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ICTs and health

The potential and the constraints in low income countries

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This paper outlines the potential offered by technological progress in the information and communication technologies (ICTs) industries for the health sector in developing countries, presents some examples of positive experiences in India, and considers the difficulties in achieving this potential. The development of ICTs can bring about improvements in health in developing countries in at

Developments in information and communication technologies (ICTs) during the last quarter of the 20th century heralded an information age in which economic and social activity has been widened, deepened and transformed. The more optimistic projections suggest that a computerized and networked world would not only ensure a more widespread and rapid growth of employment, productivity and output, but would also improve access to facilities that enhance the quality of life. In this article we consider some of the technological changes which could affect health conditions in developing countries. We focus on some experiences of using ICTs in the health sector in India which indicate how the potential of ICTs can be exploited in developing countries. We also consider the constraints on the realization of such potential.

The conceptual framework of this paper is based on the notion that ICTs can affect health conditions in poor countries both directly and indirectly. It can work directly by improving health care provision and disease prevention. It also works indirectly on the health status of the population through its effects on the broader determinants of health, such as growth, the economic position of households, and the social infrastructure (1). The effect of ICTs on health differs from its impact on other sectors in crucial ways. Achieving some of the benefits of ICTs requires that health workers are reached and not necessarily the final beneficiaries, thus, the cost of a given quantum of effect is reduced. In that respect, it does indeed hold out a great deal of promise. However, such promise is limited by a number of features which are common

to most poor developing countries. These include large gaps in basic infrastructure availability, and the ability and willingness of health workers and others to make use of the opportunities that are being offered.

Developments in ICTs

At the core of the perceived opportunity offered by ICTs lies the dramatic increase in computing power ensured by the emergence and rapid evolution of microprocessor technology. In the three decades since 1971, the number of transistors on a chip has increased from 2300 on the 4004 to 42 million on the Pentium 4 processor and the cost per Mhz of computing power has fallen from US$ 760 in 1970 to 17 cents in 1999 (2). This has helped personal computer (PC) makers and those incorporating computer chips into their products to deliver far more powerful systems at the same or reduced prices.

The growth in computing power has triggered the development of digital devices that can exploit such power, as well as of peripherals which extend its capability. These devices acquire, record, organize, retrieve, display, manipulate and disseminate information. Here, too, technological change has reduced costs substantially. The cost of a megabyte of storage has fallen from US$ 5257 in 1970 to 17 cents in 1999.

The power that this offers is considerably enhanced by the growing possibility of linking computing devices and allowing them to communicate with each other on the basis of a 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 US$ 150 000 to 12 cents over the last three decades (3). This can facilitate the distribution of the benefits flowing from computing power, at low cost, to a large target population.

A range of organizational and institutional developments associated with these technological changes has altered not only patterns of production and distribution of goods, but also, even more significantly, patterns of services. The possibility of geographical separation of the service provider and the final consumer has opened up a whole new range of business opportunities and means that the nature of delivery of many basic services such as health can be transformed.

The potential contribution of ICTs to health services

The expectations that ICTs generate for health improvement in developing countries stem from three sources. The first is their role as an instrument for continuing education and lifelong learning that will enable doctors in developing countries to be informed about and trained in the use of advances in knowledge. The second is their use as a delivery mechanism to poor and remote locations of a wide variety of services varying from improved public health education to emergency advice, including advice on dealing with and mitigating the consequences of natural

disasters. The third source is their potential use as a mechanism to increase the transparency and efficiency of governance which would, in turn, improve the available and delivery of publicly provided health services.

Conceptually, this implies that the potential of ICTs in the health area lies in their mediatory role between differentially endowed segments of the health system and between the health system, the health service provider and the beneficiary. In this role they promise to be a much better medium for delivering specific health services and of serving as a tool that can help reorganize the health system and render it more efficient. However, given their mediatory role, the actual impact of ICTs on health depends not merely on the willingness of health administrators to adopt ICTs as a tool, but on the spread of, and access to, a network of ICTs among different segments of the health system.

Thus, it is possible that the opportunity offered by ICTs in the abstract may not be relevant in practice. A typical example of the use of ICTs for advancing health status is the still nascent field of telemedicine, which undertakes to deliver the best medical advice and treatment to patients irrespective of their location (4). Besides advice based on standardized symptoms, work is in progress on ways of delivering higher-end medical care via satellite to remote rural sites or in response to disasters, for example, earthquakes. The major constraints are the access to and cost of the higher band width that is required for transmitting physiological data and complex medical images. These constraints are more severe in developing countries where even telephone-line-based access is limited and broadband access is either not available across a wide enough geographical and social space, or is far too expensive to provide to the critical mass necessary for making an impact.

Most experiments using ICTs in health service delivery and health status management have taken place in developed country contexts. Experiments with information technology (IT) to improve diagnosis and reduce the cost of Medicare suggest that almost all primary care could be provided by "physician extenders" assisted by computer-driven diagnostic tools and support systems (5). If implemented, this could reduce developed country health care costs substantially, but it is of no immediate relevance to countries where the problem is not the high cost but inadequate service provision.

However, the results of some experiments suggest that electronic health care can be useful even in developing country environments. One such example is the Indian Healthcare Project which was begun in 1994 as a collaborative project between the Government of India, Apple Computers and CMC, in the state of Rajasthan (6). It targeted the auxiliary nurse midwives (ANMs) who were the health care workers responsible for 5000 people distributed over several villages. Each ANM was expected to call on every household in her charge once a month to collect demographic data, administer immunization facilities, and provide counselling on family and child welfare and mother–child health programmes.

The project combined an IT device — the personal digital assistant (PDA)—and support tools intended to reduce the time ANMs spent doing paperwork, increase the accuracy of the data collated and supplied by ANMs, ensure the availability of village level health care data in an electronic form, and provide ANMs with information that would help them to improve the effectiveness of the services. The pilot project team designed a system based on the Newton hand-held computing platform and, at the end of the research phase, the results were passed to CMC for further development. Although Apple has dropped the Newton from its profile of products, and the subsequent follow-up has been limited in this case, the availability of new, cheap and extremely powerful PDAs makes it possible to build on the experience gained from the pilot project. This project had to be discontinued because of the lack of availability of Newtons; however, the data are now with CMC and are being used to develop similar applications elsewhere.

Of course, experiments of this kind are of no relevance if the spread of information technology is limited. But efforts are under way to ensure the population at large has access to information technology. A case in point is the disaster management project—developed as part of the Maharashtra Emergency Earthquake Rehabilitation Project — which is being implemented in the State of Maharashtra, India, with the aim of minimizing the adverse effects of natural disasters (7). The project includes a disaster management centre located at the Yashwantrao Chavan Academy of Development Administration, computerized control rooms across the state, a VSAT- and VHF-based communications network and area-specific, geographical information system (GIS)-based, disaster management plans. The system provides critical support to the disaster management functions of the administration. It is designed to 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, identify potential disaster management facilities where needed, and help access international medical and managerial support. Supported by the World Bank, the Department for International Development of the British Government and the United Nations Development Programme, the project is now reportedly complete in all districts across the state. It has important health implications because of the frequency of disasters such as earthquakes and cyclones in the region and their adverse effects in the form of injuries and epidemics. Advance information is critical in reducing fatalities and injuries, as well as in encouraging the systems necessary for epidemic disease control.

The computerization of the Mandal Revenue Offices in the State of Andhra Pradesh provides a similar example. As part of the project, all these offices (totalling 1124), the 78 revenue divisional offices, the 23 collectorates, the office of the commissioner of land revenue and the directorate of economics and statistics at Hyderabad are to be computerized. This involves data collection, development and implementation of appropriate databases and developing human resources through intensive training. The system is located on the Andhra Pradesh Statewide Area Network, which uses a 2MBPS optical fibre link to connect the state secretariat with 23 district headquarters. Here, too, a substantial part of the funding comes 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" (8). Like the project described in the previous example, this one will also help public authorities control the effects of epidemics in postcyclone and post-flood situations.

A more decentralized, village level project aimed at bringing computers to rural and semi-urban areas, is the model "wired village" project being implemented around Warana Nagar in the Kolhapur and Sangli districts of Maharashtra (9). It was designed as a pilot project that would demonstrate the contribution an IT infrastructure can make to the socioeconomic development of a cluster of 70 contiguous villages. The project aimed to provide villagers with agricultural, medical and educational information at facilitation booths in their villages, as well as access to the Internet via the National Informatics Centre Network. It also aimed to make distance education facilities available to both primary and higher educational institutes. The Warana project is being implemented jointly 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), and is being financed jointly by central, state and local governments. Early reports suggest that the project is already making a positive difference in terms of more informed use of facilities at village level primary health centres and a greater awareness among farmers of the implications of cropping practices.

Experiments are also in progress aimed at providing computer access at village level which would facilitate extension services on technical matters relating to best agricultural practices or combating pest attacks, and also provide ready access to information on market conditions, opportunities and prices, and means of combating illnesses and dealing with emergencies. 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 for the purpose of housing two solar-powered computers that are used to give villagers a wealth of data, varying from the price of rice to weather conditions and medical information. Embalam is one of four villages in which the M.S. Swaminathan Foundation is implementing the "information village" project, with a US$ 120 000 grant from the Canadian government (10).

All these projects are still in the pilot phase. But they do demonstrate the potential of ICTs to help improve governance, empower the poor and ensure a better delivery of improved social services (including health services) to India's poor. If successful, these experiments have the potential to markedly improve the health status of the populations involved.

The constraints

Despite these experiments, there is ground for scepticism regarding the realization of the potential of ICTs. Some of the more obvious constraints include the limits on physical access to new technologies, the high cost of providing such access for the less well endowed, and

exclusion from access due to the inadequate capabilities of large sections of the population. These constraints suggest that, rather than help improve social service delivery and address poverty, the ICT revolution could, in turn, generate a new "digital divide".

Of course, the international digital divide between the developed and developing countries is quite obvious. Twenty of the world's largest developing nations contribute only about 27% to the global IT market of US$ 750 billion. Less than 5% of the world's population is participating in the Internet revolution (11).

However, the real threat of a digital divide is within the developing countries themselves. This arises from a number of sources. First, in most developing countries, an overwhelming majority of the population is likely to remain excluded from the benefits of new technologies. Second, even where physical access is available, inadequate education would ensure that most people did not have the same levels of competence or confidence to participate in the transformations in work practices and lifestyles as the urban and rural e´lites. Finally, even as access continues to grow, the rapid changes in ICTs and their use would result in many of those who had had access initially falling behind in their ability to continue to use the benefits of the technologies.

The prospects are disturbing when we begin to examine the figures. Even in a successful IT "power" like India, the penetration of PCs in the period between 1998 and 1999 was only three per thousand and the number of fixed telephone lines to connect to the worldwide web was only 22 per thousand. By then, half the population of the USA had access to PCs and the worldwide average penetration was 60 per thousand in the case of computers and 125 per thousand in the case of telephone lines (12).

Much of even this extremely limited access is concentrated in urban India. Trying to accelerate penetration through schemes like the Warana "wired village" project, which the Government's IT Task Force has recommended should be replicated across India's villages, would of course be impossibly expensive. The Warana project, which connected and computerized a cluster of 70 villages, was estimated to have cost US$ 600 000. To replicate the experiment across India's 550 000 villages could cost as much as US$ 4.7 billion, which amounts to around to 12.5% of India's gross domestic product (GDP) between 1998 and 1999. This may be compared with public expenditure on education and elementary education between 1995 and 1996 of 3.2% and 1.5% of gross national product (GNP), respectively. Even the Indian Government's unimplemented commitment in this area only aims to raise the expenditure on education to 6% of GDP.

The difference in actual expenditure on education and the expenditure required for wiring India's villages is significant when we look at literacy and educational outcomes. Even as late as 1997, data collected by the Indian National Sample Survey Organisation revealed that literacy among the population above seven years of age was just 62%. The literacy requirement is set so low that in most cases being literate would not necessarily equip one for becoming digitally literate. A minimum standard of school education would therefore be a prerequisite. Here the picture is dismal. To quote the Public Report on Basic Education in India (13), "at the time of

the 1991 Census and the National Family Health Survey in 1992, half of the country's population (that is, 61% of women and 36% of men, aged 7 and above) was unable to read and write; less than 30% of all adults had completed eight years of schooling; and one-third of all children aged between six and14 years (about 23 million boys and 36 million girls) were out of school".

What these figures suggest is that building capacity in order to exploit the benefits of ICTs requires investment in schooling and in developing literacy and skills among those beyond school age, since these are the people who would be most immediately affected by the structural transformations generated by IT. This creates a dilemma. Not investing in ICTs is to forego what appears to be the main opportunity for modern economies. But excessive emphasis on IT could result in the diversion of resources away from the much more crucial expenditure on literacy and primary education, which are not just development goals in themselves but prerequisites if the digital divide is not to widen rapidly.

Finally, given its sources, most transactions in the information economy are carried out principally in the English language. This means that much of the software needed for being a digital citizen requires familiarity with English. This implies that non- English speaking countries should invest either in generating software in the vernacular, or in developing English language skills, or both, which further increases the costs of "catching up". A large part of this investment must be undertaken by the state, since the market is unlikely to service these needs.

Policy conclusions

This analysis of the constraints on realizing the potential of ICTs for improving health conditions suggests there is a need for a careful and nuanced approach to the development of ICTs in poor countries. On the one hand, it is true that ICTs offer developing countries an opportunity to introduce many improvements in health service delivery, as well as overall developmental goals which have an impact on health. On the other hand, however, despite its rapid growth, the information technology sector in most developing countries is small and the effect of its growth on the rest of the economy is limited. In addition, there is the prospect of a sharply widening digital divide even within developing economies.

All this makes it difficult for the governments of developing countries to determine their investment priorities. Providing access to new technologies for the overwhelming majority of the population who cannot access them for technological reasons would impose a large financial burden. However, an even more difficult task is that of helping those without IT skills or "connectivity" to develop the competence needed to participate, however marginally, in the emerging digital economy. With indefensibly low levels of literacy and schooling in most developing countries, many people would argue that the first task of governments should be to increase the availability of school education to the whole population.

It is plausible to propose that as a priority this should be placed above the target of providing a minimum degree of access to ICTs to those without either IT skills or "connectivity". However, the nature of the challenge of overcoming backwardness is such that a degree of syncopation is inevitable, necessitating large resources that in part must come from taxing the surpluses being garnered by the rapidly growing and highly profitable IT services sector. This is important in order to avoid both national and international digital divides.

However, the special nature of the interaction between ICTs and the health sector means that specific public investment in ICTs and related projects may yield more than proportionate benefits. Based on the examples from India, it is possible to suggest that use of ICTs in enhancing delivery and providing better information to health service professionals is both viable and important as a means of improving public health conditions in many situations. In this context, it may be more important to focus on educating health professionals in the possible uses of ICTs, and providing them with access and "connectivity", which would in turn spread the benefits to a much wider set of final beneficiaries. Thus, selective investment in the health sector in developing countries, even more than in other sectors, may provide a way of eventually overcoming some of the disadvantages of the digital divide.

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References

1. Evans RG, Barer ML, Marmor TR, eds. Why are some people healthy and others not? The determinants of the health of populations.Berlin, de Gruyter, 1994.

2. http://www.intel.com/pressroom/kits/bios/moore.htm

3. The paradigm: 1999 annual report. Dallas, Texas, Federal Reserve Bank of Dallas, 1999: 8.

4. The online doctor is in. Economist, 22 March 2001.

5. Schulte JS. The future of health-care delivery: computer-assisted diagnosis, computer assisted medicine. Heathcare Financial Management, 2001, 55: 28–29.

6. Reddy NK, Graves M. Electronic support for rural healthcare workers. In: Bhatnagar S, Schware R, eds. Information and communication technology in development: cases from India. New Delhi, Sage Publications, 2000: 35–49.

7. Vatsa KS. Technological challenges of the disaster management plan for the State of Maharashtra. In: Bhatnagar S, Schware R, eds. Information and communication technology in development: cases from India.New Delhi, Sage Publications, 2000: 50–62.

8. Kumar A. Computerisation of MandalRevenue Offices in Andhra Pradesh: integrated certificate application. In: Bhatnagar S, Schware R, eds. Information and communication technology in development: cases from India.New Delhi, Sage Publications, 2000: 105–112.

9. Vijayaditya N. A wired village: the Warana experiment. In: Bhatnagar S, Schware R, eds. Information and communication technology in development: cases from India.New Delhi, Sage Publications, 2000: 132–140.

10. Venugopal K. Computers in farm land. Business Line(Chennai) 2000.

11. Third World contributes 27% to US$ 750 billion IT market. Economic Times(Delhi) 2000.

12. Government of India, Ministry of Information Technology. Annual report 2000.New Delhi, MIT, 2000.

13. The Probe Team. Public report on basic education in India. New Delhi, Oxford University Press, 1999: 9.

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