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Information Technology in Developing Countries

6.1 INTRODUCTION

The Information Technology Revolution that the world is currently witnessing seems to be an urban-centric phenomenon. In India, as in most other developing countries, it is the English-speaking urban elite that has benefited the most from this revolution, with the Personal Computer (PC) as the vehicle. It is in this context that a need has been felt for developing a mass access device to bridge the Digital Divide and thus bring the benefits of Information Technology to the masses.

Many people around the world, including India, wonder whether the greater priority for the masses is should be food, clothing, and shelter, or the Information Technology. When one hears this, one shall be reminded of the famous saying: If you give a man a fish, you feed him for a day; but if you teach him how to fish, you feed him for life. In the context of social development, that is how IT should be viewed - as a tool for accessing information and knowledge, which in turn would help get the food, clothing, and shelter.

Information needs among the masses are many - in addition to agricultural information (relating to fertilizers, seeds, soil, weather, crop patterns, market prices for crops, pest control, etc.), information on health, employment, government developmental schemes, land records, etc., are important needs. For example, armed with the right information,
farmers can make better decisions regarding irrigation, sourcing (of better farm inputs and equipment), marketing (of their produce) and thus improving price recovery by eliminating wasteful intermediation and multiple handling, and aligning of farm outputs to market needs. The resulting growth in rural incomes will also trigger economic growth of the nation in the long run.

However, the challenge is to acquire information securely and on a timely basis, at low cost, personalized, and in the native language of the recipient.

**IT for Bridging the Digital Divide**

So, how could IT be harnessed for information access by the masses, leading to rural and social development? To understand that, we need to carefully look at the attributes that will help take IT to the masses. Among them, simplicity and ease of use, as well as affordability, are probably the most important, followed by independence from (mains) power, multi-lingual capability (and, indeed, usability even among those who are illiterate), and resistance to dust, weather, and rough handling, etc. In the final analysis, though, Information Technology must be meaningful and make an impact on daily life, for education, for communication, for earning a living, and for entertainment. The development of 'Simputer' took all these and other factors into consideration.

**A Unique Device**

The Simputer is a low-cost, portable and mobile computing device for universal access. The Simputer has been developed especially for developing economies. It runs on a two pencil cells (AA battery, which is now usually available even in the remote corners of the world) or an AC adapter, its primary input device is a built-in touch-sensitive Liquid Crystal Display (LCD) panel. Customisable multi-lingual front-end interfaces are an important feature of this device. Several Indian-language interfaces are already available, and interfaces in other regional languages such as Arabic, Chinese, etc., could be easily incorporated.
**A unique device**

A universal text-to-speech (TTS) system with a speech dictionary that is easily customisable for different Indian languages, has been incorporated in the device, in addition to already enabled Kannada, Hindi, and Marathi. The device has multiple connectivity options -- a built-in modem for accessing e-mail and Internet, an infrared port for data transfer to and from infrared-compatible peripherals, and expandability through a USB port. The LCD display has high resolution for ease of displaying different languages as well as pictures.
Local language interfaces

The use of pictorial icons on the touch-screen, coupled with the Simputer's local-language TTS, result in a device that does not limit its use to those who are literate. For instance, an illiterate farmer could touch the picture of a tomato on the Simputer's screen, prompting the device to access information on prices for tomatoes in different markets, and display as well as speak out the information in the farmer's language!

The SmartCard is emerging as a credible delivery vehicle for financial transactions on the Internet and has become an important tool for electronic commerce. The incorporation of a SmartCard Reader/Writer in the Simputer has therefore increased the functionality of the portable device for deployment of a richer set of value-added services wherein user authentication and transaction security are critical. An additional benefit of SmartCards is that forms entry is simplified and lowers the entry barrier for illiterate users, when they need to upload personal information in order to obtain web-based services. Further, the SmartCard also makes the Simputer very affordable, by being used as a shared computing device for a number of users in a local community, such as the village Panchayat (village self-government) or the village school. Thus, even a small shopkeeper could rent the
device out to individuals for a small charge for a usable duration and then pass it on to others in the community. Therefore, via the SmartCard, which stores each user’s individual profile and personal data, the device is personalized for individual use on a changing basis. When this SmartCard is inserted into the Simputer, the user profile and personal data are read from it, and updates, if any, are made during each transaction cycle.

One unique feature of the Simputer is the use of non-volatile memory for all user data, which ensures that the user data are never lost even if the rechargeable battery cannot be recharged because of power outages, which are frequent and long-drawn in the rural areas.

The carefully thought-out features of the Simputer could have an impact on the daily life of the masses in various ways (as follows).

**Education**

While the Simputer's high-resolution screen facilitates quality image and local-language text display, its local-language TTS, coupled with audio and streaming media players make it highly useful for education, especially for literacy training and self-learning. A whole range of educational applications can be developed and deployed on the Simputer for the benefit of the rural student population. It should be possible to create self-learning programs, laboratory experiments, information search engines and other tools that can supplement the school curriculum. It is expected that some of the NGOs will come forward to create suitable program material in this area.
Low-cost tool for education in the Internet age

The Simputer can also be used in schools to allow them to offer Internet access to their students at relatively low cost.

Earning a Living

The Simputer can also be extremely useful in applications such as agriculture produce marketing yard auctions, tobacco auctions, contract farming (for keeping track of the inputs, financing provided to contract farmers, and for tracking the subsequent harvesting and payments to them), etc. Microcredit schemes through self-help groups find it to be an extremely effective tool, owing to its local-language and SmartCard facility and built-in communication capabilities. Likewise, Simputer kiosks owned by local educated
unemployed youth in the villages could be an effective source of income generation by providing e-mail, voice-mail, information access, tele-diagnosis, and other services to the community members.

**Communication**

With its built-in modem and e-mail client, the Simputer makes it easy to send and receive e-mail and voice-mail, and with the built-in browser, to surf the Internet (albeit requiring scrolling and panning in order to view the contents of a web page, since the Simputer's screen is small). For those who are illiterate or can't afford to own a Simputer yet, a local small shopkeeper (perhaps an educated but unemployed youth from the village) could provide the service of preparing the e-mail/voice-mail or reading out the e-mail, much like the postman or letter-writers/readers that are found in India's rural post offices.

**Health**

The manual process of collection of health statistics, that many state governments employ, can be greatly improved by the use of the Simputer, whose interactive form-filling process will help eliminate the tedium of the data-collector and also help increase accuracy of data (owing to elimination of the manual process of transcribing the data from handwritten documents into the back-end computer). Moreover, the built-in modem can facilitate synchronization of the back-end from the remote location(s). The faster availability of more accurate data can help state governments to proactively and reactively provide better healthcare services to the rural populations.

The Simputer can also be used in other health-related applications such as tele-diagnosis, Clinical Decision Support System, patient records-keeping, reading aid for the visually disadvantaged (by adding a low-cost video camera, OCR software, and local-language TTS), etc.

**e-Governance**

The Simputer can be ideal for a wide range of e-Governance applications, owing to the smart-card facility which can ensure its use only by the appropriate government-
authorized official. Whether it is for crop data updation, delivery of land records, ration-shop inventory control, disaster management (with GPS/ GIS (add-ons), resource surveys, tax assessments, issuance of tax demand notices, utility bills, birth and death certificates, property certificates, etc., or a host of other applications, the Simputer can handle them all, and that, too, in the chosen local language(s). Moreover, whenever data are being collected by different data collectors in different languages, the Simputer can transcribe them into one common language for the common database, and transcribe data back into the respective language(s) for dissemination in different regions.

**Micro Banking**

The Simputer can also be an ideal platform for secured and convenient micro banking. At present, several small cooperative banks in the state of Maharashtra (India) are providing services to their rural clients at their doorsteps. They carry around a small portable device with a transaction printer, which enables the client to transact with the bank and obtain a receipt directly. Current models of the "portable" device have several shortcomings. The Simputer provides a much more secure environment, with the help of the SmartCard and simple-to-use encryption software (and its ability to synchronize remotely with the back end). It is expected that the Simputer can increase the level of penetration of micro banking in rural India by truly facilitating anytime, anywhere banking.
A powerful and versatile handheld computer

Helping Information Diffusion

The Simputer is developed as a powerful and versatile handheld computer, whose applications, especially in helping bring the benefits of Information Technology to the masses, and thereby helping rural development, could be limited only by the user's own imagination. It may be viewed as a Community Digital Assistant that lowers transaction cost and time, while increasing efficiency and data accuracy. It can be an effective tool for Panchayat administration and for information access in the rural areas. However, despite its relatively low cost (several models ranging from about US$ 160 to about US$ 600) compared to other devices that lack many of the Simputer's impressive capabilities, it would still be dependent on state and central governments as well as NGOs to take it to its target users. The Simputer is uniquely designed to help bridge the Digital Divide, and it is for these organizations to leverage that capability.

Several such organizations, especially in India, have already started using Simputers in applications that are relevant to social development. Notable among these are rural literacy training and education, micro credit schemes with rural self-help groups, crop
data collection for land records, ration-shop inventory control, health statistics collection, contract farming, auctions at agricultural produce marketing yards, tobacco auctions, etc.

While all these pilots have been under way for some time now, their success is expected to lead to large-scale deployment of Simputers, not just in India, but also in other developing countries around the world soon. The resulting large volumes will also have a beneficial effect on Simputer costing; and that will further help make the Simputer even more appropriate for rural development applications.

Working groups are in any case not widely available in developing countries because of the stiff pricing. Lack of funding can only partly explain this low participation. Often the number of local participants, as in Bangkok has also been handful. Not many from Developing Countries have actually contributed papers for this conference. It cannot be accepted that there are just a few professionals in 40 developing countries who are interested in issues relating to IT and development.

It should be understood the cause of this apathy. Is it possible that the agenda as defined by the articulate membership of the group does not appeal to a large number of professionals from developing countries? Successful implementation is critical and it has more to do with "soft" people issues than technology. But ignoring technology altogether is not going to help us in building bridges with the audience that it wanted to influence.

Suggestions that it should not be discussing technology at all and should focus on non-IT based information systems fail to recognise the fact that developing countries are spending large sums of money on this technology and the focus of the Working Group ought to be on how some development impact can be generated out of this investments. If WG 9.4 becomes a forum for academics without the ability to generate any useful guidelines for the practitioners I believe that the objectives of setting the Working Group would not have been fulfilled.
6.2 THE COMMONWEALTH NETWORK OF INFORMATION (COMNET–T)

1997 saw the first year of COMNET-IT's functioning through a full-time secretariat located in Malta. The following article outlines COMNET-IT's areas of focus and provides an update since its earlier days. A commitment to development through Information and Communication Technologies The Commonwealth Network of Information Technology for Development was established as an independent international foundation in November 1995, with the Commonwealth Secretariat and the Government of Malta as its sponsors.

The Commonwealth Heads of Government Meeting in New Zealand welcomed this development in its final communique. Since then, a fully-functioning secretariat has been set up with the on-going support of the Government of Malta and the Malta Government's agency for information technology, the Malta LT. and Training Services Ltd. This agency and the National Centre for Software Technology in Bombay, India, constitute COMNET-IT's Operational Centres, a prime source of operational skills in the execution of projects.

Promoting the development of a Commonwealth Information Infrastructure. To further its mission COMNET-IT is engaged in a number of primary focus areas, which include:

**Institutional Networking** i.e working with both NGOs and Government agencies for the development of electronic networking and internet-based facilities. The objective here is the transfer of knowledge in a variety of fields concerning socio-economic development

**Activities include** facilitating and breaking the funds and execution of low-level infrastructure projects developing internet-based facilities such as Web-site creation and maintenance, mailing facilities and managed discussion for training in the use and management of networks and the internet.
6.3 COMNET-IT AND THE PUBLIC SERVICE

Public Service Reform is impacted by a number of drillers, including pressures for increased accountability, devolution and decentralisation of functions, improved service-quality, open-government and achieving more with less.

Accompanying these developments are the tremendous advances brought about in the field of I.T. for the harnessing and exploitation of better quality information needed, the opportunities introduced by technological advances have themselves become one of the organisational drivers, popularly known as technology-push. Concepts such as one-stop services, integration of functions, public and business interaction with government over electronic media and data-sharing across agencies are now a feasible reality.

As we proceed along this relatively new ground, however, there is much to be learnt from each other's experiences - both good and bad - and much work that can be avoided by not "re-inventing the wheel". Indeed, whilst the local implementation for any given service area will have its own unique characteristics, there is much similarity at the level of functional requirements and therefore much scope for the sharing of knowledge amongst Commonwealth nations, most of which have a common administrative legacy.

COMNET-IT seeks to exploit these similarities for the more effective utilisation of resources. COMNET-IT activities in the area of IT for the Public Administration are designed to foster capability-building and include: policy-awareness seminars workshops addressing IT-management issues, IT Strategy for the public service and national I.T. strategy technical training for network-management and applications dissemination of a compendium of good practice compilation of a portfolio of software functionality's and products for various public sector areas maintenance of a Commonwealth skills and services directory Development Partnerships are being fostered with a number of agencies, both within and outside the Commonwealth. These include the Commonwealth Association for Public Administration and Management (CAPAM) and the International Council for IT in Administration (ICA).
6.4 COMNET-IT AND ELECTRONIC COMMERCE

Electronic Commerce has captured the increasing attention of government’s world-wide. Even as we grapple with more basic issues, there is a growing realisation that developing countries must leapfrog into the electronic age to ensure that their relative position in the global order maintains at least a status quo and hopefully improves. Concurrently with these developments, there has been an increased appreciation of the contribution of small to medium enterprise (SMEs) to the developing economies.

Using relatively low-cost computing equipment, small firms can now advertise their products globally cheaply and effectively research potential buyers and alternative sources of supply transact securely via electronic means. Whereas international trade has tended to be the domain of the larger and better-organised firms with international affiliations and distribution channels, developments such as the internet and increased trade-liberalisation are re-dressing the balance in favour of smaller firms—indeed in favour of developing economies.

These global trends have instigated a number of initiatives, such as IBCC-NET, an initiative for the promotion of electronic-trade under the aegis of the International Bureau of Chambers of Commerce (Paris), and COMBINET (the Commonwealth Business Network) an initiative of the Export and Industrial Development Division within the Commonwealth Secretariat in London. COMNET-IT Services aim to be a key component in these developments. Through its operational centres in Malta and in India and also in conjunction with in-country agencies, COMNET-IT can apply a range of highly-specialised technical services with extensive experience in secure network management, internet-based applications development and training for local capability-building. To complement its collaborative work with its network partners, COMNET-IT seeks to work with local partners, such as Chambers of Commerce, Trade and Manufacturing Associations, to develop: policy and opportunity awareness events an
internet web-site presence for institutions and their members where none exists training for self-management.

COMNET -IT has been retained by the Commonwealth Secretariat to provide technical-development services in the area of internet-based facilities and related products. COMNET -IT intends to broaden this activity, complementing it with services to local Chambers of Commerce, Manufacturing Associations and their members, where required.

6.5 COMNET-IT AND EDUCATION

COMNET-IT is seeking to develop partnerships for the development of technology-assisted distance learning and the promotion of school-networks. In the latter case, COMNET-IT, together with the Commonwealth of Learning and the Commonwealth Secretariat (Human Resources Development Division) is involved in the promotion of national and pan-Commonwealth School-networks. Announcements and developments in this area are expected to be made shortly and the next issue of this newsletter will carry a feature on this initiative. Working through Partnerships COMNET -IT recognises that information and communication technologies are powerful tools for the development of particular domains, such as Public- Administration, Education and Commerce.

The development of these domains remains the concern of dedicated institutions with whom COMNET -IT is forging close relationships through joint development, education and training. COMNET -IT is also seeking to develop local representation through credible institutions at national or regional level. It is also fostering partnerships and affiliations with similar institutions concerned with the benefits of networking and I.T. application, such as the OECD, the International Council for IT in Administration (ICA), UNECA's Africa Information Society Initiative, UNESCO and the Commonwealth Telecommunications organisation.
6.6 TECHNOLOGY WITH A HUMAN FACE

The global information infrastructure is creating gaps between the rich minority and the poor majority larger and wider than any other socio-economic and cultural phenomena in the history of mankind. IQtel Corporation now expects computer sales to overtake TV set sales in 1999, but the gap in per capita computer availability is widening. Whereas the number of computers per thousand people is 300-500 in countries like USA and Norway, the world average is 36, in India it is 1.1, and sub-Saharan Africa with its 500 million people less than one.

In the North, and possibly some urban centres in the South, much of the thrust and investment will be on home shopping and efficiency gains with relatively minor impact on overall living standards using high-speed, permanent telecommunication structures. In the South, we need information infrastructures to focus on efficiency, competitiveness, sustainability, and democratisation with potentially massive impact on living conditions and it must be done using a telecommunication structure varying from VSAT and fiber optics to manual exchanges, and with educational levels varying from Ph.D. to illiteracy. Information infrastructure and technology is not culturally and socially neutral, it must be adapted to its environment to be useful. All human beings have a right to health, to land and thus food, to influence our common future how we, as informatics professionals, can assist them in harnessing the power of the global information infrastructure is a major challenge.

A range of national and international agencies and research groups have pointed out that reaching and incorporating grass-root communities and local administrative structures both in rural and urban areas remains a huge challenge in all developing countries and particularly in sub-Saharan Africa.

The focus is made on this continent-wide problem: How can grass-root " communities and local administrative structures, representing 70-90% of the population, utilise the rapidly expanding information infrastructures to develop their communities? How can
they, given their historic marginalisation and economic constraints, start to take responsibility for generating and/or maintaining data and information about themselves? A vital aspect indicating the urgency of tackling this problem is the major paradigm changes in African politics. Dominant leaders like Mandela and Museveni are adamant that people must create their own economic and social development, and not rely on handouts from politicians or donors.

The central government role is to provide security, infrastructure, education, and a framework conducive to development. Other economic and social developments are the responsibility of communities, local administrative structures, business, non-Governmental Organisations (NGOs), and individuals. The scenarios advocated by these leaders and political movements are all inherently based on popular access to information infrastructures combined with rapid and flexible responses to changing conditions.

**Multi-Disciplinary Research**

This research will aim at developing new strategies, perspectives, and tools useful for enhancing communication and data/information sharing, both vertically e.g. large data producers versus local communities and horizontally e.g. between local communities, or between communities and administrative structures. Local participation in the expanding information infrastructure does not necessarily involves the direct use of modern information technology this is presently hardly possible in e.g. rural areas in Uganda. The research will include, on the other hand, investigating to what extent local communities and structures can assume responsibility for updating and maintaining certain data sets as well as analysing the applicability and affordability of direct data access through e.g.

**Web-based services**

It must be emphasised that the proposed research is multi-disciplinary in nature. Some elements are in the field of informatics and participatory information systems development, i.e. technology and natural sciences. Others belong to land and rural/agrarian development, i.e. typically agriculture, and some are more typical for social
sciences and development research. The following sections describe status and developments in each of the three research arenas and outline relevant technology trends.

It is outside the scope of this project description to provide an overview of differences and similarities between informatics and information infrastructure developments in the North and the South. On the other hand, I would like to emphasise that both my own experience and that of many other scientists involved with both spheres show that there are many more similarities than the vast difference in material standard of living leads people to believe. Large parts of the research done internationally on participatory and exploratory development strategies are therefore applicable in a developing country context, with local adaptations, and will be utilised in this research.

All three processes or sectors identified as suitable for the proposed research see information technology and maximum sharing/use of data and information as crucial for a successful outcome of their development plans. Note here that in the following, the term 'local communities' is used to denote a variety of groups, like villages, local councils, NGOs, associations, churches etc. The term 'local administrative structures' relate primarily to public sector employees and others within a formalised administrative structure.

The fifth IFIP WG9.4 conference comprised of more than 30 presentations from more than 20 countries and attracted around 50 delegates. The theme focused on critical research questions regarding the way organisations in developing countries make use of IT and telecommunications and the value that they get from them.

As a discipline, Information Systems has always claimed a broad hunting license, so that casting a net across the developing world is certain to draw in a harvest of great diversity. Such was the case with this conference, Whilst many of the presentations described problems of common concern among the IT communities of Africa, Asia and Latin America, simultaneously they outlined issues which underlined the differences between the countries of each region. This should come as no surprise, Underneath the thin veneer
of behaviour which is presented to the casual observer of an IT installation in the
developing world, there lies an infinite range of diversity in the cultural, social, economic
and political contexts within which such implementations operate.

Thoughtful and sensitive observations yielded the presentations at this conference, and
helped illuminate the murky waters of success with IT for those countries who stand to
gain the most from it and yet at the same time have the least to invest it.

Additionally, just as anthropologists learn about their own cultures as a result of studying
others, so too can IS professionals in the developed world gain an insight into the wider
consequences of the use of IT on society by exploring it impacts in conditions of highly
varying social, cultural and political contexts. Although it may seem that, for many
developing countries, IT remains, in the words of one presenter, an "inevitable luxury",
the conference revealed a number of conditions under which IT can not only contribute
positively towards development, but also where it is likely to be essential for
development to occur. The following summaries highlight a selection of the presentations
at the conference.

6.7 MULTIMEDIA IN DEVELOPING COUNTRIES

Super Corridor project by Dr. Muhammad Ghazie Ismail of the Multimedia Development
Corporation, Malaysia. This ambitious project is the cornerstone of Malaysia's intention
to become a fully developed nation by the year 2020 and it consists of seven key IT
projects: Electronic Government, Smart Schools, Smart Cards, Electronic Data
Interchange, Research and Development, Telemedicine, Electronic Publishing/
Telemarketing. The corridor already has more than 70 participating companies.

In his presentation on "Information Technology, Information Systems and Public Sector
Accountability", Richard Heeks described the mixed impact which IT has had on
accountability in the public sector, in some cases supporting accountability, in other
cases undermining it. Apparently, IT seems to skew or undermine accountability more
easily than it increases it. Proper alignment of the contextual factors which attend IT implementations is required in order to achieve accountability. Such factors relate to the public servants themselves, the process of system design and the organisation and its environment. IS implementations should take account of the links between systems and accountability in overcoming resistance to computerisation.

Per Lind described the PHAROS Management Assistance System software package for the managers of small and medium-sized enterprises in transition countries, which provides assistance to managers in identifying cost drivers, monitoring quality, identifying the most revenue-generating customers, identifying the most profitable products and in monitoring performance.

The system provides a quick glance screen with the PHAROS lighthouse showing green, yellow or red as status indicators. Additional levels of detail are available for managers to drill down to. As Per puts it, using information technology to enhance management capacity is crucial in order to create competitive, enterprises in transition countries. However, information tools are often based on assumptions of rationality that cannot be taken for granted in many of these countries.

The design of management support systems for transition countries needs to proceed along lines that may seem foreign to systems designers. Despite the demise of the Soviet Union, the ethos of its centralized planning style continues to haunt the implementation of information systems even in remote parts of Mongolia. According to Jrrn Braa, efforts to develop a health information system in Mongolia have been restricted to the technical aspects of the system, to the neglect of the wider view of health sector reform.

Consequently, the system has not achieved its full potential. In describing the hierarchical organization of the health information system, whereby statistics which are gathered at the local level are summarized at district and regional levels for transmission to the central Ministry, Jrrn noted an intrinsic tendency of disempowerment in this upward-
bound reporting system. Apparently, only 2% of local health care workers were aware of the rate of infant mortality.

The information system is therefore instrumental in "structuating" the entire health system, consisting of hundreds of health workers daily engaged in, collecting and collating data and reporting it upwards. Geoff Walsham provided a thought-provoking analysis of the interlocking relationships between globalisation, IT and culture. He suggested that the western notion of self-identity, which is rather individualistic, has poor explanatory power in the more group-oriented cultures of Asia.

As an illustration, Geoff described the application of a geographical information system in India, which was intended to assist with forestry management. The intended use of the system exposed several cultural differences between the originator of the technology, the USA, and its recipient, India; less emphasis on rational, analysis, absence of a map-based culture and the uncoordinated activities of, highly compartmentalized departments. In advocating support for cultural diversity, Geoff counsels IS practitioners to show sensitivity to local norms and values and he argues that the appropriation of global trends will be highly variable in particular countries with cultural diversity mediating their effects.

The first annual BITWorld conference was held in New Delhi, India, in February 2001. The conference brought together academics and practitioners from around the world to face the challenge of managing business information technology in an increasingly global marketplace. The theme of the conference was to close the international divide in managing the various impacts of information and communication technologies. The conference brought together 49 papers from contributors in 20 countries covering a variety of aspects relating to the management of business information technology. The following is a review of a selection of the presentations at the conference.

The keynote address was given by Gordon B. Davis, Executive Editor of MIS Quarterly. Gordon discussed the "Emergence of an International Community of Scholars in
Information Systems" by first discussing the continued existence and need for IS as an organizational function as well as an academic discipline. Despite the presence of threats to the viability of the IS department from such areas as downsizing, outsourcing and packaged software, Gordon sees an expansion of the concept of organizational IS into new roles in products, services, business processes, telecommunications and planning for the delivery and maintenance of infrastructures.

However, in order to achieve expansion, IS needs to embrace developments such as the strategic and competitive use of information technology, the embedding of information into products and services, the effects of information exchange among organizations and the productivity opportunities which are available in knowledge work.

Accordingly, the conceptual foundations of IS have to grow, to comprise human communications, economic analyses, strategic and competitive behaviour and collaboration. From a worldwide perspective, although the technology remains the same, many aspects of the environment, of culture and organization vary from country to country. Such differences provide a basis for exploring underlying concepts, principles and processes and allow the community of scholars to search out "truths" that are fundamental versus those which are culturally defined.

There are around 6,000 scholars in IS world-wide and their universal voice can influence critical issues with governments, it can codify important principles as authoritative reports as well as rationalizing efforts and services. As such, there is a need for a truly international organization with international governance that can focus on information systems as an academic field.

Vishnath Weerakkody presented some observations regarding the application of "Business Process Reengineering (BPR) in Sri Lanka, where, apparently, large and medium-sized organisations depend heavily on Information technology (IT) and where the business community has realized the need to respond to the challenges of a global
market place. Arising from his involvement with a BPR project, Vishnath exposed several key elements which inhibited the project's ability to accomplish its objectives.

Among these were misalignment of organizational and project goals, competing priorities for team members, team members' attitudes, a weak and inefficient organizational Information Systems/Information Technology environment and insufficient commitment to the project. Vishnath concludes that BPR initiatives in Sri Lanka are likely to face significant difficulties. Continuing the theme of BPR, Peter Keung described PFOMOSYS, the prototype of a system to measure the performance of a business process.

The measurement system intends to combine functional data, regarding the performance of a process as well as financial data, and its use consists of nine steps; identifying process goals, defining indicators for each goal, broadening goals and indicators with a checklist, getting feedback from process actors, defining data sources and target values, judging technical feasibility and economic efficiency, implementing the measurement system, using it and finally, improving business processes and modifying the indicators. Peter usefully points out that contemporary performance measures are not focused on processes and they do not take adequate account of non-financial aspects. When BPR stops, process measurement should take over, and a never-ending cycle of improvement ensues.

The social impact of smart card technology provided the subject for Simon Rogerson's presentation, in which we heard about the 91 discrete applications which he had identified.

However, 41% of these were pilot schemes and it seems that very few smart card pilots evolve into long term full applications, due largely to political, cultural or privacy barriers. Of the 91 schemes, 27% were in banking, 18% were in health and welfare and 15% were in transport. Simon focused on two particular types of application, the electronic purse and the benefit card, in order to bring out the social benefits and costs of
the technology. Widespread use of an electronic purse, for example, brings the risk of privacy breaches if there are no restrictions preventing retailers and telecommunications providers from collecting transaction data.

Whilst smart cards can bring desirable benefits in terms of convenience and improved service, a variety of potential drawbacks present themselves, such as loss of privacy and anonymity, disadvantages for the technology illiterate or wary, reduction in choice and the insidious introduction of a de facto identity card. Simon concluded by outlining some beneficial applications in public transport and in the provision of services to disabled people.

J. Christopher Westland compared and contrasted the information systems of the Shanghai and Moscow stock exchanges. Each market played a vital role in the programmes for privatizing their countries inefficient state-owned enterprises, yet each programme exhibited contrasting features which were manifested in the information systems of their exchanges. The Shanghai stock exchange computer network supports about 3,750 seats (booths with microcomputers and telephones) spread over eight trading halls.

A central database matches orders when buy and sell prices cross. The system distributes dividends and handles payment for subscription of new stocks of listed companies. The trading floor consists of computers and provides no formal trading or market making functions. The system transmits settlement prices and volumes to around 3,000 brokerage rooms around China via a combined digital data network, satellite and analogue telephone system. In Russia, a host of computerized systems exist in investment houses to process trades.

Instantaneous settlement and clearing processes do not exist and back office software often depends on couriers to get trades recorded. However, recent developments involving the major market participants are expected to lead to a regional and national market infrastructure and trading system.
The two cases of information technology use seem to reflect national differences whereby the Russian road to privatization involved heavy insider trading and profiteering whilst in China, economic reforms and family thrift created a market of individuals ready to invest in China's industries. Stage models of the growth of IT fail when used predictively for developing nations and late adopters, according to G. Roland Kaye.

In North East Asia, for instance, cultural differences have meant that late entrants to information technology have not been assimilated within existing models of growth. Groupware is not common in Japan whose hierarchical corporate culture discourages the flatter organizational style that it assumes.

However, heavy use of the Internet, which is dominated by English / language, Implies assimilation by a group of technology "haves" adopting the culture of the imperialists, but placing cultural barriers in the way of adoption by the disadvantaged majority. Consequently, dysfunctional divisions emerge in the patterns of IT growth.

Moreover, such divisions between a host culture and the imperialistic tendency of globalization encourage aspirations among software developers to universality and superficial attempts at localization which ignore the cultural assumptions embedded in the technical designs of information systems. Consequently I urban workers with access to technology will adopt western culture whilst rural communities remain disadvantaged through lack of access and increasing cultural and economical barriers to entry.

6.8 IMPORTANTCE OF TRUST AND SECURITY ON CYBER-SPACE

Information and communication technologies (ICTs) today have impacts on virtually every aspect of society and every corner of the world in information or digital age fostering commerce, improving education and health care, and facilitating communications among all stakeholders. The more cases of cyber-crimes over the ICTs especially through the fastest growing medium like Internet, the more voices for
regulating them in whatever forms. Some countries, thus, began to accommodate such
voices or demands through revising the existing laws and/or issuing new legislation(s)
– or ‘cyber-laws’ to deal with new issues on ICTs.

The term or scope of ‘cyber-laws’ is yet unclear in many countries although it can be
interpreted at large in two: One is for the relevant legislations dealing with or regulating
converged computer, telecommunications and multimedia or broadcasting in such cases
as the Multimedia and Communications Act, Malaysia; the other is for those tackling
the emerging cyber-crimes in such cases as the Information Technology Act in India
and the Convention of Cyber-crimes adopted by the Council of Europe. The term of
cyber-laws or legislations referred to in this paper will be limited to the latter.

In the global information society – beyond national jurisdictions, an escalating national
de jure regulation meets a similarly pervasive de facto futility of enforcement. National
legislatures might continue to enact regulations especially over criminal matters, but
their regulatory endeavors are unlikely to be effectively enforceable, as they desire due
to the global nature of ICTs. Global phenomena like cyber-crimes should in principle
propel nations to achieve legislative co-operation and partnership at international levels,
since cyber-space is no respecter of national boundaries. The nature and extent of the
problem in enforcing the laws over the cyberspace is enormous. Some law enforcement
agencies are responding aggressively, others are not fully aware of the problem on the
cyberspace and lack the expertise and resources to pursue the kind of cases appearing
everyday. Some ISPs have taken affirmative actions to crackdown on cyber offenders,
whilst others have not. There is a great deal more that government and/or industry can
and should do to empower individuals to protect themselves against cyber offenders and
other online threats.

The main scope and development of cyber-laws

The existing legislations and statutes need to be reviewed to determine whether they can
address the issues arising out of the new ICT era. If the current laws are inadequate to
deal with the problems, national governments and/or appropriate regional and
international bodies need to either revise the existing laws or enact new laws to provide
individual, corporate and government users with maximum trust and security, as Table 1 articulates a few examples.

Enforcement mechanismsTo optimize benefits of ICTs and secure confidence of users, information society should be safe and secured through not only cyber-laws per se but also appropriate enforcement mechanisms. However, first of all, many countries do not have specific enforcement agencies to combat various cyber-crimes.

**Table 1: Scope and Development of ICT Legislations**

<table>
<thead>
<tr>
<th>Issues</th>
<th>Laws</th>
<th>National Actions</th>
<th>International Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracts</td>
<td>Electronic Transaction Act</td>
<td>Hong Kong/ China, Singapore, Thailand etc.</td>
<td>UNCITRAL: Model Law</td>
</tr>
<tr>
<td>Harmful sites or contents</td>
<td>Penal Law or Legislation, Obscenity Law,</td>
<td>Australia, China, HK/China, India, Japan, Malaysia, New Zealand, Philippines, Singapore etc. Hong Kong/China, USA, UK, EU etc.</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Communication Decency Act, Obscene Publication Act, Self-regulation etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hacking &amp; virus</td>
<td>E-Commerce Act</td>
<td>Philippine</td>
<td>N.A.</td>
</tr>
<tr>
<td>Intellectual Property Right (IPR)</td>
<td>Copyright Law, Patents Law, Trade Marks Law, IPR Law, Green Paper on Counterfeiting &amp; Piracy etc.</td>
<td>Hong Kong/China, S.Korea, Singapore, India, EU etc.</td>
<td>WIPO: Ratification</td>
</tr>
</tbody>
</table>
It is only the recent when countries started to create such agencies. For instance, “a Cyber-crime Agency called European and Network Information Security Agency (ENISA)”\textsuperscript{4}[4] was created in early 2004 with a final approval by the European Union. The National Cyber Security Center (NCSC) was set up under the wing of the National intelligence Service (NIC) in South Korea in 2004.\textsuperscript{5}[5] Whilst, “Operation Cyber Seep
in the USA is being coordinated nationwide between the Justice Department, the Federal Bureau of Investigation, the Federal Trade Commission, postal inspectors and customs agents with supported by state authorities and foreign governments"6[6] – i.e., close coordination is required among relevant agencies at not only national levels but also regional and global levels, since one of the most important challenges often faced by the enforcement agencies is that the cyber-criminals have the ability to commit the crime quickly and then disappear without revealing their true identity or location. Often these criminals are located in a foreign jurisdiction. Thus, tracking them requires law enforcement agencies to be created and act faster through cyber border cooperation from a spectrum of organizations representing governments, businesses and consumer groups in various countries.

Second, cyber-law enforcement is relatively a new challenge for the most enforcement agencies. Many countries do not have necessary skilled law enforcement personnel to deal with computer and even broader ICT related crimes. This undercuts the efforts to battle the growing threats like cyber-crimes. In this regard, some countries have started special training for cyber policemen in India by the Ministry of Communications and Information Technologies7[7] and Anti-Cyber Crimes Cell (ACCC) officials in Pakistan8[8]. Many others are still developing their expertise and resources to investigate and prosecute cyber cases.

Third, according to a recent survey of law enforcement agencies, it appears that a majority of the agencies have not investigated or prosecuted any cyber cases. The reason for such laxity was attributed to mainly the fact that the majority of its victims don't report the conduct to law enforcement agencies. Moreover, the law enforcement agencies per se will not take them seriously: i.e., lack of awareness of importance of enforcement on cyber-crimes. Most law enforcement agencies do neither recognize the
serious nature of the cyber cases and nor investigate them. This requires for raising awareness and education from not only the enforcement agencies but also victims and citizens at large.

Fourth, at national levels, several countries began to impose legal enforcements such as penalties or imprisonments on different types of cyber-crimes. For example, according to the Spam Law passed on December 2, 2003 in Australia, “first offenses will result in a maximum penalty of US$161,000 per day for organizations and US$32,200 per a day for individuals. Repeat corporate offenders will face a maximum penalty of US$805,500 for each day of spamming, with individuals who are repeat spammers facing a maximum penalty of US$161,000 per day.”9[9] In case of Singapore, “violators of the Computer Misuse Act such as website crackers can be jailed up to 3 years of fined up to S$10,000”.10[10]

Fifth, greater cooperation, harmonization and effective communications among law enforcement agencies and relevant bodies at national, regional and international levels are essential to combat sophisticated cyber-crimes or unlawful conducts at different jurisdictions through the ICTs, especially on the Internet, since the limitation of law enforcement agencies to specific geographic jurisdictions creates serious challenges for them when they investigate activities that can be readily contrived to be extra-jurisdictional (i.e. occur somewhere else), trans-jurisdictional (i.e. occur across two or more areas), or are supra-jurisdictional (i.e. occur somewhere that no agency has jurisdiction over). To meet this challenge of cross-border cyber-crimes at regional and international levels: e.g.,

- EU issued the Cyber-Crime Treaty in 2002, which has been signed by the major European countries. Its main principle was based on a uniform approach to fight the cyber-crimes to deal with jurisdiction and enforcement.
• ASEAN countries also seek stronger security links through a consideration to develop a treaty on cyber-crime, so is the commonwealth.

• OECD developed a new web site www.oecd.org/sti/cultureofsecurity dedicated to help combat security risks to information systems and networks.11[11]

• UN ESCAP organized a seminar on 'Harmonized Development of Legal and Regulatory Systems for E-Commerce in Asia and the Pacific’ to raise awareness among lawyers, justices, and legal professionals.12[12]

• ITU as the mandates has taken various actions from developing international standards to organizing numerous seminars and meetings in order to build confidence and ensure security of ICT, especially its networks.13[13]

Sixth, another important enforcement mechanism can be community or industry self-regulation such as code of conducts or practices: e.g., the USA – especially the FCC14[14] - together with private industries15[15] is in favor of 'un-regulation' of Internet markets or 'self-regulation' by industries themselves especially in the areas of privacy or personal data protection. Last but not least, law enforcements should be hand-in-hand with developing technical measures such as software (e.g., open-source e-mail software, filtering system) and hardware (e.g., a new 'chip and pin card’16[16]).

Future ahead

The more cases of cyber-crimes over the converged ICTs especially through the growth of Internet and e-commerce beyond national boundaries, the more voices for regulating them at national, regional and international or multi-lateral forms. As the types of cyber-crimes vary, however, ways of tackling the different types of cyber crimes especially through legislations or regulations may diverse from one country to another, especially
when they occur within a specific national jurisdiction with different definitions and socio-political environments from others. Thus, harmonization of the relevant or different national laws is increasingly required, which has been recognized and taken up actions by UN agencies like the ESCAP and ITU. As well demonstrated in such cyber-crimes as ‘love virus’ or ‘cyber attack’ affected by more than one national jurisdiction, there is also need for either bi-lateral or multi-lateral cooperation on the prosecution of international hackers or criminals to go farther and possibly include a cyber-law treaty, as practiced by the EC.

As a matter of fact, international legal instruments, which by definition embody global consensus and/or bind all member nations, could provide countries with useful and creative tools for specific and defined areas of cyber-crimes as international enforcement mechanisms: e.g., global conventions, multilateral treaties (e.g., the Cyber-crime Treaty in the EU), international laws, global standards (e.g., ITU and ISO) for confidence and security, model uniform laws (e.g., UNITRAL), and model contracts/standard terms.

Recognizing the need for confidence and security in the use of ICTs at a global level, moreover, the World Summit on the Information Society (WSIS) led by the ITU in 2003 has adopted that “... A global culture of cyber security needs to be promoted, developed and implemented in cooperation with all stakeholders and international expert bodies. These efforts should be supported by increased international cooperation. ...” in its Declaration of Principles. The WSIS has also adopted the Plan of Action including that “governments, in cooperation with the private sector, should prevent, detect and respond to cyber-crime and misuse of ICTs by: ...
considering legislation that allows for effective investigation and prosecution of misuse; ....; and encouraging education and raising awareness.”19[19]

In view of the fact that cyber-crimes are growing at alarming rate, each country by all stakeholders needs to have more pragmatic approaches (as below) at national, regional and international levels: e.g.,

- Raise awareness of serious nature of the cyber-crimes for various target groups from individuals, industries, and governments to specific enforcement agencies.
- Revise, enact and enforce national and international laws specifying various substantive and procedural aspects of issues emerging from cyber-space: i.e., cyber-crimes.
- Harmonize different national laws to regulate and police the cyber-crimes in a consistent and collective manner at various jurisdictional aspects.
- Coordinate and cooperate between and among the law enforcement agencies of one’s own country as well as other countries concerned.
- Endeavor to establish International Tribunals to regulate cyber cases or crimes increased beyond national jurisdictions.

To sum up, every stakeholder should be aware of and actively involve in preventing and solving together the destructive side of ICTs - i.e., cyber-crimes - with an appropriate balance between regulations and self-regulations subject to the different types of crimes in cyber-space, in order to optimize more creative side or benefits of ICTs, which will further transform the paradigms of our cultures, politics, and socio-economy beyond national jurisdictions in the interconnected world today.
6.9 IT AND WOMEN EMPOWERMENT

It is imperative for a sustainable development in developing, over-populated countries like India that women have access to education and appropriate need-based technologies. Out of the five thrust areas earmarked for India’s Vision 2020, the information and communication technologies (ICT), like the other four, have also given us vital tools to achieve our development strategies. These tools and technologies coupled with the power of knowledge can enable women in developing countries to join the battle for economic, social and political empowerment. Already a “digital divide” implying uneven distribution of the technologies within the societies and across the world has set in, upsetting the balance of gender equality. Ready access and use of ICT is expected to bridge this “gap” or “divide” to a large extent, provided social and economic benefits are directly linked to these emerging technologies. There are factors like education, financial independence, language barriers, cultural cross-linkages, traditional skills and remoteness of locations, besides cost of technologies, which would determine the participation of women in this sector. Presently, women constitute 31% of the total workforce. NASSCOM has predicted that male-female ratio by the year 2005 would be 65 to 35, which indicates towards a healthy trend. But, the socio-economic disparity would not be removed by these statistics alone. A Herculean task lies ahead to provide ICT to many more segments of women, not considered hitherto.

While it is being strongly felt that women take up the challenges of ICT, the problems at the grass-root level also cannot be ignored. Women’s participation in ICT may be in the form of dedicated users, workers, entrepreneurs, technical service facilitators, inventors, managers and policy makers.

Information and communication have been playing an increasingly important role in economic and social development of nations. Experts believe that this century belongs to the power of Knowledge & Information. On one side, the recent developments in
communication technology have drastically reduced the geographical barriers, while on the other side computers have enormously enhanced the capacity to accumulate and access information. The possibilities for information access are infinite. This ‘information society’ has grown in the last one decade in leaps & bounds breaking many existing paradigms and creating an image of “indispensability” in our lives.

Unfortunately the access to these technologies is highly unequal, somewhat built-in in all our development sectors. This is true for different geographical regions and diverse socio-ethnic groups inside India. The inequality contributes to increasing the gap between those who have access to abundant information resources and those who are deprived of this access, thus reinforcing the marginalization that already exists in terms of development and technical resources. If not the worst, but a major suffering group of this bias is the women. They are not only under-represented in terms of access to these technologies, they also do not get a fair deal in many social transactions. Developing and less-developed regions inside the country portray a vivid story of this inequality. Ironically, these women contribute largely to the work force that produces computer components and finer elements of technology in extremely deplorable working conditions. Women are in high demand for these jobs, but are conspicuously absent in computer systems administration, technical development and decision-making. Women are very few as producers of information, thus with less access than men to the information and networking resources. Naturally they have fewer possibilities of orienting technology to address their specific needs. What are the reasons for this gender inequality? Some of the probable answers can be:

- Lack of a clear National policy for promoting ICT for women’s development.
- Poor ICT infrastructure, inefficient telephone services, lack of electricity in many remote, far-flung areas, and frequent power cuts.
- Poor literacy among women (in spite of intensive measures to promote education), and inadequate computer skills
- Unaffordable costs of computer hardware and software, maintenance and connectivity.
- Little awareness of the full range of opportunities offered by ICT other than access to information; limited online information in vernacular languages.
- Absence of favourable bandwidth and connectivity for smooth operation.

These are not insurmountable barriers, neither we lack resources to overcome these barriers. Shifting the focus partially towards unconventional areas of use, ICT can catalyze remarkable changes in society. *Norti Bai is a 55-year old school-dropout from Rajasthan, the desert-state of Western India. She hardly speaks any language except her local dialect; but she maintains and disseminates information to villagers on wells, tube wells and ponds of 11 neighbouring villages with the help of a computer database. Her basic training in ICT boosted her status in society from a diffident housewife to a conscious lady with a mission.* Similar cases can be seen in many other parts of India which points towards a changing social scenario.

**Role of the Government and the NGO Sector**

A number of women’s organizations have realized the importance of creating and participating in regional and worldwide information exchange which will enable them to share ideas, proposals, documents and information. Computer networks are a form of appropriate technology that makes this exchange possible. Combined with other media forms like printed material, radio, television, to name a few, such exchange can more easily be extended to regions and groups that cannot access computer networks. Need of such networks has mainly arisen due to issues of concern to women, which do not preclude basic housekeeping, health & sanitation, children’s education, balancing resources and traditional chores. ICT is not at all aimed at breaking the traditional role of women. It rather aims at empowerment that will fortify the male bastions. In doing so, they often face obstacles like resource crunch (financial and technological), reduced access to training and technical assistance or non-gender sensitive methodologies, social and cultural barriers for women and girls to access technology, educational short-comings, misconceptions about technology, language barriers, etc., some of which have already been mentioned above. Since problems are inter-linked and solutions are diverse in nature, the endeavours also have to come from different quarters.
There have been attempts to overcome the obstacles of women’s access to ICT in India. The major initiatives undertaken in the formal sector may be summarized as follows:

- Repackaging of Internet-accessed information and combining Internet technology with ‘traditional’ or more established tools of communication like radio, television and print media.
- Facilitating content development on the web-production and use of ICT resources in different Indian languages.
- Government policies to ensure that women are brought to the mainstream through ICT programmes through accessible technology, relevant and useful to women.
- Institution of scholarships and awards, with incentives, to promote the enrollment of girls and women in ICT programmes.
- Continuing training programmes and awareness workshops on the use and potential of ICT throughout the country.

These are significant openings created for women. Decentralisation and devolution of powers through Panchayats (these are smallest units of local administration) have included computerization, installation of kiosks for information and networks for dissemination. The elected women representatives can use these to interact with their constituencies and their colleagues in other parts of the country. ICT can influence changes and restructure in the prevailing power equations.

The Department of Women and Child Development under the Ministry of Human Resource Development is the key agency for development and welfare of women and children. Most of the provincial governments also carry out women related activities through Social Welfare Departments. Ministry of Human Resource Development and Ministry of Information Technology have formulated a number of schemes, particularly in the area of education and training in ICT. These schemes can succeed with gender-sensitivity and removal of regional biases.
Opportunities galore in ICT-enabled services in a country like India where there has never been a paucity of ideas or knowledgeable people. Political networks and advocacy groups have been formed due to proliferation of these technologies. Income generation is another area where ICT has been making headway. ICT can link women in various areas, help coordinate agenda, speed up communication, reaching a vast number of people in less time. ICT offers invaluable tools for dissemination of indigenous knowledge. Women's effective participation in the information society needs to be assumed if countries are to successfully achieve their development goals and practices. While there have been lots of development efforts to increase the access and use of ICT in general, there is still a marked difference in their impact on the lives of men and women. That is precisely the reason why international agencies prefer to do their work in India through certain Non-government Organisations (NGO) and voluntary bodies.

As the largest democracy in the world, India has a huge array of non-government organizations active in education and women's issues. There have been numerous experiments in India devoted to addressing the digital divide, particularly because of the high-profile domestic IT industry against an extremely poor and uneducated population. However, only a few are specifically targeted at women.

State governments are also investing in IT training and infrastructure amply demonstrated by Andhra Pradesh. According to the Ministry of IT, "State and Central governments have instigated programs to increase the use of computers in poorer regions". Although States like Uttar Pradesh, Madhya Pradesh, Kerala, Tamil Nadu, Rajasthan are prioritizing IT, the poor telecommunications infrastructure is still the major obstacle to broader access and application of IT in India.

Intermediary organisations could also contribute to building capacities of women by providing them training in basic computer skills (like accessing the Internet), and other skills like desktop publishing, website creation, e-commerce, etc. To facilitate access for women from various classes and sectors, the intermediary organisations need to be
strategically located in local institutions, such as health centres, women’s employment centres and studies departments, libraries, community centres, etc, to which women have open and equal access. A large number of NGOs are showing genuine interest in this sector.

**New Horizons of ICT for Women: Problems and Prospects**

The ICT policy when looked at from a gender perspective must take into consideration the various dimensions, including education, employment and empowerment.

According to the 2001 census, female literacy is 54.16% as against male literacy of 75.85% in India. The enrollment of girls in educational institutions decreases as educational level goes higher. The enrollment of girls in Engineering/ Technology/ Architecture at the Bachelors level (in 1998) is 57,968 as against 285,137 boys. This imbalance is largely due to socio-economic reasons, and a very large concerted drive is required to remove this imbalance.

Since the percentage of women enrolling for higher education is quite low, the benefit of ICT can go to a large section if more and more IT courses at 10+ or 12+ levels are introduced as vocational streams. The girls’ polytechnics are promoting some of these with preferences in jobs, and special incentives in the initial years.

<table>
<thead>
<tr>
<th>Women’s education at a glance (India)</th>
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<tbody>
<tr>
<td>Literacy rate of women</td>
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<tr>
<td>(as against men 75.85%)</td>
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<tr>
<td>Secondary education</td>
</tr>
<tr>
<td>Education and law</td>
</tr>
<tr>
<td>Women Tertiary students</td>
</tr>
<tr>
<td>Women students in natural sciences</td>
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</tbody>
</table>

*(Natural Sciences include the fields of computer science, engineering, math, architecture, town planning, transportation, and communications)* (Source: ‘Women and IT in India’. URL: [http://projects.aed.org/techequity/India.htm](http://projects.aed.org/techequity/India.htm))
Keeping in view the plight of rural women, who are more unaware of new technologies than their urban counterparts, government is providing special packages for them, who are involved in home based or small-scale activities related to handloom, handicraft, sericulture, etc. From identification of projects to the marketing of products, these packages are helping women entrepreneurs to a great extent. Government of India is in the process of establishing Community Information Centres (CIC) at all block levels, which are designed as the prime movers of ICT in the most economically backward and geographically difficult terrains. CICs are supposed to provide multipurpose information (on health, education, social welfare and small-scale industry, etc). This might prove to be a “shot in the arm” for the rural women that can boost their economic and social status.

Information and communication technologies have created new types of work that favour women because the technology enables work to be brought to homes and allows for better accommodation of work and family schedules. Women have also been able to capture a large proportion of jobs in ICT-enabled services because of the worldwide shortage of skills necessary for work in this sector.

Many women are software programmers, but very few are in hardware design. New ICT jobs for women especially in India are in the service industries in information processing, banking, insurance, printing and publishing. So far, the most promising potential for women is in the creation of new jobs at “Call Centres” and in work involving data processing. The International Labour Organisation reports that ‘telecentres and fax booths have created a quarter of a million jobs in India in the last four years alone, a huge proportion of which have gone to women’.

<table>
<thead>
<tr>
<th>Women in the Workforce</th>
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<tbody>
<tr>
<td>Total women in workforce</td>
<td>31%</td>
</tr>
<tr>
<td>Women in IT workforce (software sector)</td>
<td>19%</td>
</tr>
<tr>
<td>Women Internet users in India</td>
<td>23%</td>
</tr>
</tbody>
</table>

(Source: Women and IT in India)

While specific gender data on the networking profession in India were not available, fewer women are employed in networking compared to software occupations. This is
attributed to the preconceptions that the physical aspects of the work are too difficult for women such as the long, erratic hours and traveling. The lack of mobility is cited as one of the major constraints to women’s ability to participate in the IT work force in India. If women want to work in the IT sector, they have to relocate themselves. However, living alone away from home is not the norm for young, single women because of security issues and the traditional view that women’s role is in the home with the family. As a result, the current IT employment opportunities in large cities like Hyderabad or Mumbai are often not appealing or feasible for many women, particularly those from the other parts of the country. So, there are many cases where women have sufficient IT education and training, but do not work in the field because they lack the essential mobility to go to where the jobs are.

There are many more cases of similar and different nature, which have encouraged the NGOs, the government and the funding agencies to expedite women’s development through ICT. From managing water distribution at the village-level to standing for local elections and having access to lifelong learning opportunities, ICT is opening up new vistas of development. The Information and Communication Technologies are for everyone and women have to be an equal beneficiary of the advantages offered by the technology. Moreover, the benefits accrued from the synergy of knowledge and ICT cannot be restricted to the upper strata of the society and have to freely flow to all segments of the women population.