like e-health and e-education (Gurumurthy 2003 and Emtervall and Lingefelt 2001).

The situation of women in India

Before further assessing the manner in which ICTs have and can be used to bridge the gender divide, it would be useful to identify the challenges being confronted in the area of empowerment of women. Even though the life expectancy of women in India has improved at a faster rate than that of men (Table 8.1), so that by the mid-1990s women in India had greater expectation of longevity than men as expected on the basis of known biological patterns, another demographic indicator, viz. the sex ratio paints a depressing picture. While the aggregate sex ratio for all ages improved between 1991 and 2001, it was in the latter year still lower than the level touched in 1981, pointing to a long-term decline. And the sex ratio for the 0-6 years age cohort has declined continuously and quite substantially (Table 8.2), pointing to the likely role played by the combination of greater neglect of girl children and wider practice of female foeticide based on modern medical techniques to determine the sex of the foetus. The latter, we must record, is an area where new technologies, incorporating information technologies, have been used to realise, in the crudest fashion, objectives deriving from perspectives that accord women a lower status than men in society.

Table 8.1: Life expectancy at birth (years)

	1970-75	1981-85	1992-96
Rural			
Male	48.9	54.0	58.9
Female	47.1	53.6	59.8
Urban			
Male	58.8	61.6	64.9
Female	59.2	64.1	67.7
Total			
Male	50.5	55.4	60.1
Female	49.0	55.7	61.4

Source: Registrar General of India, 1999 (based on SRS).

Table 8.2: Sex ratios over time
(females per 1000 males)

	1971	1981	1991	2001
Total population	931	935	927	933
Population aged 0-6 years	964	962	945	927

Sources: 1. Women in India, A Statistical Profile, GOI, MHRD, DWCD.
2. Census of India 2001, Provisional Population Totals.

An inter-regional comparison across states of India for 2001 suggests that the variation in sex ratios has virtually nothing to do with per capita income or degree of development (Table 8.3). The lowest sex ratio is to be found in Delhi, which has the highest per capita income of all states, and is the most urbanised, and among the most developed of all states. The agriculturally developed and high per capita income states of Punjab and Haryana are next in terms of low sex ratio; in fact, in Punjab, the figure drops to an appalling 793 girls per 100 boys in the age group 0-6 years. By contrast, Kerala, which has much lower per capita income, shows the best sex ratio at 1058 women per 1000 men, close to international norms. However, even in Kerala the 0-6 years sex ratio is unsatisfactory, while it is higher than the national average. In general, several of the states that are economically less developed (such as Andhra Pradesh, West Bengal and Tamil Nadu) perform better than the national average by these indicators.

This points to a complex relationship between economic growth and the status of women, especially in terms of the extent to which girl children are valued. The evidence of worsening sex ratios in richer pockets also suggests that economic development does not preclude the misuse of technological changes to undertake tests to determine the sex of the foetus and encourage the associated rise in female foeticide. In fact, access to more modern medical practices and higher incomes to meet the costs of sex determination tests in richer regions appears to increase the extent to which such tests are used. This makes clear that social perceptions of the status of women and the relative desirability of girl children do not automatically change and keep pace with income and the level of development, resulting in the fact that growth accentuates the consequences of some forms of gender discrimination. The solution, therefore, can only be greater public attention to the task of changing social perceptions and consciousness.

Table 8.3: Sex ratios by state, 2001

	Total	0-6 years
Andhra Pradesh	978	964
Bihar	921	938
Delhi	821	865
Gujarat	921	878
Haryana	861	820
Karnataka	964	949
Kerala	1058	962
Madhya Pradesh	920	929
Maharashtra	922	917
Orissa	972	950
Punjab	874	793
Rajasthan	922	909
Tamil Nadu	986	939
Uttar Pradesh	898	916
West Bengal	934	963
India	933	927

Source : Census of India 2001, Provisional Population Totals.

Fortunately, ICTs are being sought to be used to combat this menace as well. In New Delhi, India, the Datamation Foundation in collaboration with

the Nari Raksha Samiti, has launched an initiative titled Save the Girl Child Campaign to use ICTs to generate and record complaints against members of the medical community indulging in selective sex determination tests and selective abortion of female foetuses. The campaign has set up a dedicated website (http://www.indiafemalefoeticide.org) on which more than 750 cases of selective sex-determination tests and consequent illegal abortion of the female foetuses have been recorded. Further, through links with other organizations active in the field such as *Nanhi Kali, Nari Raksha Samiti and Nari Dakshta Samiti*, an attempt is being made to increase the number of recorded cases, to mobilize opinion against the activity and to monitor individual complaints effectively.

At a regional level, UNICEF's Meena Communication Initiative has played an important role in focusing attention on the rights of the girl child in South Asia. Aimed at changing perceptions and behaviour that hamper the survival and development of female children, the campaign uses the cartoon character Meena, an assertive and courageous little girl, and a set of events derived from research of real world conditions to challenge prevailing perceptions and practices. These 'adventures' are presented in a range of formats including animated films, videos, radio serials, comic books, posters, discussion guides, folk media, calendars, and stickers. The Meena series has had as a spin-off the production of ancillary education materials, including posters, comic books, flipcharts and educational packages (Rathgeber 2002).

Infant mortality

Even when the discrimination against girl children does not occur in the womb, differentials with regard to dietary provision, immunisation and health monitoring, resulting from gender-biased attitudinal differences to female and male children leads to higher early mortality among girls. Evidence from the Registrar General's Sample Registration Surveys (SRS) suggests that, while infant mortality rates in India have declined over time, the rate of decline has decelerated over the 1990s. This problem is more pronounced among girls. The infant mortality rate for males fell by 26 per cent between 1981 and 1991 (from 110 per thousand to 81 per thousand) but only by 12 per cent over the subsequent decade, to 71 per thousand. The deceleration in the rate of decline of infant mortality among girls over the two decades was even sharper, from 27 per cent to 10 per cent, such that the female IMR was 72 per thousand in 2001. Of course this conceals the extent of female foeticide, which is likely (if anything) to have brought down female IMRs. Some states have very high female IMRs, ranging from 96.9 per thousand in Orissa to 81.4 per thousand in Haryana in 1998-99. The female IMR in Madhya Pradesh in that year was as high as 101.5 per thousand. What is even more disturbing is that in the recent past, there is evidence of *rising* IMRs in several states, which reverses the long run trend of decline evident across India since Independence.

Death rates during the first five years of life also show very significant gender differentials. In 1998-99, the national average child mortality rate (CMR) was 29.3 per thousand. However, the CMR for rural boys was 27.9, while that for rural girls was one and a half times higher at 41.7. The urban gender differential was somewhat less: the urban CMR for boys was 14.6 while that for girls was 19.7. It should be noted that for all these variables there are significant variations across states, and in addition, within states as between different sub-regions, ethnic and social groups such as certain castes and tribes and minority groups.

The special dangers faced by females continues to a later stage in life as well, especially when they are in vulnerable circumstances like child birth. Thus the rate of decline of maternal mortality has been very slow in India. Maternal mortality for the country as a whole was estimated at 580 per 100,000 live births in the early 1990s (Bhat *et. al 1995)*. Once again, there are significant rural-urban differentials (the rural rate at 638 is nearly double the urban rate of 389 per 100,000 live births).

Nutrition

Part of the reason for the slow decline of maternal mortality is that the nutritional problems associated with effective child-bearing remain significant and widespread. Poor nutrition for girls during adolescence (and resultant anaemia and inadequate

calcium intake) contributes to future obstetric risk and also affects the reproductive process. While the all-India average intake of calories is substantially below the Recommended Dietary Allowance for both men and women, the largest deficits are in the case of pregnant and lactating mothers. This can contribute to foetal loss, low birth weight and death during infancy. Deficiencies of micro-nutrients are rampant: not only calcium for pregnant and lactating women, but iron, riboflavin and Vitamin C for all women.

Under-nutrition may be described as a characteristic feature of the condition of women and girl-children in most parts of India. While there has been some improvement in nutritional conditions over time, gender disparities in this area remain significant and have probably even widened over time. Thus, estimates by the National Nutrition Monitoring Bureau indicate that the proportion of men defined as "Chronically Energy Deficient" in terms of Body Mass Index declined to nearly half from 55.6 per cent in 1975-79 to 28.6 per cent in 1995-96. However, the extent of decline of Chronic Energy Deficiency among women was significantly less, even though it did go down from 51.8 per cent to 36.2 per cent over the same period (Gopalan and Shiva 2000).

Literacy and education

Associated with India's unsatisfactory progress on the literacy and education fronts, are substantial gender differentials in even the modest achievements that have been recorded. Female literacy rates are much lower (with the illiterate proportion usually between 50 and 70 per cent) among Scheduled Tribes and Scheduled Castes, as well as among certain minority groups. Similarly, drop out rates tend to be much higher for girls than for boys. Typically by middle school the ratio of girls to boy students falls sharply, especially in rural areas.

The government has been conscious of these differentials, though progress in redressing them has been inadequate. Many of the schemes for increasing access to primary education include among their principal aims, the reduction of gender disparity in access to schooling, and sought to change the education system accordingly. These have included changes in syllabus to meet specific needs of girls and changes in school times to allow older girl children to undertake household tasks that are unfortunately seen as their responsibility. The introduction of mid-day meals for school children has also been seen to have a positive effect not only on nutrition of girl children but also on attendance. This has been mandated as compulsory for all states by the Supreme Court of India, but is yet to be put into universal practice.

The principal task in dealing with these forms of gender discrimination is advocacy in campaign mode to correct for the mindsets that lead to these kinds of problems. This has to be combined with efforts to educate parents and the community on the need for adequate sanitation, timely immunisation and adoption of appropriate nutritional practices (assuming the economic means to do so exist). In both these cases, ICTs can play a useful role. In fact, older forms of communications technologies such as the radio have a crucial role to play as well in a society with limited literacy. This is illustrated by the activities of the *Kutch Mahila Vikas Sanghtan*, (KMVS), an NGO working with rural women in 150 villages of Kutch district Gujarat. After involvement in community development work for over a decade, KMVS launched in 2000 a weekly, 30-minute sponsored programme in Kutchi language on All India Radio's Radio Bhuj, titled *Kunjal Paanje Kutch Ji* (Sarus Crane of Our Kutch), the programme deals with a range of gender-related issues such as the participation of women in political processes, a girl's right to education, female foeticide, harassment of brides for dowry, unnatural deaths and suicides of women, pressure on women to produce boys, maternal mortality and disregard of mother's health.

An instance of direct use of ICTs to improve health care delivery has been discussed in more detail elsewhere in this report. The India Health Care Project initiated by CMC Limited aims to improve the effectiveness of health prevention programmes by using computers, communication technologies and Personal Digital Assistants (PDAs) for data collection in rural health care delivery systems in Andhra Pradesh, India. The thrust of the initiative

is to reduce burdensome data collection and collation procedures and the excessive paperwork implicit in the current system used to deliver health care. The approach is to train the health workers in the use of PDAs to collect, collate and process data, by using software designed to take account of the semi-literate levels of health workers. The 40-60 per cent reduction in time devoted by health workers for processing the data would, it is hoped, be used productively to improve the quality of health care delivery.

Labour force participation and employment

For women as for men access to productive employment opportunities is the key to the reduction of poverty and the redressal of inequities in the distribution of income. However, only a part of women's work can make this contribution since it is known that a significant part of women's work – in processing of primary produce for own consumption, basic domestic handicraft production, and in services such as cleaning and child care - is unpaid. Since the latter is typically not captured by the employment data, there is also a tendency to overestimate the extent of "unemployment" among women as well as underestimate female work participation rates. This problem afflicts the two main sources of employment data in India as well, viz., the Census and the National Sample Survey.

It must be noted however that within the category of paid employment, gender differentials in wages are lower in India than elsewhere in Asia, including, in East and Southeast Asia. What is worrying in the Indian context is that in recent times those differentials appear to have widened across a significant range of non-agricultural activities in both urban and rural areas. Indeed, the increase in the gender wage differential for all categories of urban work is quite striking. While this may be the result of generally worsening of conditions of employment, it is also true that such aggregative gaps result to a substantial extent from gender based job segregation, in that women workers are typically found at the lower end of the skill and value added spectrum.

Table 8.4: Gender wage differentials
(female wages as per cent of male wages)

	1993-94	1999-00
Rural public works	0.7	0.8
Rural casual agricultural labour	0.7	0.71
Rural casual non-agricultural labour	0.78	0.63
Urban, all categories	0.72	0.6

Sources: 1. NSSO Employment and Unemployment in India, December 2000
2. K. Sundaram, (2001).

The deceleration and even decline in organised sector employment was one of the more disturbing features of the 1990s, especially given that industrial output increased manifold and the service sector in which much of the organised employment was based, was the most dynamic element in national income growth. Despite this, not only did organised sector employment expansion slow down considerably compared to the earlier decade, it actually fell in absolute terms for male workers. This fall was due to the collapse in public sector employment, a process that was in turn partly the result of downsizing which accompanied economic reform. While public sector employment fell especially in the latter part of the period under consideration, private organised sector employment continued to increase, albeit slowly. But this increase was not enough to compensate for the decline in public employment, so that total male employment in the organised sector fell slightly over the decade.

For women workers, however, there has been some increase in aggregate organised sector employment, in both public and private employment, although this still reflected a substantial deceleration in aggregate organised sector employment over the 1990s compared to the earlier decade. This increase in female employment in the organised sector, in the context of falling organised employment for men, implied a substantial rise in the share of women in formal employment, as Table 8.5 indicates. Secondary sector employment shares for women workers remained approximately stable, with if anything a slight decrease over the 1990s. While self-employment among women workers tended to

decrease, there were increases in the share of both casual employment and regular employment.

Table 8.5: Share of women in organised employment

(per cent)

	1971	1999
Public sector	8.1	14.5
Private organised sector	15.8	23.1
Total organised employment	11.0	17.2

Source: Directorate General of Employment and Training

Employment in the ICT sector

It is also worth considering an export sector of specific interest to this study - that of software and IT-enabled services - which in the 1990s emerged as the fastest growing segment of India exports. Much has been made of the growth potential of this sector and its ability to increase educated employment, as well as of the important potential it offers especially for urban educated women to enter employment on relatively advantageous terms. There is no doubt that these new sectors in India offer a very promising combination of employment opportunities and export revenues from hardware, software and IT-enabled services. Projections by both private industry and government of the likely trends in output, exports and employment, are extremely optimistic. If these projections get realised, employment in the software sector in 2008 would be around 8 per cent of India's organised sector employment in 1998. To this should be added the projection that direct and indirect employment in the hardware sector is expected to touch 1.6 million and 3.2 million respectively, taking total IT employment to 7 million in 2008. And of course this still does not include the employment potential of a wide range of IT-enabled services, including data entry and processing, medical transcription and back-office work subcontracted by multinational companies, where it is often argued that the scope for job expansion is even greater.

As always, however, there is need for caution in interpreting such optimistic figures. The ability to make use of the technology is critically determined by levels of education. And, as we have seen already, levels of education for women remain relatively low, although there have been increases in both literacy and participation at all levels of education especially among the urban female population. Similarly, since much of the activity is in English, the employment generated by both the software and IT-enabled services sectors is currently concentrated among the richer and English-educated sections of urban (and even metropolitan) India, and is likely to remain so. It is also true that the impact of IT on growth and employment is uncertain. The remarkable rates of growth recently recorded are from very small bases, and the sector typically remains very small relative to the rest of the economy, in India as elsewhere. These rapid rates of growth should be treated with caution, also because gross revenues are misleading in an industry segment characterised by substantial dependence on imported capital goods, components and software, since this substantially reduces the domestic multiplier effects of such spending. It is not clear how much of this export revenue is little more than the sale of cheap skilled and not-so-skilled IT-enabled labour services whose output is transmitted via modern communication technologies to sites where those services are required. The possibility of such service delivery has helped India circumvent the obstacle to service exports created by immigration laws in the developed countries. This means that a large part of software exports is not very different from the exports of nursing, carpentry, masonry and other such services, except for the fact that unlike those exports, the presence of the service provider at the point of sale is not required in the case of IT-enabled services.

The micro evidence suggests that women workers are reasonably involved in this sector, and in particular activities their share of employment is much higher than that for the formal sector as a whole. A survey by Nagesh Kumar of 141 sample establishments in activities such as internet/email bureaus, data entry and processing services and software customisation and content development services, in Delhi, NOIDA and Hyderabad, also examined the gender aspect of employment. (Kumar 2001) It was found that 72 per cent of the establishments did not employ any women workers, but customisation services had a relatively large proportion of women, ranging from a quarter

to half of the workforce. In the software industry as a whole the share of women workers is estimated to be 27 per cent. It is interesting that customisation services is the relatively more skill intensive of the activities covered in the survey, but Kumar notes that since back office work, voice mail etc., had been excluded from the survey, some of the activities in which women workers are more significant may have been excluded. This sector shows clear signs of labour market segmentation by gender, caste and class. Since almost all of those involved are from the urban upper caste English-speaking elite of Indian society, it has been argued that the pattern of development of the software and IT-enabled services sector brings into sharp relief the tendency of the market to reinforce or aggravate existing socio-economic inequities. (Vijaybhaskar et al., 2000) While it will certainly draw more educated women into paid jobs and reduce the problem of educated unemployment to some extent, it would not bring about any major transformation in aggregate employment patterns in the near future. Of course, it is true that among the urban and educated categories of women, this has meant a substantial increase in the possibility of white-collar occupation, which has changed employment conditions very much for the better.

ICT initiatives for employment

Thus the relevance of special ICT initiatives relating to women's employment depends on their ability to carry such employment opportunities to the more disadvantaged among the women themselves. There are a number of experimental initiatives underway aimed at increasing the range of and returns from occupational activities for such women. Some of these are facilitating ventures, such as use of IT in micro-credit activities that render them sustainable. Others aim to strengthen marketing of goods produced by women through the internet. Yet others seek to improve production practices and upgrade technology in activities engaged in by women. We list below some of these initiatives.

Needless to say, the SKS initiative discussed earlier to introduce smart cards that reduce the operations costs of micro-credit ventures is an example of an initiative in the first category. But there are other similar schemes as well. In a community-banking programme called *Kalanjiam* being run by the Dhan Foundation in two districts (Madurai and Ramanathapuram) of Tamil Nadu, and in pockets in Karnataka and Andhra Pradesh, two kinds of handheld devices - i-Station and DataVision – have been introduced on a pilot basis to improve the efficiency of operations and reduce costs. Both of them allow smart cards to be used as electronic passbooks, with attendant benefits. The i-Station, developed by iNabling Technologies (Bangalore) reduces duplication in data entry, as well as allows for data transfer from rural locations to central offices either directly or via email. DataVision, developed by Web Ezee Technologies, has text-to-speech capabilities and allows oral / aural language-localisation. The device also features an LCD display, a keypad for data-entry purposes, rechargeable long-life batteries, and a dial-up and/or GSM modem for remote connectivity.

Instances of using ICT for marketing in order to strengthen earning opportunities for poor women are also being experimented with. One among the few e-commerce projects geared to marketing commodities produced by rural women's cooperatives and NGO's focusing on women is India Shop set up by Foundation of Occupational Development (FOOD). The advantages in terms of better prices and higher profit margins resulting from bypassing the middleman through such ventures is obvious. To support the venture, FOOD runs in parallel an E-marketers project, which trains computer operators at different locations to partner local cooperatives, deliver products, provide customer services, and promote the web site. After the initial pilot period where the E-Marketers were provided free internet access to carry out their work, they continue to receive DSL internet connections from FOOD for a small fee, while some choose their own Internet service provider. E-Marketers are trained by FOOD for free, and receive a commission ranging from 2 per cent to 5 per cent of sales by the women's cooperatives and NGOs. The commission helps each E-Marketer to sustain the project and motivates them to further expand their client base. FOOD now collaborates with the Council for Advancement of People's Action and Rural Technology (CAPART) to expand this successful model to other parts of the State.

Finally, ICTs are being used to build productive skills among disadvantaged women as well as offer knowledge-based services that help improve the productivity of women's enterprises. The Seelampur project of Datamation entails putting ICTs into the hands of Muslim women in a slum area in Delhi and directly linking the use of ICTs to the alleviation of their poverty. The project seeks to modernize the vocational skills of Muslim women in the area in bead-making, dressmaking, carpentry, and embroidery and lend marketing support to help them enhance their incomes. Datamation is in the process of developing 50 multimedia CDs focusing on skills enhancement, women's empowerment, and life skills. The CDs will be shown via the existing cable network since not all women can make it to the Community ICT Centre. The project has successfully negotiated with local cable operators to provide free telecast time.

The National Institute of Agricultural Extension Management (MANAGE) has set up Village Information Kiosks in 11 villages in the Ranga Reddy (RR) district of Andhra Pradesh. The kiosks are housed in the premises of Mutually Aided Cooperative Thrift and Credit Societies (MACTCS), savings and credit groups of women, federated at the sub-district (*mandal*) level. The eleven village-booths cater not only to the eleven villages proper, but each of these villages caters to 25-30 surrounding villages, from where these MACTCS have group members. This project is an agriculture extension initiative, which seeks to provide for quick dissemination of technological information from the agricultural research system to farmers in the field and the relaying of their feedback to the system. Staff of the MACTCS are trained by MANAGE to run the kiosks. In all the Village Information Kiosks, the maintenance and operation of MACTCS finances is one of the major services. The kiosks are a window to information on the prices at the farmers' markets in the state. Villagers use the net to link up with schemes; they check their eligibility for housing loans, crop loans and other schemes. CDs on income generation activities have also been provided[8]

FOOD has recently set up kiosks in Kanchipuram and Chengelpet districts of Tamil Nadu. The organization plans to train around 100 women to run these information centers. Called RASI (Rural Access to Services through the Internet) *Maiyams* (centres), every centre is connected to the office of the district collector and will be managed by self-help groups. The objectives are to provide a communication channel to the collectorate, including for grievances; provide information by linking Panchayat offices and also by building a database of best practices (for e.g. in agriculture); and have an educational component (e.g. health education). Content in Tamil is being developed by FOOD. The kiosks will also be self-sustaining, and will provide services such as Desk Top Publishing (DTP).

A project titled "Sustainable Dryland Agriculture by Mahila Sanghams" has been initiated by the Government of Andhra Pradesh, under the UNDP-GOI Food Security Programme. A major area of the project is in evolving appropriate methodologies to meet the information needs of women farmers. These range from information concerning agronomic practices and farming methods, information on how to access and use new technologies, market news and agricultural commodity prices, weather predictions and rainfall patterns, recommended crops for the season and information on meetings and workshops on relevant issues. A database of relevant information will be maintained and updated at a central hub, which can be accessed through a network of computers in information centres, which will be located in the office of the Mandal Agricultural Officer. These centres will be equipped with computers and modems for dial-up internet access, and will provide services to the entire community. In addition to information related to dryland agriculture, the information centres will also maintain a gender-disaggregated village database with basic demographic information, land-holding patterns and income profiles. The centres will provide a platform for distance learning through centrally developed interactive learning packages

[8] *From MANAGE Bulletin Vol 7, Issue 4, August/September 2001 quoted in Gurumurthy 2003.*

on specific technologies. The centre will also provide simple services like filling in and printing out applications for various government schemes in the required formats, at a small charge.

SEWA has a blueprint that integrates its community-based strategies with ICTs. The introduction of ICTs in their activities has set the stage for the exploration of how value-addition from new technologies can get women closer to the goal of ensuring an effective organisation to protect and promote women's rights as workers. SEWA started by piloting its computerisation in a few activities, limiting itself to one district. For instance, the IT design for the savings and crafts activities was piloted in Patan district.

A briefing paper on the intiative notes: "....developing software for the optimal management of grassroots organisations, whose end-users have limited computer awareness and proficiency in English, is a formidable task, especially since no prototype is available in the market. Hence, SEWA ICT cell had to develop its own prototype – customised software for the two activities (crafts and savings). For the pilot, Patan district was selected mainly because both the activities are adequately represented and the management systems for each of the two activities are well developed, hence making the transition into a computerised management system fairly smooth. Importantly, it also gave the ICT cell the opportunity to test the software (and fix any 'bugs') before mass deployment and expansion into other activities." [9]

Thus there is a range of ways in which ICTs are being used to empower women and redress gender inequities. Inasmuch as such inequities result in manifold ways in a reduction of the overall human development achievement of communities and nations, their redressal has implications that go way beyond the mere question of the status of women, though that in itself is a major objective to pursue. What is encouraging about these experiments is that they do provide indications of the direction in which we need to move to scale up these activities so that the outcomes can make a real difference from the point of view of the human development agenda embodied in the millennium development goals. As Gurumurthy argues: "A strategy for enhancing women's access has to be multi-pronged. It will entail a change in social structures, community and household norms, economic and technological models, and the creation of spaces for women's agency. The lessons from micro-level initiatives … indicate some directions for moving towards greater access for women. Crucial among these are capacity-building for women, sensitive design of projects, continuous adaptation of design and delivery based on women's needs, the exploration of technology menus that fit women's comfort (like the use of radio and multi-media). A proactive role for private sector support in technological and financial contributions towards meeting women's needs, policy response that accounts for women's interests and the involvement of non-government organisations working with women on varied agenda, can lend a strong scaffold to build a gender-sensitive ICT for Development discourse and practice."

[9] *Briefing note on SEWA ICT Cell, SEWA quoted in Gurumurthy 2003.*

9. ICTs and Health

With public and private expenditure combined on health in India estimated at 5.2 per cent of GDP, Indian spends more of its income on health than most other developing countries and almost as much as many developed countries. However, just 17 per cent is expenditure by the State, pointing to the predominance of private expenditure in total health expenditure. Despite these private outlays, the government accepts that while morbidity due to common communicable diseases and nutritional deficiency is still extremely high, that due to non-communicable diseases is on the increase. Even by the mid 1990s of the more than 25 million children born every year, close to 2.5 million were expected to die before they were one year old and another 1.2 million before reaching the age of five. Maternal mortality, due to hemorrhage, sepsis, puerperal complications, obstructed or prolonged labour, anaemia and lack of access to health facilities, claimed 407 lives for every hundred thousand live births in 1998.

A major cause of morbidity on these counts is, of course, malnutrition. Nearly one out of every two children was malnourished on both a weight-for-age and height-for-age basis. More than a third of women were undernourished as per the Body Mass Index and over a half of ever-married women and three-fourths of children suffer from anaemia. Add to this the problems of inadequate access to safe drinking water and reasonable sanitation facilities, and high morbidity is substantially explained. Dealing with these problems, using ICTs or otherwise, requires dealing with causes which are not directly in the health area, and have been discussed elsewhere. It is with respect to prevention of communicable diseases and with treatment of non-communicable diseases in whose case the lack of access to medical help plays a crucial role in determining morbidity and death that ICTs play a direct role in health improvement.

Communicable diseases

After hunger, the principal health threats stem from some old diseases such as cholera, tuberculosis, malaria, *kala azar* and, newer ones such as HIV/AIDS. Some of these have staged a comeback because of insecticide resistance among vectors, resistance to antibiotics and poor public health practices. Thus malaria, whose incidence was estimated at 75 million cases and 0.8 million deaths in 1947, and which had retreated to incidence levels of 0.1 million cases and no deaths in 1964, staged a comeback with 7 million cases in 1976. Though this incidence rate has come down since, it has stagnated at around 2 million cases over the last few years right up to 2001. In the case of *kala-azar*, endemic in West Bengal, Jharkhand and Bihar, the official Economic Survey for 2002-03 reports that "there has not been a significant decline in reported cases and deaths during the Ninth Plan due to inadequate insecticide spraying operations and poor outreach of diagnostic services." Inadequate public expenditure on health is an obvious problem here. *Kala-azar* had virtually disappeared by the mid-sixties, but returned in epidemic form by the late 1970s. In 1991, 77,100 cases were reported with an estimated 5,000-7,000 deaths. Similarly, recent estimates suggest that there are 1 million new cases of TB every year and 300,000-500,000 deaths every year, even though the government claims that the Revised National TB Control Programme covers 515 million people in 248 districts, making it the largest public health programme against TB in the world.

India's National Human Development Report

(Planning Commission, Government of India 2002) included in its diagnosis of the ailments afflicting India's health care services the following:

- Persistent gaps in manpower and infrastructure, with wide inter-state differences, especially at the primary health care level;
- Sub-optimal functioning of the existing infrastructure and poor referral services;
- Inadequate or inappropriate manpower, diagnostic and therapeutic services and drugs, in a significant proportion of hospitals, particularly in the public sector;
- A misplaced emphasis on development and maintenance of private health care services at the expense of a broadening and deepening of the public health care system;
- Escalating costs of health care and increasing dependence of people on private health care services, often leading to indebtedness in rural areas;
- Inadequate integration of public interventions in the area of drinking water, sanitation and urban waste disposal with public health programmes; and
- Inadequate strengthening of the institutional framework and delivery mechanism of public policy programmes relating to the five aspects of preventive health care – health promotion, specific protection, early diagnosis and prompt treatment, disability limitation, and rehabilitation.

It should be clear that while ICTs can help in some of these areas, they may not be helpful in many others, where the problems with the health care systems must be dealt with by undertaking larger expenditures and reorganising the health delivery system. As a highly information intensive industry, virtually every area of health care management and delivery is potentially capable of being supported to some degree by modern information management technologies. Health care information technology is now established as being capable of reducing the cost and/or increasing the quality of health care delivery.

The core themes of modern health care information technology are the increasing automation of the financial/administrative and clinical aspects of care (e.g. scheduling systems; laboratory test results access); the provision of additional clinical feedback at the point of care, provision of medical assistance remotely e.g. thorough telemedicine and analysis of clinical data from multiple sources to assist in the formulation of improved treatment programs etc.

In addition, the emergence of the internet as a 'universal' technology has dramatically increased the role of information technology in information delivery. Thus, areas not traditionally considered part of the health IT industry are becoming more closely associated with it (e.g. access to medical literature, the dissemination of clinical protocols, etc.)

As the technology infrastructure to which health care facilities have access continues to improve, information systems projects become easier to accomplish, including the ability to provide access to many health care services remotely via advanced telecommunications technologies and services.

The main applications of health care information technology are:

- Automation of basic processes of care, to make them more efficient, cost effective and reliable.
- Capture of critical clinical information, and automation of its interpretation (such as automated notification of potential adverse drug reactions).
- Provision of tools for decision support and information analysis, to support clinical research and clinical quality improvement programs.
- Extensions to the scope and reach of clinical services through telemedicine.

The potential gains from ICTs in health are illustrated by some grass-roots usage experiments in which ICTs has been applied to increase the efficacy of social service delivery. A remarkable

pilot project along these lines was the Indian Healthcare Project begun in 1994 as a collaborative project involving the Government of India, Apple Computer Inc. and CMC Ltd in the state of Rajasthan.(Reddy and Graves 2000). It targeted the Auxiliary Nurse Midwives (ANMs) who were healthcare workers responsible for 5000 persons distributed over several villages. The ANM is expected to call on each household under her charge once a month to collect demographic data, administer immunisation facilities, and provide counselling on family and child welfare and mother-child health programmes.

The project sought to combine the use of an IT device, the personal digital assistant (PDA) and relevant support tools to:

- reduce time spent doing paperwork by ANMs
- increase the accuracy of the data collated and supplied by the ANMs
- ensure availability of village level healthcare data in an electronic form
- provide the ANM with information that helps her provide more effective services.

The pilot project team designed a system based on the Newton handheld computing platform and at the end of the research phase turned over the results to CMC Lt for further development. Though Apple has dropped the Newton from its profile of products, the availability of new, cheap and extremely powerful PDA's makes it possible to build on the experience gained from the pilot project.

Thus, Handy Vaid is a Jiva initiative that seeks to get timely health advice and medication to the patient's doorstep by making innovative use of PDAs. A representative carrying a PDA through the village collects information and queries from the villagers using a pre-designed consultation form. This information is then transferred to a doctor in the city, who diagnoses the problem and suggests appropriate treatment, precautions and medication. The doctor's diagnosis and suggested treatment is then once again transferred to the PDA and carried back to the villager.

Handy Vaid is seen as the solution to improving health services and the overall living conditions in some of the most underserved areas in the country. Since this program does not require doctors to travel to or live in remote locations, it will be possible to reach the benefits of this programme even to the most remote and inaccessible populations.

Sisu Samrakshak is also a project that seeks to deliver health care, especially for children, through the use of ICTs. Based in Hyderabad and Karnataka, the project is a joint venture of UNICEF and CoOptions Technologies. On the one hand, the project aims to efficiently collect information on the health and socio-economic status of its target population. On the other, it seeks to develop content that would provide information on health, water supply and sanitation, besides education and economic and social development, which is to be reached to that population. It is expected that the project would use anganwadi workers, ANMs and health workers trained in maternal health and child care based in Information Dissemination And Acquisition Centres (IDACs) to provide accurate, timely, contextual information on women's health, antenatal care and services, new born care, child development including nutrition and immunisation for ages 0-60 months. Armed with PDAs these health workers would record basic data at the centres and feed the data into a portal to get customized reports which can be used to advise mothers and families.

In a different kind of experiment Aravind Eye Hospital is helping to eradicate blindness by using internet-connected kiosks to provide video consultations and diagnosis, as well as extensive education and training, to local healthcare providers.

Experiments of this kind sometimes get less attention then high-profile, high-tech possibilities, whose overall impact would be far more limited. A typical example of the advanced use of ICT for advancing health status is the still nascent field of *telemedicine*, which promises to deliver the best

medical advice and treatment to patients irrespective of their location.[10] Besides advice based on standardised symptoms, work is on in delivering higher-end medical care via satellite to remote rural sites or in response to disasters, like earthquakes. At the moment the real constraint is the access to and cost of the higher bandwidth needed to transmit real physiological data and complex medical images. Hence, it is unlikely that telemedicine would in the near future serve to link the 80 per cent of the population living in India's rural areas, with the 80 per cent of the medical community that lives in the cities.

Telemedicine applied in medical practice results in :

- Reduction in the need to transfer patients to a site of medical expertise.
- Decrease in the reallocation of medical specialists to the patient.
- Decrease in the number of patient days in the hospital
- Better organized and less costly healthcare.
- More effective and efficient use of medical and technological resources.
- Enhanced diagnostic and therapeutic quality of care
- Prevention of deaths by increasing the levels of second opinion diagnosis between medical practitioners.

In India, Apollo Telemedicine Enterprise Ltd., a sister concern of the Apollo Hospitals Group was established in September 1999 and specializes in giving remote consultation and second opinions to remote sites where access to quality healthcare is difficult to reach. Apollo Telemedicine is reportedly the pioneer in launching the first rural telemedicine centre in the country catering to a population of 50,000 villagers. There are other examples as well. Thus, as many as ten hospitals covering eight states have recently been hooked to the network of the Indian Space Research Organisation extending super-speciality medical consultations to remote areas. The areas include locations in the Andaman and Nicobar Islands, Tripura, Leh, and Assam. Through the use of Insat satellites and VSAT equipment, this telemedicine experiment expects to connect patients at the remote end with specialist doctors in urban areas for medical consultation and treatment. Medical records of the patient like medical images and outputs from diagnostic devices would be sent to the specialist doctors who after perusing them provide advise on the course of treatment in a videoconference with a doctor or a paramedic at the patient's end. Given the fact that less than two percent of specialist doctors in India are practicing in rural areas where the majority of the patients live, this is indeed a major advance. Links have been established between superspeciality hospitals and smaller hospitals in neighbourhood district towns. Among the projects which are already in place are:

1. GB Pant Hospital in Port Blair linked to Sri Ramachandra Medical College and Research Institute, Chennai;
2. ISRO Shar Hospital at Sriharikota and Aragonda Apollo Hospital in Chittoor in Andhra Pradesh linked to Apollo Hospital Chennai;
3. District Hospital, Chamarajanagar and Vivekananda Memorial Hospital in Mysore district of Karnataka linked to Narayana Hrudayalaya in Bangalore, Narayana Hrudayalaya and Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata linked to Tripurasundari District Hospital, Udaipur, South Tripura;
4. AIIMS, New Delhi linked to Guwahati Medical College and a hospital in Assam; and
5. AIIMS linked to a district hospital in Leh.[11]

A different version of such an experiment is the TeleHealth initiative of the Asia Heart Foundation,

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[10] *See for example, "The online doctor is in", **The Economist**, London, March 22, 2001.*

[11] *"Telemedicine, a boon to rural health care", Newindpress, 24 October 2002.*

that is specifically targeted at the poor. The project plans to set up a number of interlinked Cardiac Care Units (CCUs), networked in a hub-and-spoke fashion, with some serving as the main or central units and others as subsidiary and local units. The main and subsidiary units communicate with each other using VSATs connected to satellites. Using this connectivity a patient located at subsidiary and remote CCU can engage in a consultation with a specialist in the main CCU via a videoconference. The project uses main centers in Bangalore and Calcutta to link with sub-centres located in Karnataka, West Bengal and Tripura.

At the moment these are some of the principal experiments that are being conducted in the country. However, at present these kinds of instances are the exception. Links are more between metros and urban and semi-urban areas than between cities and villages. How easily they can be replicated and their spread increased to meet the public health crisis confronting the country is yet to be seen.

ICTs and HIV/AIDS

First reported in 1981, HIV/AIDS infections touched epidemic proportion in the 1980s itself. By 2002, the disease had claimed 25 million lives worldwide. India has been identified as one of the countries where the epidemic is spreading rapidly, and though estimates of prevalence vary, the National Aids Control Organisation reports the number of HIV infections in India at 3.97 million in 2001. With estimates in 1998, 1999 and 2000 placed at 3.5, 3.7 and 3.86 million respectively, it is argued that there are signs of a gradual decrease in the number of new infections. However, the officially reported number of new infections, at 0.11 million in 2001, is still extremely high.

The cumulative number of actual AIDS cases is reported at 48933 as on 31 March, 2003. Of these cases, 36,411 are males. With more than 85 per cent of these cases identified as having acquired the infection through sexual transmission, this rather than perinatal transmission, use of blood products or of injectable drugs, seems to be the principal means of transmission in the country.

The obvious difficulty with the health emergency created by AIDS is the lack of either a cure or a vaccine to prevent infection. Only by curbing practices that ensure transmission of the disease can the epidemic be brought under control in the current state of science. Thus beside research to find a vaccine and a cure, efforts to increase awareness of the means of transmission of the disease and to persuade people to adopt practices that prevent transmission are the principal tasks in the battle against AIDS.

India's National Aids Control Organisation (NACO) is the lead organization in the battle against the AIDS epidemic. Its activities include policy formulation, monitoring and surveillance, and awareness generation. NACO's website plays an important role in the last of these, serving as an information warehouse on policies and programmes, on monitoring and surveillance results and on guidelines and best practices relating to the war against AIDS.

The first of a series of Behavioural Surveillance Surveys (BSS) being conducted for India's National Aids Control Organisation is revealing. The BSS covered 3832 respondents in the 15-49 age group (1916 males and 1916 females) in each of 22 sampling units created by clubbing together some of the 35 states and union territories in the country. Finally 84478 respondents were contacted across the country, of which 42631 were females and 41847 were males and 42125 were from urban areas and 42263 in rural areas.

The first BSS was slightly reassuring, since more than three out of every four respondents were aware of the fact that HIV/AIDS is transmitted through sexual contact, and slightly lower but similar proportions were aware of transmission through blood transfusion and of transmission through sharing needles. However, underlying this aggregate cause for comfort, were reasons to believe that the awareness project has far to go. To start with, there were substantial inter-state variations in awareness, with particularly low awareness rates among rural women in Bihar (21.5 per cent), Gujarat (25 per cent), UP (27.6 per cent), MP (32.3 per cent) and West Bengal (38.6 per cent). There were substantial rural-urban

disparities in awareness, especially in Madhya Pradesh, Bihar and West Bengal.

These variations are even more disturbing when we note that the average literacy rate of the respondents in the sample at 75.1 per cent was high, though once again with regional variations. It is likely that a sample which includes a larger proportion of illiterates would yield lower awareness rates. Further, even among the sample respondents, awareness was either incomplete or not always correct. Thus the possibility of mother-to-child transmission was less known to the respondents across all states and union territories in the country. Less than 25 per cent of respondents knew that HIV/AIDS couldn't be transmitted through mosquito bites or by sharing a meal with an infected person. More significantly, only 46.8 per cent in the entire country were aware of the two important methods of prevention of transmission i.e. consistent condom use and sexual relationships with faithful and uninfected partners. Not surprisingly condom use with non-regular partners was inadequate. A third of males (33.6 per cent) and a fourth of females (26.6 per cent) reported consistent use of condoms in sex with non-regular partners in a 12-month recall period. Overall, among the 3575 males reporting such sex, 51.2 per cent reported using condoms during the last sexual encounter with their non-regular partners as against 39.8 per cent among 715 females reporting such sex.

It should be clear that wrong knowledge of transmission possibilities would spillover in the form of practices that stigmatise and socially exclude those known to be infected. Besides the unacceptability of such exclusion in itself, which therefore needs to be remedied, exclusion also adversely affects reporting and detection of the disease. Increased awareness therefore not only directly helps prevent spread of the disease but does so indirectly as well.

It was for these reasons that the United Nations General Assembly's Declaration of Commitment on HIV/AIDS identified four areas for action: (i) prevention of new infections; (ii) provision of improved care and services for those infected and affected by HIV/AIDS; (iii) reduction of vulnerability, especially among groups which have high or increasing rates of infection; and (iv) mitigation of the social and economic impact of HIV/AIDS.

ICTs can be used to further goals in these areas in a number of ways:

1. They can be used as a tool for advocacy, awareness raising, and education aimed at prevention of transmission of the disease. There are many features of the technology that make it most suitable for the purpose: it is low cost, it allows for information to be made available from global and local sources and it can be interactive while allowing for the anonymity of the user.

2. They can be used as a means for information provision and networking aimed at empowering stakeholders and encouraging consultations on policy formulation. They can also support the sharing of information among medical practitioners and researchers working in the area.

3. They can be used both for monitoring the HIV/AIDS situation in the country as well as the efficacy of policies aimed at limiting the spread of disease. With regard to the latter, by allowing for the placement of vital information in the public domain they can encourage transparency, track financial commitments and hold governments accountable.

4. They can be used as a means of building communities of those affected by HIV/AIDS and can serve as an online source of mutual support.

An obvious example of the use of ICT for such purposes is the website of the National Aids Control Organisation which provides information on the current status of HIV/AIDS infections in the country with a monthly update, reports on behavioural surveys being conducted by NACO and provides access to medical information online.

There are other organisations working in the HIV/AIDS area which have taken to ICTs as a means of communication. Samuha, for example, is an

organisation that has been working since 1989 among the poor in the state of Karnataka, with a range of activities in its portfolio. One of its arms is Samraksha, which focuses on counselling, care and support of HIV/AIDS victims. The organisation has a network of five outreach sites for counselling, six outpatient clinics, two 10-bedded Respite Homes, and community-based home care and hospital support services. Over the last year Samuha has set up Samuha Communications to combine fieldwork with information documentation and dissemination on the grounds that any work that requires long-term attitudinal changes, such as HIV/AIDS prevention, has to reach out to a wider number of people, and that most development organisations are not equipped to take on the additional task of communicating their findings and experiences.

One pilot project aims at using ICTs and GIS technology for a networked HIV/AIDS intervention and awareness programme in Devadurga taluka of Koppal district in North Karnataka. Networked intervention cells ensure that the team responsible for setting up a district resource cell will also serve as an interface with the local community. The project will use macro-social feedback from a GIS mapping of HIV/AIDS afflicted communities in these areas, which will be executed in collaboration with the Centre for Knowledge Societies in Bangalore.

A similar effort is being undertaken by Saathii (Solidarity and Action Against the HIV Infection in India), which has offices in the US and in Chennai, Tamil Nadu. SAATHII is a non-profit organization established to provide a platform for dialogue among health care providers, policy makers, educators, volunteers and people living with HIV/AIDS, leading to formation of a collective voice in the fight against the HIV infection in India. SAATHII's key activities include information dissemination, networking, capacity building, training, advocacy, and program and policy development. SAATHII works closely with Non-governmental organizations (NGOs)/Community-based organizations (CBOs), people living with HIV/AIDS, the Indian government, Indian academia, and international organizations. It serves clinicians, scientists, activists, people living with HIV/AIDS, artists, social workers, nutritionists, lawyers, public health professionals, educators and volunteers working on HIV/AIDS prevention and treatment issues in India.

The organisation has the following declared objectives:

1. To serve as an electronic clearing house for dissemination of research, advocacy, education, funding and training information relevant to the fight against HIV infection in India.
2. To provide physical, social, and political space to exchange ideas, network, and plan for coordinated advocacy in the fight against HIV infection in India.
3. To facilitate daily exchange of information on HIV/AIDS issues with colleagues working in/for India.
4. To advocate for additional funding and technical resources for the fight against HIV infection in India.
5. To raise awareness about HIV-issues among Indians and others residing outside of India and within India.
6. To develop training programs on research methodology, NGO management, grant writing, and clinical management of HIV/AIDS.

Saathii seeks to disseminate research, training and funding-related information on a real-time basis to those with limited access to libraries and the internet. It publishes a weekly/daily electronic newsletter providing information on current research advances in behavioural, basic science and clinical aspects of HIV/AIDS that are relevant to resource-limited settings, updates on HIV-related national and international conferences, national and international training and funding announcements that are relevant to India and news items and letters that merit political action. It also collaborates with AIDS-India e-forum to disseminate India-relevant information on a daily basis and seeks to facilitate active discussions on current HIV events relevant to India, and sharing of information on various programmes, individuals and experiences. The AIDS-India e-forum is a

virtual organization set up as a yahoo e-group in response to the AIDS crisis in India. It facilitates networking, communication and collaboration among those of who are involved or interested in AIDS related issues in India. It has more than 1700 registered members, and is currently extremely active with 4 or more messages/ responses circulated every day.

It also collaborates with the John Lloyd Foundation, and Sahaya International, Rural Education and Action Development (READ), and Positive Women Network of South India (PWN+), to collect comprehensive information on all HIV/AIDS-related services (including prevention and care) in all the states and union territories of India. Upon completion of the mapping, the resource directory will be disseminated to the organisations by regular mail and will be available in a searchable data-base format on www.saathii.org and other web sites. These services will also be networked by state and type of service through a common channel of electronic communication across the country. This resource directory will assist people living with HIV to access health care in their geographical region, enable them to make an informed choice about their care providers, will assist general population in having easy access to HIV prevention information, will facilitate in building partnerships among different NGOs/ CBOs and will help international donors and collaborators in identifying promising programs.

The Saathii website is crucial to these activities. It includes information on the list and expertise of various government and non-government, Indian and international agencies working on HIV/ AIDS-related issues in India; updates on research relevant to India; funding resources; guidelines for writing grant proposals for western/Indian funding agencies; Indian government/NACO's (National AIDS Control Organization, India) guidelines for prevention and treatment; UNAIDS/WHO guidelines for prevention and treatment; mentors/ collaborators within and outside of India; and links to active e-mail discussion groups and other relevant information.

Besides, information technology, digital broadcasting is also being experimented with in the campaign against AIDS. The UNDP's equal access digital broadcast initiative is based on the premise that the internet is not always a viable or an appropriate technology for mass dissemination, particularly as it is limited in its ability to reach areas with little or no telephony or power infrastructure. Alternative technologies, like community radio and satellite based audio and multimedia, are seen as more effective as they provide wireless access, are inexpensive, readily available and are inclusive of the rich oral traditions of many rural communities.

The initiative recognises that ICTs are merely an enabling tool, the effectiveness of which depends largely upon engaging the talents and skills of the communities being served. Collaborative, bottom-up approaches that place the needs, abilities and voices of local community members at the centre, are critical for successful integration and maximum utility of ICTs.

The first phase of the DBI is operative in Nepal with over 400 community-based sites. Engaging audio programming, including a locally produced 120 episode 70 week soap opera/magazine format audio series ("Kura Khasra Mitha"/"Let's Talk Straight") will be broadcast daily (in Nepali) on the Equal Access Asia Development Channel. Content has been created by a consortium of development specialists, Nepalese media and community-based organizations. Active listening and discussion groups at each site will receive this content direct from the satellite via low-cost, portable receivers. This programming will assist communities in dealing with HIV/AIDS prevention, women's and girls' empowerment, violence against women and related development issues. Expanded content topics will cover: Microenterprise formation, sustainable livelihoods, nutrition, literacy, and the environment. Programming will also be re-broadcast through local community radio stations and Radio Nepal with a combined audience reach of 18 million (over 80 per cent of the Nepalese population). As part of Phase I of the project equipment is to be deployed in three other countries, including India and two Southeast Asian countries, for the same purpose.

A crucial input into the task of meeting the challenge set by the HIV/AIDS pandemic is the provision of timely and credible information from an array of development sectors to not just clinicians and medical scientists, but also behavioural specialists, policymakers, donors, activists, industry leaders, and affected individuals and communities. Unfortunately, many affected communities are poor and they and those who work among them have limited or no access to appropriate communications networks, Yet the evidence suggests that many working in HIV/AIDS in poor countries are already benefiting from the internet and e-networking. Information and communication technologies are facilitating South-South/South-North knowledge sharing, increasing the number of people involved in HIV/AIDS policy dialogue, promoting partnerships and networking, improving access to and quality of information, and increasing accountability and transparency in decision-making. This not only demonstrates how ICTs can play a role in dealing with HIV/AIDS but also points to the need to build the content and infrastructure need to use this potent tool in the overall battle against the epidemic.

Improving the environment

Advances in the area of health are closely related to ensuring improved environmental conditions, which is a human development objective in itself. Poor countries aspiring to rapid development that increases productivity and per capita incomes face today a problem that was ignored during the early phases of capitalist development, which saw the rise to economic dominance of the present-day developed countries. They need to realise such growth without affecting the environment in a way that damages the ability of others to improve their quality of life either today or in the future. This is not merely because the consciousness of the need for a better environment has increased. It is because it is increasingly clear that if not growth itself would not be sustainable.

Thus a protected environment is crucial from two points of view: it is necessary for improved well being; it is needed to render growth and development sustainable. As has been argued repeatedly, polluted air and water increase the prevalence of disease; soil degradation and depletion of aquifers affect agricultural productivity; diminishing forest cover and destabilisation of eco-systems can in the long run result in landslides, flooding and drought; indiscriminate use of non-renewable resources generate direct obstacles to development; and industrial and household emissions contribute to the problems associated with global warming.

A central environmental issue in India with major public health ramifications is that of the twin, related problems of safe water and sanitation. While organic and bacterial contamination of water can occur through many routes, inadequate sewage treatment facilities and improper disposal of industrial effluents constitute the principal sources of contamination. There are large flows of untreated municipal sewage and industrial effluents into the main water bodies, which monitoring and regulation by the Central Pollution Control Board has not been able to arrest. According to the National Human Development Report, since only 25 per cent of Class I cities and 10 per cent of smaller towns have base water collection, treatment and disposal facilities, not more than 20 per cent of waste water in Class I cities and 2 per cent in Class II cities is treated. We must recall that while official statistics claim that 90 per cent of the population in urban areas has access to safe drinking water, only 49 per cent has access to proper sanitation facilities, which results in the fact that the threat of continued and increasing contamination is real. Further, while there are some instances of state and community action against the release of untreated effluents, a large number of industrial units in the country gets by without adequate investment in the proper treatment and disposal of effluents. Much more effort is therefore needed to: (i) monitor and quickly collate and transmit information on pollution; (ii) strengthen the infrastructure required for ensuring safe water quality; and (iii) enforce regulations with regard to industrial pollution with the use of an appropriate system of incentives and penalties.

The situation is similar, with air pollution resulting from suspended particulate matter and gaseous pollutants. These too come from improper

practices or lack of proper practices on the part of individuals/households, commercial enterprises and the government. Examples of these are the use of unprocessed cooking and heating fuels, the burning of fossil fuels in industry and thermal power plants with inadequate safeguards and the release of pollutants by old and badly maintained motor vehicles.

An important component of a sustainable environment is the forest cover in the country. After a period of substantial deforestation, which still continues in some areas, around a fifth of the land in India is under forest cover and has been so for the last two decades. It is estimated that dense forest cover has stabilized at around 36 million hectares. The National Forest Policy of 1998 called for raising the proportion of land under forest cover to one-third and for some time now this is sought to be done through a Joint Forest Management Programme, which seeks to ensure environmental sustainability for the population in participation with them. The programme involves a nation-wide attempt to conserve and regenerate forest resources through decentralised village-level Joint Forest Management Committees (usually with one representative from each household) which set aside areas to be developed as forest, prohibiting any encroachment, including for minor fuel wood collection (which still remains the dominant source of cooking fuel across rural India).

What role can ICTs play in the effort to *monitor* and *reverse* the trends of deteriorating air and water quality, prevent further deforestation and increase the area under forest cover? It could improve the devices to measure, record, collate and transmit information on water and air pollution needed to decide on the necessary action. It could use remote sensing and GIS mapping techniques to monitor the state of forest cover. It could help educate individuals/households, commercial enterprises and agencies of the State regarding the best practices to be adopted to keep down pollution. It could support networks of organizations, communities and agencies involved in improving the environment and ensuring sustainability, by allowing for easy and fast sharing of information, facilitating advocacy work and providing an instrument for mobilisation of public opinion.

10. In Conclusion

From our assessment of the challenges and opportunities that ICTs offer for development, it should be clear that this is an area where partnership is inevitable. The overall project requires combining the appropriate technology with capital intensive infrastructure and the knowledge and experience required to deal with development challenges at village, block, district, state and national levels. It must therefore draw on the strengths of government, civil society, the private sector, technologists, development theorists and practitioners and the international development community (including donors and international civil society organizations).

The role of the national government is indeed central. In India, as in most developing countries, much of the telecommunications infrastructure created in the early post-World War II years was in the public sector. Thus the State has a major role to play in ensuring better and wider connectivity, even if it is the case that the high costs of extending that infrastructure in a large country like India requires public-private partnerships to finance and manage the venture. But even here, given the fact that very often private incentives are not the best signals for creating the infrastructural base for putting ICTs to use for development, State regulation of the partnership is quite crucial. The need for a universal service obligation for private licensees for provision of telecommunications services and the difficulties of ensuring compliance with that obligation illustrates the role that the government would be called upon to play.

But the government's role does not end with being a facilitator of the process through the provision of the necessary infrastructural base and the appropriate regulatory environment. In practice, the government is and will remain the most important actor in the field of human development. Large scale projects at the national and state levels for employment, food distribution, education, health and environmental protection are best undertaken by the government, its deficiencies notwithstanding. Thus, in substantial measure, the government has a major role to play in inducting ICT for developmental processes. This it does in many ways: by using ICTs as tools for e-governance that increases participation, transparency and efficiency, by using ICTs as instrumentalities in the implementation of development projects and by using ICTs as means of service delivery.

However, government alone cannot ensure that ICTs play their designated role in development. To start with, the effort of developing the appropriate technology and innovation aimed at reducing the costs of that technology is most often best undertaken by individuals, autonomous institutions, private firms and civil society organizations, that have the requisite knowledge and the flexibility to ensure success. Partnerships between these entities and the government which serves as facilitator and financier and international organizations that provide technological and financial support for the process would be necessary to accelerate the process of technology development. The TeNet experience discussed earlier is an instance of such partnership.

Secondly, even assuming cheaper technology becomes available, ensuring the connectivity that allows for the potential of hardware and software innovations to be exploited requires substantial effort and investment. Since the state can access only a part of the national/social surplus within the country's mixed economy framework, it

would be hard put to finance the outlay in full, necessitating private participation and a public-private sector partnership. That partnership lies not just in sharing costs, but in the state taking up necessary coordination and regulatory functions. The capital intensive nature of the industry makes it prone to market failure of different kinds, requiring a strong regulatory presence of the State. Atomistic decision making can and does result in unnecessary duplication of expensive infrastructure, which given resource constraints may not be optimal. Further, profit considerations would prevent network expansion into less densely populated, poor and remote areas. This not only goes against any commitment to provide universal connectivity and service, but inasmuch as connectivity and development are related, it reinforces differentials in the spread of development in the first place. To add, in the final analysis the benefits of a network is directly related to its size. Failure to expand the network reduces consumer benefits and therefore profitability in the long run. This and other factors also lead to oligopolisation of the industry. Thus a broad-based public-private partnership is indeed crucial.

Developing technology and ensuing connectivity does not exhaust the requirements for use of ICTs in development. It requires working out the points at which ICT use can facilitate and advance the development agenda and designing special projects to exploit the technology for development purposes. This defines the third area of partnership. The state is not the only actor in the development arena. Civil society organisations have played and do play a major role in development and have the knowledge, the experience and the grass-roots organisation required to induct ICTs into existing projects and design projects aimed at utilising ICTs in innovative ways. Private firms have entered the area with the growing recognition of the need for corporate social responsibility and are well placed to experiment with the utilisation of ICTs as illustrated by the activities of Datamation, for example. And international donors and NGOs, with their long track record in supporting development activities, collating international experiences and scaling up small experiments, cannot but be involved in this emerging area.

Thus a range of domestic and international partnerships (public-private, government-CSOs, and private sector-CSOs) are both inevitable and necessary in the area in keeping with the goal of promoting such partnership incorporated in the Millennium Declaration. From a policy point of view, it is crucial that each of the actors consciously seek to build such partnerships, since this would help both coordinate micro-experiments and scale them up in order to realise the full benefits of the technology.

It needs to be mentioned here that use of the technology itself generates partnerships that have larger implications for development. These are partnerships which by sharing information, views and experiences generates discussion, all undertaken with the help of the technology, which helps arrive at international positions, standards and mechanisms on development in general and the use of ICT for development in particular. Further, by helping mobilise a constituency for these democratically derived positions, standards and mechanisms it creates international pressures on different actors – governments, CSOs and the private sector - to adopt them. These positions relate not just to the use of ICT for development per se, but to macroeconomic issues such as debt reduction, capital controls, fiscal and monetary policy and sustainable development, to name a few areas. Inasmuch as they constitute means of advancing development, the partnerships generated by use of the technology become a strong instrument of advocacy for advancing the agenda.

This study has examined the ways in which ICTs can be used in India to realise the stated, time-bound goals set by the United Nation's Millennium Declaration in different sectors, the constraints to using ICTs as an instrumentality for the purpose and the dangers involved in any excessive emphasis on ICTs as means to realising the MDGs. It examines the many routes through which ICT's impact on human development is expected to occur, once access to the technology is provided to the people, independent of their social and economic standing, and to decision-makers

concerned with furthering human development goals.

It emerges that while there are indeed many experiments under way in India that seek to use information and communications technology to improve the quality of life of the disadvantaged, there are also many constraints to realising the presumed potential uses of ICT for development. The primary and most important constraint is ensuring the diffusion of the technology. Crucial to such diffusion, through which the full human development potential of the technology is realised, is connectivity. Unfortunately, India's communications infrastructure is still limited in size and spread, and though it is witnessing rapid growth in recent times, that growth is much less than warranted. Hence, efforts to widen the spread of the communications infrastructure and increasing access to the technology are central to the ICT for development effort. This makes the many experiments geared to reducing the costs of connectivity, to making cheaper the hardware necessary to exploit that connectivity and to increasing the availability and reducing the prices of software in the Indian languages central to the ICT for human development project.

Further, a conscious choice of open-source software in ICT for development projects would be necessary to keep initial and subsequent upgradation costs down. While there are indications that some organisations and some state governments (as in Madhya Pradesh) have begun action in this area, a more concerted effort is called for. One difficulty is that excessive concern with sustaining India's success on the software services export front has resulted in policy being biased towards facilitating and encouraging those exploiting IT for profit as opposed to those exploiting ICT for development. That is, despite recognition of the importance of ICT for development, there is a tendency to view ICT policy from the point of view of the "seller" as opposed to the point of view of the "user". Redressing this imbalance may be crucial for directing ICT policy towards facilitating and encouraging the use of the technology for development purposes.

While the use of the new technology is indeed still extremely limited in India, and diffusion of the benefits of IT that can make a difference to the quality of life must wait, there are signs of change. Besides being intensively used among a set of top-end users, the technology does seem to be in the process of diffusion among a set of lower-end, low-frequency users. This dual nature of the diffusion of the technology suggests that there are two routes through which the technology can impact on the quality of life. Elite users, who use the technology to share information and analysis in crucial areas such as the environment, health, corporate practices and labour conditions, can debate, develop and contribute to creating international best-practice standards in the relevant area, which provide the basis for national policy and for mobilisation of public opinion nationally and internationally to change policy regimes. This would be the top-down, trickle-down means for the technology to influence human development.

The other would be for the technology to be diffused leading to use by and participation of the disadvantaged in the formulation and implementation of policies as well to the direct provision of improved services that affect the quality of their lives. This is the more democratic face of the technology and the best manner in which it can be used to advance human development goals. Unfortunately, the current extent and pattern of diffusion of the technology in the country is such that it is the first of these which overwhelmingly predominates and is likely to continue to do so in the foreseeable future.

The use of ICT for development with the aim of realising the MDGs, is constrained in part by the socio-economic context itself. Two features of that context are of particular importance: (i) evidence of deceleration in growth, after an initial spurt in the immediate post reform years; and (ii) evidence that even the growth that is occurring is having little impact on employment growth, especially in the commodity-producing sectors, viz. agriculture and industry. These tendencies are surprising since the evidence on the huge stocks of food grains with the government, the massive build up of

foreign exchange reserves and the persistence of unutilised capacity in industry suggest that the Indian economy is demand and not supply constrained. If therefore, food stocks are used to launch a massive food-for-work programme directed at building rural assets and infrastructure, this would not only result in higher output growth but also in employment growth. Unfortunately, an excessive concern with curbing the fiscal deficit, at a time when the tax-GDP ratio is falling, has resulted in the government foregoing the opportunity. Unless this tendency is reversed, the supportive economic environment needed to exploit the benefits of ICTs will not be realised.

The persistence of widespread poverty and hunger are among the principal disappointments with the post-Independence development experience in India. A reading of the available literature on the incidence, determinants and routes to alleviation of poverty suggests that poverty reduction is predicated on (i) a relatively egalitarian path of growth; (ii) increases in agricultural productivity that help raise wages and keep food prices under control; (iii) expansion of non-agricultural employment, including in rural areas; and (iv) direct public action in the form of poverty eradication programmes aimed at generating productive employment for the poor.

ICT's direct contribution to poverty reduction can come either through the employment generating effects of ICT diffusion into poor rural and urban areas or through its effects on enhancing returns from economic activities undertaken by poorer households. Its indirect contribution can come through facilitating and reducing the costs of delivery of services that either promote wage- and self employment or help overcome structural constraints to the realisation of the poverty alleviation effects of particular projects; and through improving the quality of delivery of employment generating and poverty alleviating projects being implemented by the government.

There are, indeed, reasons to believe that by facilitating decentralised and (entrepreneur-wise) distributed or diffused growth, the technology can bundle income increases with reduced inequality that can have poverty alleviating consequences. Further, as mentioned earlier, besides increased wage employment at higher wage rates in the agricultural sector, an expansion of non-agricultural employment is crucial to reducing poverty even in rural areas. The effort to use ICTs in poverty alleviation must thus focus on the new opportunities for micro-entrepreneurship that information technology offers.

If costs of diffusion are reduced there is a strong possibility of an increase in opportunities for wage employment and micro-entrepreneurship in new areas opened up by the technology. An example of such opportunities is offered by the model computer project Gyandoot in the state of Madhya Pradesh, which is revenue generating and is expected to become independent of state funding.

Experiments are on to provide computer access at the village level, which facilitates not merely extension services on technical matters relating to best agricultural practices or combating pest attacks, but also provides ready access to information on market conditions, opportunities and prices that allow small farmers to maximise incomes from their output. This could help raise the magnitude and reduce the vulnerability of returns earned by small producers from their economic activities.

The direct effects of ICTs on poverty reduction can also come through a reorganisation of economic activity that allows producers increase their returns. A striking case of such effects is the introduction of ICT devices into the management of operations of the National Dairy Development Board in Gujarat.

Besides the direct contribution that ICT can make to alleviating poverty, it can contribute indirectly in two ways: (i) by facilitating and reducing the costs of delivery of services that either promote wage- and self employment or help overcome structural constraints to the realisation of poverty alleviation effects of particular projects as in the case of the SKS smart cards project; and (ii) improving the quality of delivery of employment generating and poverty alleviating projects being implemented by the government by smoothing

the process of delivery and by improving the monitoring of both the delivery and effects of the project through e-governance, as is partly true of the many e-governance initiatives being implemented by the state governments.

India's record on the educational advancement front after five and a half decades of independence is indeed poor. The slow rates of improvement in literacy and education for both men and women remain major failures of the Indian development process. Given the low level of literacy, the justification for the effort and the investment being made to extend the reach of computers across the country and provide access to all is indeed weakened. Similarly, India's record on the education front while indicating progress, shows that much remains to be done.

Can ICTs make a difference here? When assessing the way in which ICTs are being used in education, it is necessary to assess whether it strengthens the quality of the institutional system, or serves as a partial "quick-fix" for problems created by the lack of adequate resources and is more in the direction of replicating solutions of the kind represented by the tendencies towards "teacher-category proliferation" and "pluralisation" discussed above. Though there are a number of initiatives which are located within the formal institutional framework of schooling, there are others where computer-literacy and computer-based training is being experimented with as a means of circumventing the lack of access to formal schooling for a significant proportion of India's children. A degree of caution in this area is definitely called for. If ICT use is not to aggravate the tendency to downplay the importance of formal schooling, emphasis must be on integrating it into formal school education. But here again, unless adequate spread can be ensured, we could see a widening of the digital divide.

Further, policy makers should be conscious of a real dilemma. Not investing in ICT for education is to forego what happens to be the leading opportunity in modern economies. But excessive emphasis on IT could result in the diversion of resources away from the much more crucial expenditures on literacy and primary education, which are not just development goals in themselves but a must if the digital divide is not to widen rapidly.

In the area of redressing gender equities and empowering women there is a range of ways in which ICTs can and are being used. What is encouraging about these experiments is that they do provide indications of the direction in which we need to move to scale up these activities so that the outcomes can make a real difference from the point of view of the human development agenda embodied in the Millennium Development Goals. The lessons from micro-level initiatives indicate some directions for moving towards greater access for women. Crucial among these are capacity-building for women and sensitive design of projects based on women's needs. The involvement of non-government organisations working with women, can help build a gender-sensitive ICT for Development discourse and practice.

As a highly information intensive industry, virtually every area of health care management and delivery is potentially capable of being supported to some degree by modern information management technologies. Health care information technology is now established as being capable of reducing the cost and/or increasing the quality of care delivery. Unfortunately, this is an area where through the use of ICTs in modern, institutionalised health care management, the existing divide is in part being aggravated, inasmuch as those facilities neither cater to the predominant health problems of the poor nor are those facilities accessible to the poor.

However, there are some experiments in which ICTs have been mobilised for public health purposes. Further, even though at present telemedicine is primarily an experiment which reaches the better off, it does have potential to reach advanced diagnostics and health advice to the poor in remote areas. It is necessary for those involved in using ICTs in the health area to keep in mind the possibility that the prime targets of the ICT for development exercise may not be the actual beneficiaries.

Given the tasks of information dissemination and advocacy in the HIV/AIDS area the role that ICTs can play is obvious. ICTs can be used to further goals in these areas in a number of ways: (i) They can be used as tools for advocacy, awareness raising, and education aimed at prevention of transmission of the disease; (ii) they can be used as means for information provision and networking aimed at empowering stakeholders and encouraging consultations on policy formulation; (iii) they can support the sharing of information among medical practitioners and researchers working in the area; (iv) they can be used both for monitoring the HIV/AIDS situation in the country as well as the efficacy of policies aimed at limiting the spread of disease; (v) they can be used as means of building communities of those affected by HIV/AIDS and can serve as an online source of mutual support.

ICTs also have an important role to play in the effort to *monitor* and *reverse* the trends of deteriorating air and water quality, prevent further deforestation and increase the area under forest cover. They could improve the devices to measure, record, collate and transmit information on water and air pollution need to decide on the necessary action. They could use remote sensing and GIS mapping techniques to monitor the state of forest cover. They could help educate individuals/households, commercial enterprises and agencies of the state regarding the best practices to be adopted to keep down pollution. They could support networks of organisations, communities and agencies involved in improving the environment and ensuring sustainability, by allowing for easy and fast sharing of information, facilitating advocacy work and providing an instrument for mobilisation of public opinion.

There are a few over-arching lessons that are being derived from the experiments with using ICT for development. It appears that ICT applications developed by or in collaboration with those directly involved in implementing development projects are more likely to suit local conditions and to be sustainable. Top-down approaches, by contrast, have been found to be less successful or downright failures. Further, given illiteracy and the language barrier applications must be available in local languages and, to the extent possible, be visually oriented and use voice interfaces. Finally, as the MSSRF experiment suggests content provided through information and communications technology should not be limited to knowledge from outside sources, but should draw on knowledge from the local community as well as be influenced by the felt needs of the beneficiaries, especially the poor.

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