INFORMATION AND COMMUNICATION TECHNOLOGY AND DECENT WORK: STUDY OF INDIA'S EXPERIENCE

(Research Report prepared under the auspices of ILO/JILPT Networking of National Institutes of Labour Studies in the Asia Pacific Region)

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November 2004

INTRODUCTION

Technological change is always accompanied by realignments of the markets and work organization. With the advent of information and communication technology revolution such realignments have undergone unprecedented changes. 'Information-isation' of the society has placed work organization in the centrestage discussion on reorganization of the economy. It benefits some and deprives others; it creates new skills while effecting deskilling; it creates new commodities and alters relations between human beings and the world of commodities. Information and communication technology (ICT) enhances productivity and paves way for added employment opportunities. Those economies, which innovated these technologies, have gained global competitiveness and those who shied away from it lost economic opportunities that they could have made use of. Digital globalisation has become the term of postmodernity. Information-isation has both effective and affective dimensions; it influences the whole social fabric by remolding the individual and inter-individual relations in the civil space and in the family. It influences both work and leisure. ICT heralds the days to come.

Digital globalisation cuts across the factor market barriers and ushers in possibilities for narrowing down the gap between the developed and developing economies. Use of ICT alters the labour processes and invents new forms of work organization. This has paralled with the accentuated growth of globalisation and reformulations of work organizations in most of the economic activities. The changed condition has led to several reconsiderations of labour processes. Informationalism, which has set into all societies, has led to several reconsiderations that affect labour flows and labour processes. Institutions involved with the problematic of labour have begun to reconsider their concepts and categories in a new light. Of various reconsiderations, the question of decent work has emerged as a comprehensive term of new paradigm during the turn of the last century. With the advent of ICT, the issue of decent work has gained added importance because of the structural properties immanent in the ICT sector and the anticipated impacts of it on development and labour processes. The phrase 'decent work' has to be situated within this reconsideration. This phrase

reorients some of the continued preoccupations of ILO and redefines the nature of agency intervention in the labour market.

Decent work has four different components: employment, social security, workers' right, and social dialogue. There are also attempts to develop indicators of decent work (Anker et al., 2002). Yet, the quantification of decent work is problematic because it is predominantly a qualitative variable. Decent work captures not only the formal economy but also unregulated informal sectors. Decent work refers to "both adequate opportunities and remuneration for work (in cash or kind). Decent work also embraces safety at work and healthy working conditions. The social security component of decent work is intended to protect against the risk of losing income." (Ghai,2002)

The concept of decent work is gaining wider circulation, particularly in the context of digital globalisation. ICT industries in India have been proliferating and it put primacy on individuals as participants in value-chain. This industry has posed several challenges to the solidarity of the workers and the traditional labour market institutions. It is in this context that this project is carried out. The central concern of this report is to examine the impact of ICT production and its use on decent work in India. As mentioned above, there are several statistical indicators of decent work; they are the following: *employment opportunities, unacceptable work, adequate earnings and productive work, decent hours of work, stability and secured work, fair treatment, safety in work, social protection, balancing work with family life, social dialogue and workplace relations, enhancement of capacities for employment and socio-economic context.*

The indicators of decent work can be discussed at two levels: a) at the macro level of the industry; b) at the micro level of firms and workers. While for the industry level indicators, we have utilized extensively the extant secondary sources on the industry, for the micro level we have used the method of primary survey of 100 workers involved in two IT clusters in Bangalore and Trivandrum. The sample size and locations were decided in order to provide adequate representation to different

activities, firm sizes and cluster characteristics. These micro indicators must be understood in the context of the industry level characteristics of decent work.

Accordingly the report is structured in two parts. Part I of the report discusses the ICT industry, its dominant characteristics and proliferation in India. Part II of the report deals with the issue of decent work in the ICT industry. Part I is further subdivided in three sections. Section 1.1 deals with the role of ICT in the development process. Section 1.2 analyses the structure, composition and diversification of ICT industries in India. Section 1.3 discusses the trend and pattern of growth of the industry in India. Part II is further divided into two sections. Section 2.1 provides an overview of the decent work in the industry on the basis of secondary literature and published information Section 2.2 provides an analysis of the results of the primary survey of IT industry workers. The conclusion sums up and underscores some of the important findings and observations, and puts forward some of the possible trajectories of future analysis.

Part I

1.1 ICT AND DEVELOPING ECONOMIES

The technological innovations in microelectronics, computing telecommunications and opto-electronics, microprocessors, semi conductors and fibre optics have altered the mode of assimilation, processing, storage and dissemination of Information. Information thus, is becoming the mainstay of growth by increasing efficiency through restructuring the organization of other factors of production, viz., capital and labour. This ongoing process is ushering in a whole gamut of structural changes in every sector of the economy across the globe. There are reductions in cost and increase in growth. New entrepreneurial classes are emerging; new forms of work are replacing the traditional forms. New Industries are mushrooming; traditional industries and industrial structures are withering.

This technological change offers a mixed bag to the developing economies. ICT is advantageous for developing economies because it has much lower entry barriers, being less capital intensive, more labour intensive and far fewer economies of scale. (Heeks,1995). These factors make this sector attractive to developing economies like India where there is a surplus of skilled manpower and low capital base. The developing countries would visualize this technology as 'the' opportunity to catch-up with the developed countries. But there are many factors that may counter-act against this competitive advantage of the developing economies. The relatively capital rich developed economies may find it cheaper to substitute low cost labour and intermediate technology from the developing economies with greater automation .The comparative advantage of developing economies may further be eroded due to the rising demand for customized products in the developed economies in stead of mass produced goods. Manual labour and intermediate technology cannot manufacture customized goods.

Most developing economies have a 'sellers' market where producers are not subjected to competitive pressures which are a necessary condition for diversification and innovation. Investment in fundamental Research and Development is meager in developing economies. Returns on R&D are irregular and productive only in the long run. This kind of investment can be taken up only by the developed economies (Brunner, 1995). The newly industrialized south-east Asian economies had followed the traditional trajectory of industrial stages, from being labour intensive, primary goods exporters to being capital intensive, sophisticated manufactured goods exporters, as their economy progressed. Most developing economies may not have this option now. The ongoing technological transformation in the production process would only widen the technological gap and the consequent developmental gap between the developed world and the developing world.

We would begin with the proposition that developing economies can have selective advantages and some disadvantages, which are the by products of the spread of the

technology. The analysis carried out here is to search both of them as they have presenced in Indian context.

1.2 GROWTH, STRUCTURE AND SPREAD OF ICT IN INDIA

In India, the advent of ICT has been viewed with immense optimism. ICT is being prescribed as the panacea for a plethora of problems faced by India such as unemployment, lack of growth, technological backwardness etc. The Ninth Five Year Plan Document notes, "IT and allied sectors have immense potential for employment generation. It is expected to emerge as one of the largest employers of work force in the country, providing jobs to about 25% of the labour force in the long run. It is expected to generate about one million additional jobs every year. It would also lead to increased productivity in various sectors"(Planning Commission, Ninth Five Year Plan(1997-2002) Document).

The growth of output in the ICT sector during the last two decades has been quite impressive; the annual compound rate of growth of output was 37.4 per cent during the twelve years between 1990-91 and 2001-02. (Chandrasekhar, 2002) The total value has registered a significant increase from Rs.2214 crore during 1990-91 to Rs. 62134 crore by 2001-2002. (Table 1 and Chart 1).

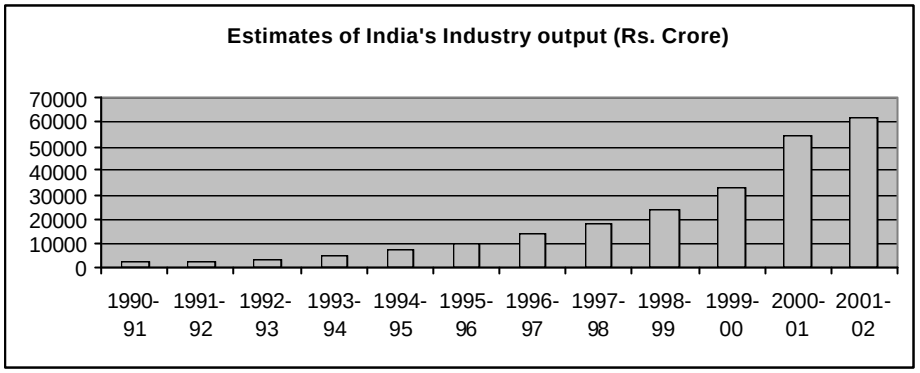
Table 1

Estimates of Output of Indian ICT Industry (Rs. Crore)

	Total Value
1990-91	2214
1991-92	2717
1992-93	3455
1993-94	4761
1994-95	6841
1995-96	9713
1996-97	13434
1997-98	18015
1998-99	23956
1999-00	33052
2000-01	54566
2001-02	62134

Source: Dataquest, Vol XIX No 13, July 15, 2001,and Vol XX No 13, July 15, 2002

Chart 1



The net result has been that the ratio of gross ICT output to GDP has grown from 0.38 per cent in 1991-92 to around 3 per cent by 2001-2002. This growth is impressive due to two reasons. The first one is that this growth has been accompanied by significant increase in exports of the sector. Growth in export of output of this sector has been higher than the output growth. That is, the export led growth of this sector has been advantageous to the balance of payment situation of India. Moreover, India's share in the world software and IT services production and export has been increasing over time. The second reason is that, production in this sector has been effected entirely by the private firms with institutional and policy support from the government. Both small and large firms have more or less identical conditions for entry and sustenance. This enables the developing countries to participate in this dynamic sector more effectively, compared to the conventional industries. In the contemporary situation where the State's role in economic production is waning, this feature is quite impressive. To comprehend this growth of the ICT sector we need to know the structure of it.

The ICT industry can be classified into three sectors for the purpose of discerning its impact on the labour market and on decent work in particular; a) the ICT-producing sector, which consist of the software and services, and hardware and peripherals b) the IT-enabled Sector, and c) the ICT-Using Sector.

1.2.1. Software Industry

The software segment dominates the ICT industry in India; more than 70 per cent of the revenue is being generated by this segment (Table 2; Chart 2). The relative share of all other segments, including the hardware segment, which at one time dominated the industry, has been dwindling. The hardware segment, which accounted for 37 per cent of total revenue in 1994-95 declined to 15 per cent by 2000-01.

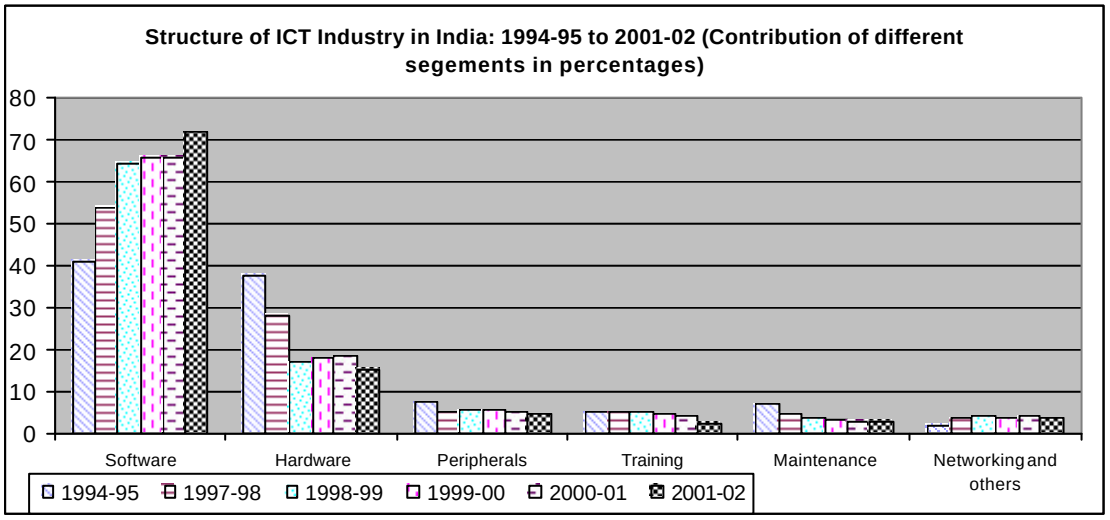
Table 2

Structure of ICT Industry in India: 1994-95- 2001-2002
(in percentages to the total value)

	1994-95	1997-98	1998-991	1999-00	2000-01	2001-02
Software Production	40.91	53.66	64.44	65.74	65.64	71.63
Hardware Production	37.58	27.95	17.02	17.71	18.43	14.96
Peripherals Production	7.55	4.93	5.73	5.33	4.83	4.5
Training	5.24	5.23	4.99	4.61	4.27	2.36
Maintenance	6.96	4.39	3.9	3.03	2.89	2.95
Networking and others	1.76	3.84	3.92	3.58	3.94	3.6
Hardware Exports to Total IT Exports		0.85	0.61	2.78	3.9	4.47
Software Exports to Total IT Exports		99.15	99.39	97.22	96.1	95.53
Domestic Share to total IT Industry		60.14	55.12	51.44	45.21	39.09
Total IT Industry (value in Rs.crores)		18016	23956	33053	54566	62134

Source: Dataquest

Chart 2



The software industry is predominantly an export-oriented industry, accounting for above 70 per cent of the revenue of the software industry. The share of export earnings in the total software revenue has been shooting up during the last decade.

The software exports from India have been growing at phenomenal rates during the recent years (Table 3; Chart 3 & 4). In fact the boom in the ICT sector had been driven

mainly by the export oriented growth of software industry. Indian IT software and services exports accounted for over 18% of India's total exports during 2001-02. It is expected that by the year 2008, Indian IT software and services industry will account for 7% of India's GDP and 35% of India's total exports. However, India's IT software and services industry, at present, represents around 2% of the overall global software market. The Government and software industry, however, have set an ambitious goal for the software sector amounting to around $50 billion of software exports by 2008; a share of 6% of the relevant global market (Dept. of Information Technology, 2003).

Table 3

Software Exports from India

Year	Software Exports (US$m)	Growth Rate of Exports
1989/90	105.4	51
1990/91	131.2	24
1991/92	173.9	33
1992/93	219.8	26
1993/94	314	43
1994/95	485	53
1995/96	734	51.34
1996/97	1085	47.82
1997/98	1750	61.29
1998/99	2650	51.43
1999/00	4000	50.94
2000/01	6300	57.5
2001/02	8500	43

Source: www.man.ac.uk/idpm/isiexpt.htm June 2002

Chart 3

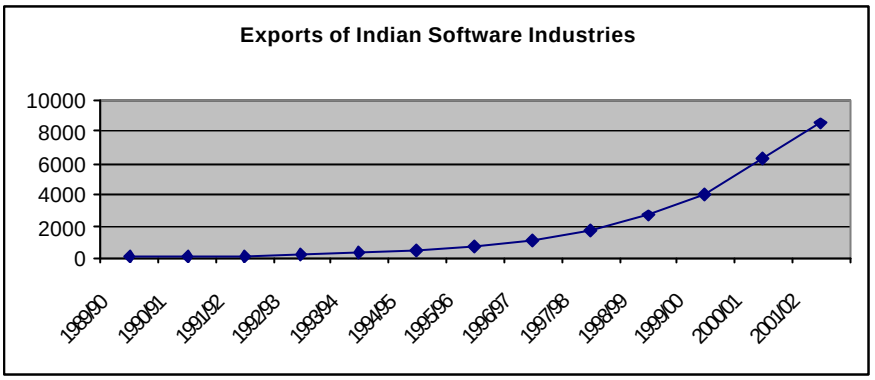
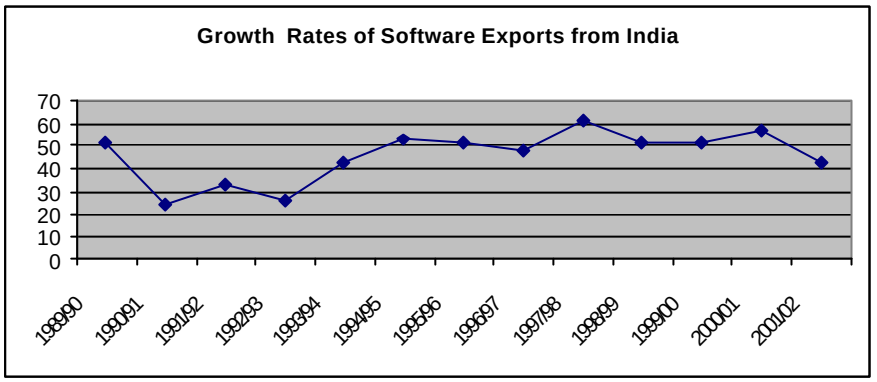


Chart 4



The major destinations of software exports from India are the developed economies of America and Europe; they together imported about 88 per cent of Indian software in 2000-01 (Table 4; Chart 5). U.S.A imported more than half of India's export; in 1999-00, North America accounted for 64 per cent of the exports. The demand for Indian software exports to North America arises from different factors such as, shortage of skilled workers in U.S., cheaper labour, lower cost of production in India and the 12 hour time gap between U.S. and India which makes it possible to have 24 hour working days in the U.S. through networking.

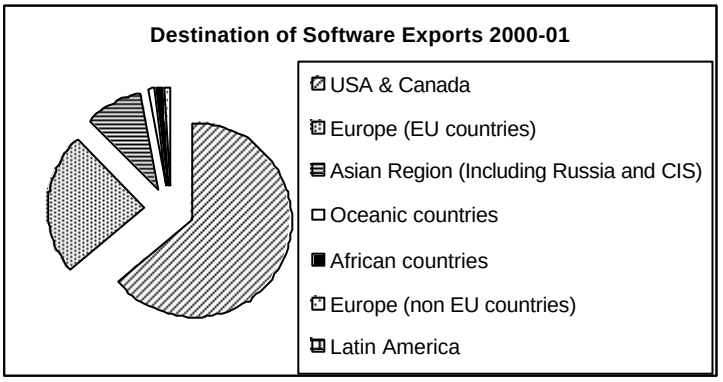
Table 4

Destination of Indian Software Exports

Destination	2000-01
USA & Canada	64.19
Europe (EU countries)	23.44
Asian Region (Including Russia and CIS)	9.25
Oceanic countries	1.23
African countries	0.69
Europe (non EU countries)	1.08
Latin America	0.13
Total	100

Source: Annual Report (2001), Dept. of Electronics, Ministry of Information and Technology

Chart 5



The majority of Indian software exports belonged to activities at the low end of the value chain. The Indian exports mainly consisted of on-site software maintenance work. Nevertheless, in the recent years, change in the trend towards off-site software development. In fact, in the year 2001-02, a majority of the exports, for the first time, were off-site (Table 5; Chart 6). The use of offshore development has helped Indian companies to provide competitive advantage to their clients. With improving infrastructure, such as greater bandwidth and larger number of servers, the share of off-site work is only expected to increase.

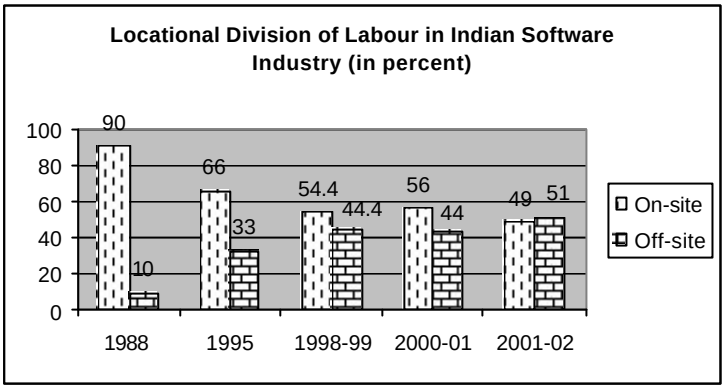
Table 5

Locational Division of Labour in Indian Software Industry (in per cent)

Location of work	1988	1995	1998-99	2000-01	2001-02
On-site	90	66	54.4	56	49
Off-site	10	33	44.4	44	51

Source: Kumar, 2001; NASSCOM CD-ROM

Chart 6



Indian software companies have diversified their specializations in a wide range of domains and industries. They are also able to undertake a variety of tasks. (Tables 6 & 7 ; Chart 7 & 8). Kumar (2002) observes that since the companies have diversified their specializations, it provided scope for diversified earning potentials. For instance the web-based revenue increased its proportion from 4.8 per cent to 16.6 per cent over the period 1998-99 to 1999-2000. Such diversifications have also equipped the companies to handle larger and more complex project than in the past. (Arora et.al, 2000)

Table 6

Major Domain Specialization of Indian Software Companies (1999-2000)

Domains/Sector	Number of Companies

	Offering Expertise
Banking, Insurance, Stock Exchange, Financial Accounting	247
Manufacturing, retail, trading & distribution	331
Transport/ airlines/ railways/ports	157
Web Applications/ Online Information Services	295
Engineering, Electronics, Design Automation/ Robotics	224
Medical & Health	163
Education, training/ entertainment	115
Telecommunications	174

Source: Kumar (2000b)

Chart 7

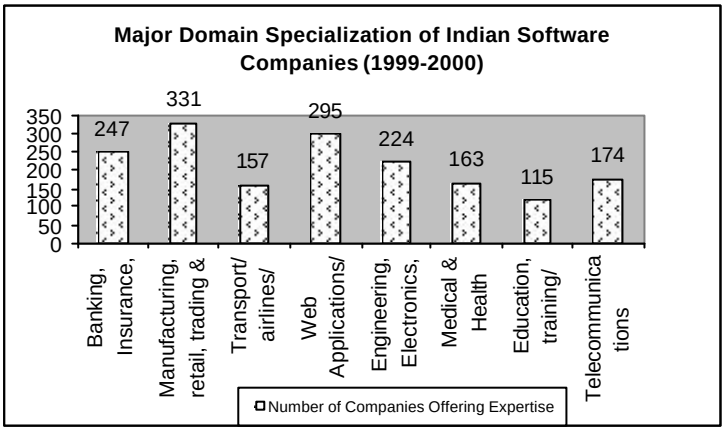


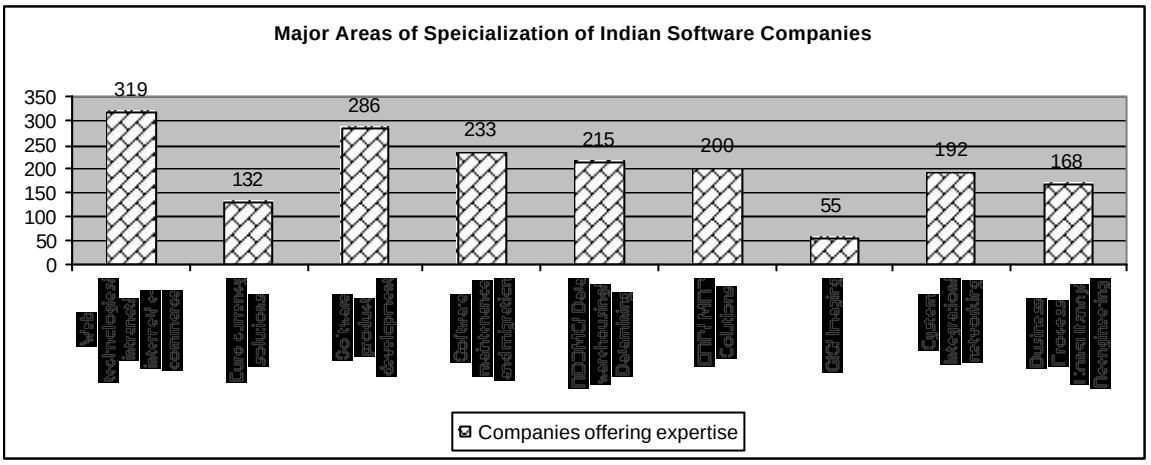
Table 7

Major Areas of Specialization of Indian Software Companies

Areas	**Companies offering expertise**
Web technologies/ intranet/ internet/ e-commerce	319
Euro currency solutions	132
Software product development	286
Software maintenance and migration	233
RDBMS/ Data warehousing/ Datamining	215
ERP/ MRP Solutions	200
GIS/ Imaging	55
System Integration/ networking	192
Business Process Consultancy/ Reengineering	168

Source: Kumar (2000b).

Chart 8



ICT has a tendency to cluster at specific regional locations and the relative size of the clusters shift from one location to another. Currently, 97 per cent of the software firms are working from Metropolitan cities and their suburbs. Although Bangalore is considered India's "Silicon City" today, the industry originated in Mumbai (Heeks, 1995). The business district of Nariman Point in Mumbai was the site of origin of the Indian software industry in the late 1970s. Rise in prices and commute times led to the industry moving to the Santa Cruz Electronics Export Processing Zone (SEEPZ) in the city's western suburbs.

The regional distribution of software industry is highly skewed even within the metropolitan cities, with about 87 percent of the firms clustering in and around the Mega cities of Delhi, Mumbai, Kolkatta, Bangalore, Chennai and Hyderabad in 2000-01 (Table 8; Chart 9 & 10).

Clustering within a location provides cost advantages and locations outside the cluster would engender higher transaction costs. Even at regions where this industry is in its infancy, we can observe tendency to cluster. There are however considerable differences among the mega cities on their relative share of software firms. While Delhi and its suburbs had nearly a quarter of the total number of firms, Kolkatta had only about 4 percent of firms. The southern regions of Karnataka, Tamil Nadu, Andhra Pradesh and the western region of Maharashtra had a concentration of more than 62

percent of all firms. This alludes to the fact that apart from high degree of clustering, the industry itself is highly localized at certain regions.

The typical software firm is a multi-product firm. Most small software firms are engaged in customized production. In general, the Indian software firms are involved in different software activities, such as content development, CAD, CAM, GIS etc. But there were considerable regional variations in the number of activities undertaken. For example, firms in Kochi/Thiruvananthapuram undertake only 7 activities, while there are 13 activities in Pune (Table 8). It suggests that there exist regional variations in the capabilities and conditions of firms to diversify into diverse activities. Further, it can be hypothesized that there is no one to one correspondence between the share of different locations and the number of activities undertaken. The locations such as Kolkatta and Pune elucidate this observation.

Table 8

Location of Software Firms 2000-01

	Percentage Share of Location	Average Number of activity
Ahmedbad/Gandhinagar	2.3	10.8
Bangalore	18.1	11.2
Kolkatta	3.7	11.9
Chennai	10.4	11.4
Delhi/Gurgaon/ Faridabad/Noida	24.3	10.7
Hyderabad	9.6	11.6
Kochi/ Trivandrum	1.6	6.7
Mumbai	21.2	11.1
Pune	2.2	12.9
Others	6.7	11.0
All India	100.0	11.20

Source: Abraham, (2003)

Chart 9

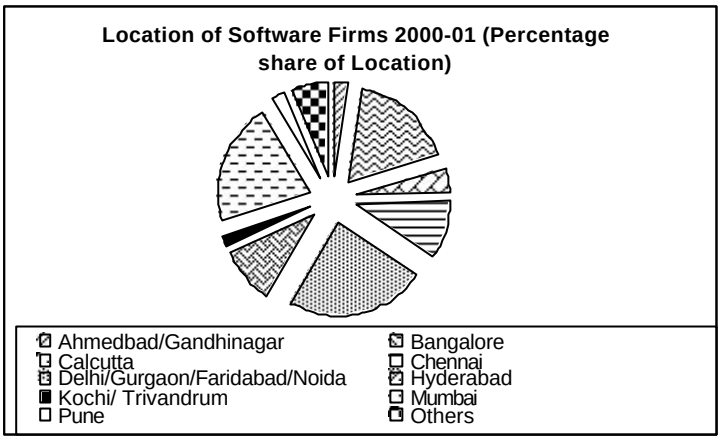
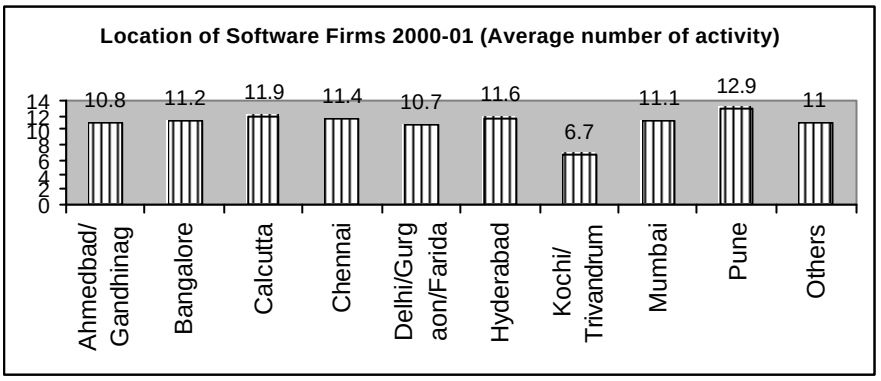


Chart 10



1.2.2.Hardware Industry in India

Computer hardware comprises of data processing equipment (computers), peripherals and networking products. There are four kinds of PC suppliers in India; they are: Multinationals (MNCs), Indian brands, Branded assemblers and Unbranded assemblers. There are certain specificities in the supply of hardware in India. In the true sense there is hardly any manufacturing of computer hardware in India. What are supplied in India are assemblages of components imported from other countries. As per the Manufacturing Association of Information Technology (MAIT) statistics, unbranded assemblers carry out majority of the PC assembling. The MNCs such as Compaq and HP procure their components from specific international vendors based on the corporate vendor sourcing policy. (Table 9; Chart 11). The assemblers have

been able to control the market mainly because of the import duty policy wherein the import duty for the complete system is higher than duties for component parts. The hardware segment has remained as an assembling segment mainly because of the restrictions in the growth of the domestic manufacturing sector. Liberalization of component imports and reductions in import tariffs would have encouraged all producers to increase the share of components imported from abroad. Also, import liberalization and the relaxation of regulations on foreign firms has increased the share of major international players in the domestic PC market.(Chandrasekhar,2001). Many firms, which were involved in hardware production, such as WIPRO, are moving towards sale of imported systems as well as assembling of imported components. The increased dependence of the hardware sector on imported goods would mean that the sector would have very low effect on growth and employment in the country. The computer hardware production is more capital intensive than software production. Probably, due to this fact, India has a comparative advantage of production of goods requiring human skill rather than machineries. The relative importance of computer hardware production in the ICT sector has declined over the years. This is evident from the fact that in the past years the share of hardware segment in the total ICT sector declined drastically to 15 per cent and 5 per cent in the peripherals (See Table2).

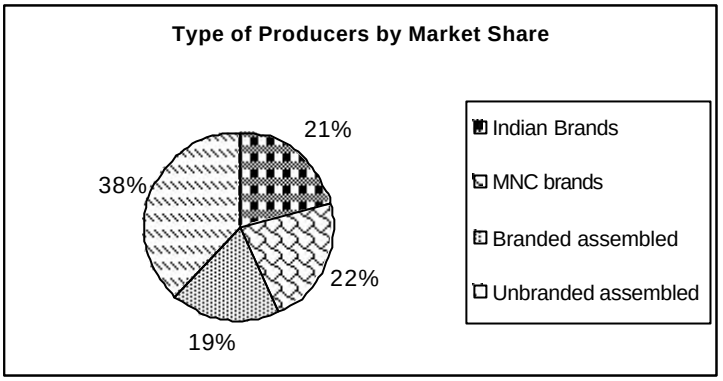
Table 9

Type of Producers by Market share

Indian Brands	21%
MNC brands	22%
Branded assembled	19%
Unbranded assembled	38%

Source: IT Industry Performance Mid-Year Review[19] 1999-2000, Ministry of IT, New Delhi January 21, 2000.

Chart 11



In terms of the structure of computer systems, the Indian market has a very large share of single user systems and it has been increasing (Table 10; Chart 12 & 13). This suggests that computers are fast diffusing into smaller markets and they are increasingly finding inroads into household and retail level activities. The MAIT Mid-Year review for 1999-2000 revealed that PCs sold to the business segment grew by 42%, while in households it was 58% during the previous year (1998-1999). In the small size establishments within businesses, i.e. those firms with less than 10 employees at the floor, PC consumption grew by 57% during the same period—a significant improvement in the PC penetration into the smaller sector. The socioeconomic class 'B' (the not so up-market households) has increased their share in total purchases to 38% compared with 28%, implying that PCs are finding their way into lesser affluent and not-so-up- market homes as well. (Gopalan, 2001).

Table 10

Structure of Sale of Computer Hardware (In Percent)

	2000-01		2001-02	
Hardware	Units	Value	Units	Value
Servers	2.20	17.94	1.67	16.56
Workstations	0.60	2.85	0.53	2.72
Single-user systems	97.20	79.20	97.81	80.72
Total systems (In Numbers)	1,978,452	10,059	2,085,969	9,295

Source: Dataquest

Chart 12

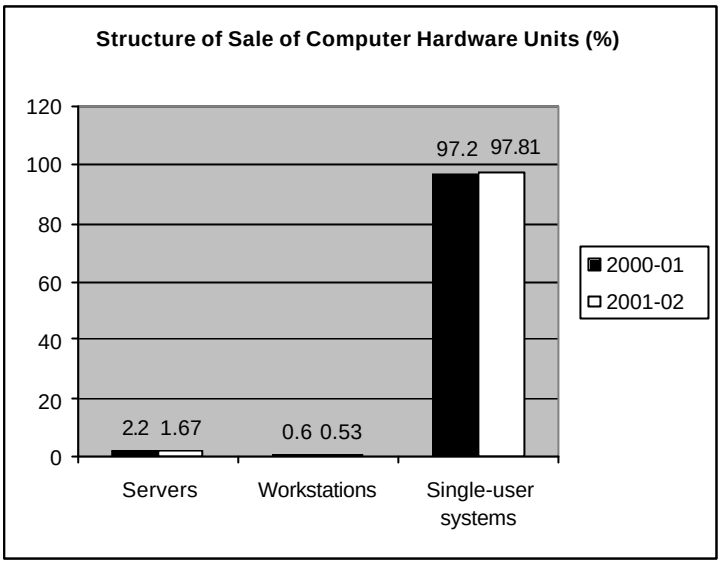
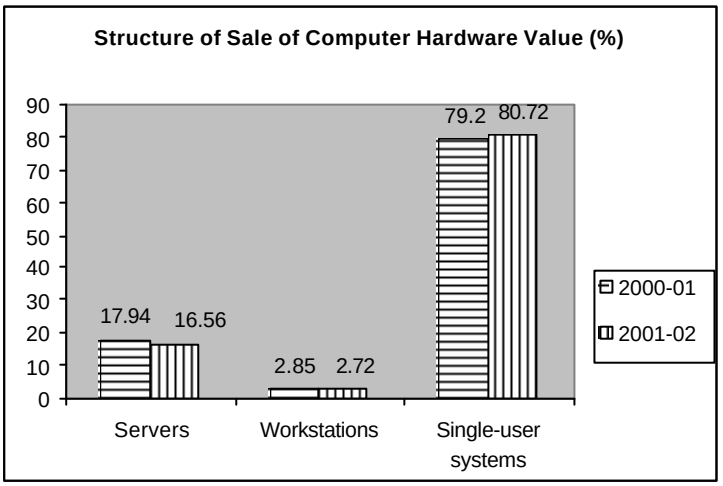


Chart 13



1.3.3 The IT-enabled Sector

IT–enabled services is a product of the 'digital convergence' of information technology and communication technology, which have facilitated a global electronic network. A whole new gamut of services, under the generic title IT-enabled Services (ITes) have cropped up, especially in the labour abundant developing regions of South Asia and South–East Asia. There are four types of IT-enabled services in India, they are the following: a) in house or captive centers, units that originally spin-offs, business

process outsourcing units and broad based service producers who offer consulting or IT services in addition to BPO. (Chandrasekhar, 2002)

IT-enabled services take advantage of the cheap skilled labour and also the international time differentials. ICTs allow for the increased tradability of service activities, particularly those that have been constrained by the geographical distance and temporal separation between production and consumption. It has also enabled spatial division of labour in the production of certain services such as legal databases, remote maintenance of accounts, data processing etc. The essential difference between IT-enabled sector and the IT-using sector is that while latter had existed before the advent of IT and had utilized traditional production techniques, the former sector is the product of IT and cannot exist independent of it. In terms of sourcing of work many large firms have their own out location units in different parts of the world. Apart from that there are also specialized outsourcing firms which work as independent units taking up outsourced works of other firms.

The outsourced or cross-border IT-enabled services are now receiving greater attention as this category of ITes has a great potential for growth and contribution towards employment opportunities in India. The spectrum of I.T-enabled services in India is fast getting diversified into a variety of activities such as Call Centers, Medical Transcription, Back Office Operations, Revenue Accounting, Insurance Processing, Legal databases, Content Development, Payroll, Logistics Management etc.

The NASSCOM survey (NASSCOM, 1999) of I.T. Enabled Services estimated that this sector employed 41,000 people in 1999 and they generated revenue of Rs. 20.30 billion (Table 11). This is expected to increase to Rs. 810 billion by 2008 and the sector is projected to employ more than 1 million people. A huge pool of English speaking and computer literate workforce, relatively lower wages and availability of infrastructure for setting up I.T-enabled services have provided the competitive advantage for India to be a destination for the cross border outsourced IT-enabled services. The proliferation of I.T-enabled services and its continuing demand-led

growth may well open up strong opportunity for India in terms of generating employment as well as increased export. However, the current trends are such that for most IT-enabled service providers in India, a majority of the revenue comes from serving clients in industries such as banking and finance, insurance, e-commerce, software, telecom, media and entertainment, retail trade and airlines. Most of them currently focus on a narrow portfolio of services, settling for low-end work. While most IT- enabled service companies plan to enhance the existing skills, expertise and established reputation with clients to grow their portfolio of services, they remain cautious about migrating their service portfolio to high value services (www.dqindia.com, 29th July, 2002)

Table 11

Revenues of IT-Enabled Sector (Rs.Billion)

IT Enabled Services	**1999**	**2008 (Projection)**
Back Office Operation/ Revenue Accounting/ Data Entry/ Data Conversion	6.8	1900
Remote Maintenance and Support	2.7	1350
Medical Transcription/ Insurance Claim Processing	3	110
Call Centres	1	60
Data Base Services	0.7	65
Content Development	6.1	250
Total	20.3	810

Source: NASSCOM (1999), NASSCOM- Mckensey Report, New Delhi

Table 12 depicts the employment and revenues from the IT-enabled services. Both employment and revenue have increased substantially between 1999 and 2002. This growth has been impressive within the short span of three years. Contribution of IT-enabled services to the total IT exports has also been on an increasing path between 1999 and 2002; it increased from 14 per cent to 19 percent.

1.3.ICT DIFFUSION IN INDIA

We have already observed that ICT sector has been growing in an impressive manner. It is important to examine the extent of diffusion of ICT because to gain international competence and to sustain the growth diffusion of it within the country is critical. Diffusion can take place in four different ways; they are the following:

1. Through the growth of IT sector itself
2. Through the diffusion of information technology into the manufacturing sector, which transforms production processes and increases productivity.
3. Through the utilization of IT networks by producers and consumers to undertake online transactions, which would reduce transaction costs and alter market structures.
4. Through the utilization of IT network by governments, communities and individuals to share/provide information and offer various services either for a fee or free of cost. (Chandrashekhar, 2002)

If IT sector can get diffused in the developing economies, then the greatest attraction of ICT is its ability to narrow down global income inequalities. Not only that ICT can be a growth engine on its own by increasing efficiency in the production process, but it can also be instrumental in redistribution of wealth and poverty reduction by reaching the less privileged segments of the economy, such as the rural areas and women. Yet, the real question is whether it is actually able to diffuse into other sectors and enhance growth and development. Many studies have confirmed the positive pay offs of IT in enhancing growth and development. Kraemer and Dedrick (2001) find evidence of positive correlation between IT expenditure and growth in GDP and productivity in the Asia-Pacific region. Similarly, Jorgenson and Stiroh (1999) and Oliner and Sichel (2000) have argued that the ongoing technological innovations in ICT have augmented economic growth in many industrialized economies by restructuring the organization of the primary factors of production, viz; capital and labour, especially the latter.

In the Indian context, however, available evidence shows that in the manufacturing sector, there is hardly any use of IT. Prevalence of IT use was confined to accounting and management, which accounted for 35 per cent of the total work-load (Table 12). The utilization of networking facilities, Internet and robotics was extremely low at 1.5 to 4 per cent. It is evident that till now the Indian manufacturing sector have not tried, in a large scale, to utilize IT in the production process. But there are exceptions as well; for instance in the motion pictures industry about 27 percent firms use robotics and in non-conventional energy industry 25 percent firms use robotics and artificial intelligence.

India's enviable growth in the ICT sector thus is not flowing into the rest of the economy. The export-oriented growth of the software industry in India has so far received ensured demand for abroad, but not so much from internal market. It is essential that India develop a specific diffusion policy, especially in the manufacturing sector to exploit this technology so as to achieve greater productivity, redistribution and growth.

Despite all these, there have been many attempts both by the government and by the Non-government sectors to harness the potential of the technology. New innovations in the technology that would suit the Indian populace have been another move in this direction. For example, the Simputer, developed from Indian Institute of Science, Bangalore and Encore, a software company providing computing facility at U.S.$200 compared to the P.C. at $650.00. Similarly, the corDECT of Indian Institute of Technology, Madras provides advanced wireless access system and Midas Communications and Analog Devices Inc. provide access with seamless integration of voice and Internet services. The investment in the equipment, U.S.$ 45000, can serve about 1000 customers in a radius of 10 to 25 Kms in rural areas (World Economic Forum, 2003).

Table 12

The Use of ICT in the Manufacturing Sector of India

(Percentage to total number of factories)

NIC Classification	No. of Factories	Computer for Managerial	Using Network	Robotics, Using computer in

	(Numbers)	/accounting work		Internet	production process
Food products	14695	13	0.8	1.4	0.9
Other food products	8109	24.2	1.4	2	1.1
Beverages tobacco etc	8668	47.8	0.4	0.3	0.2
Cotton textiles	9227	22.3	0.5	1.9	1.5
Wool silk manuf. Of textiles	3989	49.3	1.3	2.3	1.9
Jute& other veg fibre textlites	503	16.7	4	3.8	2.8
Textiles prodn incl. Apparel	5409	51.3	3.2	11.3	2.7
Wood & wood products	3787	9	0.4	1	0.2
Paper& paper products	6304	38.5	1.8	3.7	4.7
Leather products	1742	37.6	1.9	7.2	0.3
Basic chemicals & products	9357	50.7	2.9	5.6	2.6
Rubber plastic & coal	7597	42.6	2.8	4	1.6
Non-met. mineral products	11376	13.4	0.4	0.9	1.1
Basic metal & alloys	6915	41.9	0.9	3.7	1.7
Metal products	8243	31.7	0.9	2.9	1
Machinery & equipment	8208	44.4	2.1	5.6	2.7
Electric machinery & equipment	5743	55.8	3.5	10.9	4.9
Transport equipment	3999	47	1.6	7.2	2.6
Scientific equipment	2243	48	4	14	4
Repair of capital goods	2240	25.9	0.8	2	0.4
Electricity	3644	64.7	0.9	3.1	3.2
Gas and steam	80	75	2.5	3.8	5
Water works and supply	293	10.6	0.7	1	0.7
Non conventional energy	4	50	25	25	25
Storage& warehousing	1078	9.7	0.4	0.4	0.1
Sanitation	102	3.9	0	0	0
Motion picture etc	51	64.7	7.8	0	27.5
Laundry & others	94	18.1	0	0	0
Repair services	1966	37.6	2.6	4	1.1
Total	135666	135666	47067	2043	5046
Percentages	100	34.7	1.5	3.7	1.8

Source: Annual Survey of Industries (1998-99)

India is one of the pioneers in introducing ICT in the realm of governance; to begin with, its applications were mainly for cost optimization, decision-making, reducing corruption, project monitoring and rural development. By the late eighties establishments such as NICNET connected government users, EDUNET connected educational institutions and INDONET for industrial users. (Bhatnagar, 1990) Many

State governments introduced ICT to enhance administrative performance and e-governance found its ways at different levels of administration. E-governance in India tries to develop infrastructure, train human power and to initiate policy changes. Details pertaining to some of the major E-Governance projects are provided in Table 13.

Table 13
Major E-Governance projects initiated by Government Department/Agencies at the State and District Levels

Project	Implementer (s)/ Collaborators	Technology/ Innovation	Expected/ Actual outcome	Interface Agency	Location	Remarks
India Health Care Project	Government of India, Apple Computers, CMC Ltd., Institute of Design, CDIT	Navigation based on iconic representations on a modified Newton Message pad	Reduce time spent on paper work; increase the accuracy of data supplied, electronic storage of village level health data.	Rural health Care Workers (Auxiliary Nurse Midwives)	Pilot Project run in Rajasthan	Obsolete Technology from Apple Computers, Newton Technology is no longer in production in Apple
BHOOMI	Government of Karnataka, NIC Compaq	Compressing the entire land related data into digital format and setting up touch-screen kiosks in 177 talukas from where farmers could get the revenue document by paying Rs. 15 as user fee. Proprietary software	Curbs corruption, demystify land registry operation; enhance transparency, faster and more reliable delivery.	Land registration Department	Karnataka	The system has been put into operation after validation of 20 million printouts through village officials and after distributing them to 6.7 million farmers for their feedback. A total 700 officials for 177 sub- districts have been trained for the propose

		incorporating Compaq's bio-logon metrics system, which authenticates users of the software using their fingerprint. Software sensitive to variations in manual records across districts.				
Maharashtra Emergency Earthquakes Rehabilitation Project	Government of Maharashtra, DFID, UNDP, GoI, World Bank	VGF and VSAT network for connectivity and GIS based Disaster Management Information System	Better resource mobilization, faster decision making, cost reduction and efficient use of information pool.	Government officials and NGOs	Maharashtra	Effectiveness depends greatly on commitment of personnel involved.
Warna Wired Project	GOM, NIC	A complex IT infrastructure with high-speed wireless LAN with the VSAT and Mast for its omni-directional antenna of 2Mbps bandwidth, proxy server.	Increase efficiency and productivity of cooperatives. Create more employment opportunities.	Cooperative Societies	Maharashtra	A strong example of State-Civil society partnership
Moderniza	National	Micro	Disincentive	Milk	Gujarat	Diffusion

tion of milk collection centers	Diary Development Board	Processor based milk collection system consisting of milk weighing system, data processor, and printer to measure the butterfat content of milk test the quality of milk and make prompt payments to farmers.	s of adulteration, reduced time for payment, confidence building.	Cooperatives		depends on Private sector initiatives for mass production.
Computerization of Postal System	Government of Andhrapradesh, CMC	Proprietary hardware based on Motorola 68k processor with LCD and keyboard called Computerized Universal Postal System (CUPS) incorporating regional languages for interface.	Optimization of regular work schedules, single window operation, reduction in delivery time.	Post Offices	Andhra Pradesh	Low level of diffusion, though exclusively designed for rural areas, tested only in a three urban post offices.

Computer Aided Administration of Registration Department	GoA, AP Technology Services, NIC, Fortune Informatics Ltd., NIIT	Electronic delivery of land registration services through a client-server architecture system using the CARD software development for the purpose, hosted by AP State wide Area Network (ASPWAN) using 2MPB optic fibre link.	Demystification of land registry, enhance transparency, faster and more reliable delivery, automation of indexing and accounting, improve citizen interface.	Land Registration Department	Andhra Pradesh	Huge Cost of maintenance, Service charges to be levied for covering establishment costs.
GyanDoot	GoM, Zila Panchayat, IIT Chennai	Pentium II remote access Server and kiosks with OFC. Low cost TDMA based WLL indigenously developed by IIT Chennai to improve bandwidth and connectivity problems.	E-Governance, E-Education, enhancement of efficiency of governments, prompt service delivery.	IT Department, GoK, through IT Mission, Kerala	Kerala	Functioning only in District Centers. Not accessible to vast Majority of villagers and those who live outside the city limits. Low user turn out.
FRIENDS	Government of Kerala, C-DIT, Comtech IT	Fees and charges for different services could be	Eliminate the queue and avoid long waiting time.	IT Department, GoK, through IT Mission,	Kerala	Functioning only in District Centers. Not accessible to vast Majority of

	Solutions	paid in a single location with computerized billing. The software, which uses ASP, Windows 2000 and SQL RDBMS, is programmed to accept payments due to different agencies by incorporating the specific rules and regulations regarding remittances pertaining to each agency.		Kerala.		villagers and those who live outside the city limits. Low user turn out.
IT@School	GoK, Microsoft	Computers bought by the school should have pre- installed Windows9x as operating system.	More effective dissemination of computer knowledge in schools.	Department of Education, Government Schools	Kerala	Criticized for it indifference to use FSF, delay in the installation of equipments and publication of text books as well as training for teachers.
Sevana	GoK (IT department) State Library Council, IMK	Package named 'Sevana' provides information on various government schemes, programmes	Enable the rural citizen to have free access to the internet, enhance transparency and efficiency.	State Library Council	Kerala	Pilot project has been started in Kallara village in Trivandrum.

		, general information on local bodies, links to important sites and other facts relevant to the rural populace.				

Source: Sreekumar(2002)
Note: This is not an exhaustive list. Moreover, computerization projects of Government Department without the involvement of citizen interface are also omitted.

National information Centre of Government of India and state level educational institutions collaborated to launch networks of fibre-optic cables, V-SATs, PCs etc. However, E-governance has to go a long way to attain sustainable human development and eradication of poverty.

E-governance is being experimented at various levels of administration by different government bodies. ICTs can significantly reshape the relationship between the government, private sector and the civil society by increased communication and networking, which in turn would provide greater transparency and accountability. Andhra Pradesh and Madhya Pradesh had been the two pioneer States in introducing ICT in governance. The annual plan of each department/sector in Madhya Pradesh Government have detailed sub-plan for IT. A distinct budgetary head of account for IT related activities is introduced in the annual budget. An action plan is prepared to ensure that all offices of the district Government including those at the sub-district levels are computerized and networked by the year 2003. Another similar example is the computerization of the *Mandal* Revenue Offices in the State of Andhra Pradesh. As part of the project all the MROs (totalling 1124), the revenue divisional offices (78), the collectorates (23), the office of the commissioner of land revenue, and the directorate of economics and statistics at Hyderabad are getting computerized. This involves data collection, development and implementation of appropriate databases and development of human resources through intensive training. Storage of a wide range of information, including documents relating to property rights in computerized

databases and providing public access to these databases would promote transparency that strengthens democracy, empowers people and speeds up decision-making.

Another type of initiative emanates from the civil society, such as the M.S. Swaminathan Foundation, which is implementing the “information village” project in four villages of Tamil Nadu. The foundation provides villages with free technology and information in exchange for the villages’ promise to house the computers and staff who are operating there. The foundation extents its expertise and information on technical matters relating to best agricultural practices, combating pest attacks; but more importantly it provides ready access to information on market conditions, opportunities and prices that allow small farmers to maximize incomes from their output.

The gain in consumer surplus (the difference between the price that a consumer actually pays and the price that the same consumer is willing to pay) depends not merely on the total amount of IT spending but also on the composition of IT spending. In the case of India, it is an ICT exporting country and its performance in the internal consumption is said to be not impressive and this could be one of the reasons for lesser gains in consumer surplus when compared to other countries such as U.S., U.K., Singapore, Australia and New Zealand. India is facing an adverse terms of trade because the prices of commodities (ICT) is generally falling it is importing commodities which are becoming more expensive. Further, the general wage hike in the IT sector is adversely affecting (Dutch disease) the general growth of other sectors (Joseph, 2001). In general what one can state at this juncture is that, internal consumption of ICT products have to be promoted while maintaining the exports of this booming sector.

There are many exercises of IT diffusion at the pilot study level, but they have not made sufficient inroads into the economy that any claims can be made regarding its impact on the macro economy. If ICT is to make significant impacts on the economy, it is essential that there are greater concerted and coordinated efforts by the

governments, private sector and civil society. However it is not lack of political will alone that is preventing ICTs to proliferate into various sectors. A major impediment for ICT diffusion is the lack of sufficient infrastructure.

Comparison with other developing and developed economies shows that India has one of the lowest ICT expenditures as a share of GDP (Table 14; Chart 14). During the period 1990-99 the India's share in its total expenditure increased from 1.7 to 3.5 percent, while India's competitor in ICT, namely China, was able to increase the expenditure share form 1.9 to 5 per cent. The declining share of public infrastructure expenditure in India would act as an impediment to the development of an infrastructure base for Indian ICT. The number of Internet hosts in India is at the abysmally low figure of 0.2 per 10000 people, in comparison to 1479 per 10000 in U.S.A. But the number of Internet users in India had increased from negligible figures in 1992 to respectable figures by the turn of the Century. (Chart 15). Thus, while the stock of users is increasing the density of use of Internet is very poor for the economy to take advantage of the communication and networking economies. The availability of PC is a basic requirement for use of IT. In India only 3.3PCs are there per 1000 people in 1999. China, which stood at almost equal footing to that of India in 1990 have increased the density of PC four times more than that of India (Chart 16).

Table 14

Indicators of Information Technology

Country Name	ICT Expenditure (% of GDP)		Internet hosts (per 10,000 people)	Internet users(in thousands)		Personal computers (per 1,000 people)	
	1992	1999	1999	1990@	1999	1990	1999
Brazil	3.5	5.8	18.5	5	3500	3.1	36.3
China	1.9	4.9	0.5	N/A	8900	0.4	12.2
Finland	4.7	5.9	1117.0	70	2143	100.0	360.1
India	1.7	3.5	0.2	1	2800	0.3	3.3
Israel	4.6	7.4	187.0	5	800	63.3	245.7
Ireland	5.5	6.5	155.6	2	679	85.7	404.9
Netherlands	6.7	7.1	403.4	80	3000	93.3	359.9
United Kingdom	7.2	9.4	268.8	100	12500	107.6	302.5
United States	7.5	8.9	1479.7	3000	74100	216.8	510.5

Source: World Development Indicators,(2001), IBRD

@ Internet users for Brazil, Finland, Ireland, Netherlands, U.K. and U.S.A. is in 1991 and India is 1992

Chart 14

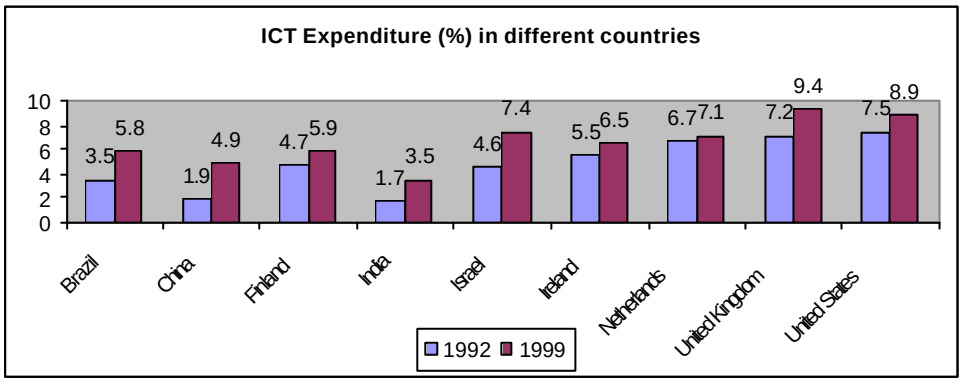


Chart 15

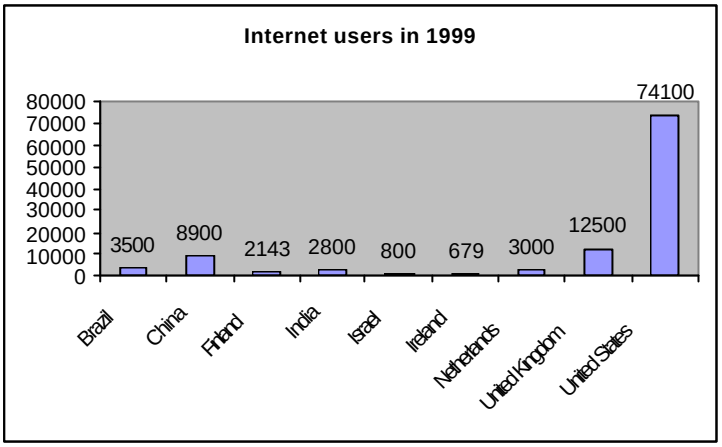
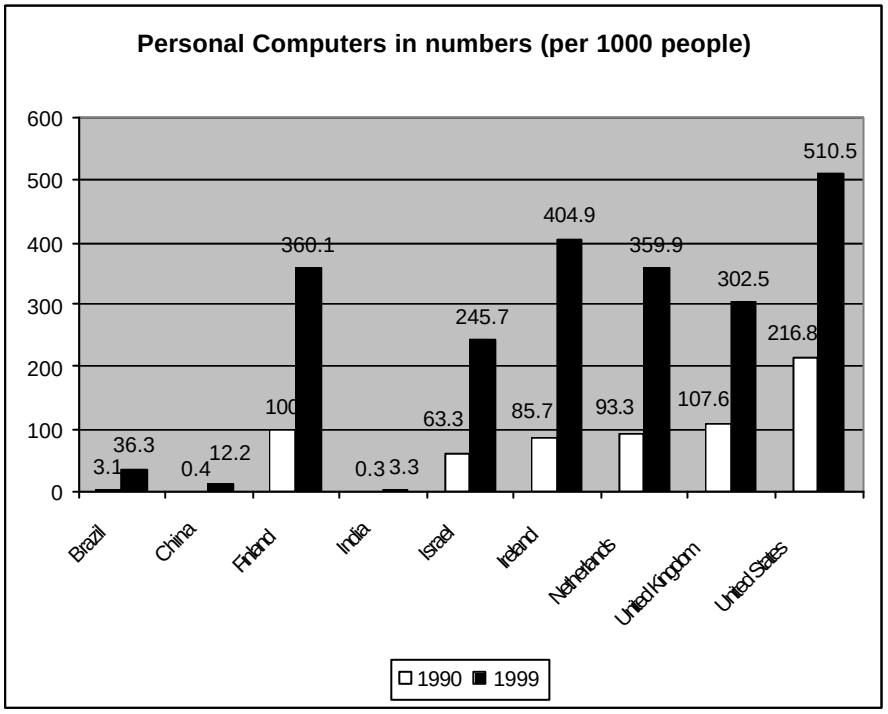


Chart 16



It is also contended that India's Internet users have not brought in any of the Indian languages into the web. It is said that there may be e-zines and several entertainment and localized information sites, but there is no focus on access to services for the regional languages (Joyojeet Pal, 2003) unlike China's experience.

In the case of communication indicators too India's records are abysmal in comparison to developed countries as well as developing economies like China and Brazil (Table 15). Interestingly, the average minutes per subscriber's international outgoing traffic has declined for both India and China during the period 1990 to 1999. Again, in 1990 both China and India had reported same levels of telephones and mobile phones, but by 1999 China had outpaced India by many times in both telephone lines and mobile phones. But both countries are very much below in this case when compared to the developed economies.

Table 15

Indicators of Communication Technology

Country Name	International telecom, outgoing traffic (minutes per subscriber)		Mobile phones (per 1,000 people)		Telephone mainlines (per 1,000 people)	
	1990	1999	1990	1999	1990	1999
Brazil	17.5	23.6	0.0	89.3	65	149
China	51.1	17.9	0.0	34.1	5.9	85.8
Finland	69.7	151.1	51.6	651.0	534	557
India	29.4	17.9	0.0	1.9	5.9	26.5
Israel	72.6	279.0	3.2	472.0	343	471
Ireland	265.4	573.0	7.1	447.4	281	478
Netherlands	130.0	224.0	5.3	436.0	464	607
United Kingdom	99.6	179.7	19.3	457.0	441	567
United States	58.9	154.6	21.1	311.6	545	664

Source: World Development Indicators,(2001), IBRD

Even within the country the trends in telecommunication density point towards a regional digital divide; States like Bihar, Orissa, West Bengal and Uttar Pradesh are having only a marginal position in the ongoing technology revolution. During the period between 1997 and 2000, Punjab and Kerala almost doubled their Tele-density,

and most states were able to record at least one unit rise in the Tele-density in the same period. At the same time, West Bengal, Uttar Pradesh, Orissa and Bihar had made slow progress. Telephone lines being an essential component of the ICT the regional variations in the Tele-density would mean the productivity, growth and development benefits of ICT would not reach certain geographical locations and this result in a regional digital divide in the economy (Table 16; Chart 17).

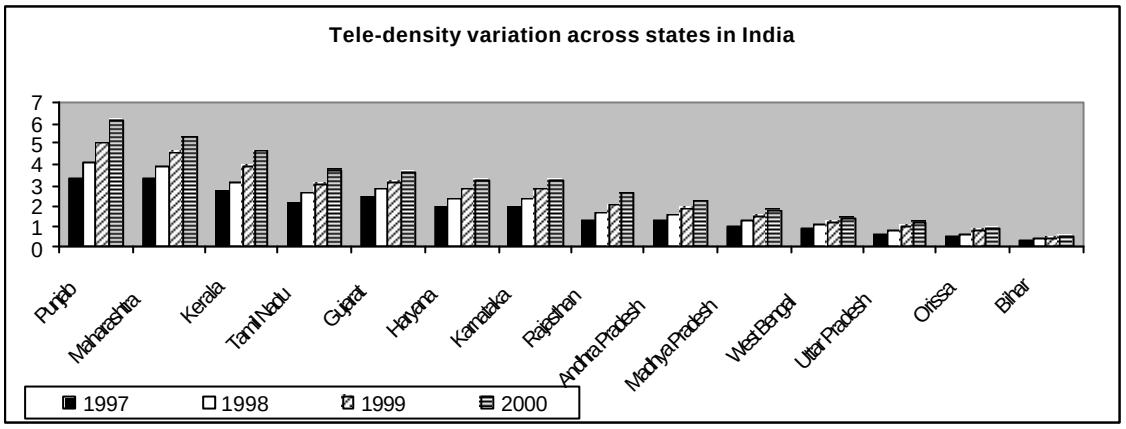
Table 16

Tele-density Variation Across States of India

State	1997	1998	1999	2000
Punjab	3.34	4.1	5.03	6.18
Maharashtra	3.38	3.92	4.55	5.28
Kerala	2.67	3.22	3.88	4.68
Tamil Nadu	2.14	2.57	3.09	3.72
Gujarat	2.44	2.79	3.19	3.64
Haryana	2.00	2.36	2.8	3.31
Karnataka	1.98	2.34	2.76	3.26
Rajasthan	1.32	1.65	2.06	2.57
Andhra Pradesh	1.35	1.59	1.87	2.2
Madhya Pradesh	1.06	1.27	1.52	1.82
West Bengal	0.96	1.09	1.23	1.39
Uttar Pradesh	0.68	0.83	1.02	1.25
Orissa	0.59	0.69	0.82	0.96
Bihar	0.36	0.43	0.5	0.59

Source: Department of Telecommunication,

Chart 17



Development rural connectivity, E-Governance, Wired Microecomerce, IT-enabled Artisanal Industries, Computer training, Tele-Health, research Advocacy and Consultancy Resources etc. could allow the rural citizenry to make more informed choices in their daily life. However, despite the economic promise of ICTs the immediate impact of it in rural areas are far from equitable due to factors such as differential access to capital resources, literacy and education, access to education, agricultural technologies, etc. These inequalities are the result of socio-cultural asymmetries such as land ownership and caste discriminations.

Low level of proliferation of the basic infrastructure for the development of ICT in India acts as a deterrent to diffusion of ICT in India. The current hype surrounding the ICT and its impending effect on the development of the economy may well remain as hollow promises unless adequate measures are taken to establish linkages with the ICT sector and the rest of the economy through the construction of physical infrastructure required to increase the use of ICT in the economy.

It is argued that government has not been able to ensure technology absorption and development in the hardware sector and to mobilize revenue from the ICT sector. This has led to inadequate government expenditure on infrastructure development for the sector and this is likely to affect the sustainability of the growth rate attained by the

sector. It is argued that government expenditure is required to reduce the widening digital divide as well as for the growth of the industry itself. (Chandrasekhar, 2002)

Part II

2.1 Decent Work and ICT

The structure of the traditional labour market is fast changing. Permanent jobs are becoming an anachronism. Contractual work is becoming the prevalent form of employment. Concepts such as flexibility, informalisation and informationization are becoming the evolving terms of the present day economic order. The ICT provides flexibility of action, space and time for the worker. The shop floor, as the production space is also fast losing its prominence, is becoming a constantly shifting space. Teleworking e-lancing, and other forms of digital work forms are taking the place of the traditional shop floor and common workspace. These and many other changes in the production process caused by the introduction of ICT are altering the dynamics of relation between work, worker and employer. This section examines various indicators of decent work in the ICT sector as well as the new technology's impact on employment and labour.

2.1.1. Employment Opportunities and Skill Profile in ICT Sector

The classical understanding on the relationship between technological change and employment seems to be straightforward. Either the introduction of new technologies leads to more efficient production processes, reduces costs by saving labour, capital materials, energy and other factors of production; or it leads more directly to the development of new products that generate new demand. (Soete, 2001) IT industry repudiates this understanding of technological change and employment, as this understanding is no longer valid in the case of the new technologies, especially the ICT. The employment creation and destruction effects of ICT are enmeshed in many direct and indirect employment effects. The increasing tradability of service owing to separation of production from consumption makes it more similar to the manufactured goods while automation and outsourcing is dampening employment in the manufacturing sector. Simply counting new jobs created or old jobs destroyed cannot

assess whether the net balance of these direct and indirect effects will ultimately be positive or negative.

Many studies have recorded the *disintermediation effect* wherein the middle level and routine workers are replaced by computers and automated machines. Jorgenson and Stiroh (1999) concluded that the continual decline in rental price of computers have led to rapid substitution of this equipment for other inputs in the manufacturing sector of USA. Tulpule and Dutta (1995) illustrate the severe labour displacing effects of Micro electronic technologies in the Indian textile industry. Such labour displacing effects have not been compensated by a sufficiently large increase in output in the case of most firms.

However, in the case of service sector the possibility of codifying services and converting services to packaged goods, mainly through the use of ICT, have increased the possibility of production and marketing of services. This means that the employment opportunities generated in the service sector increases the impact of the ICT. For instance, The introduction of Automatic Teller Machines for basic banking services would reduce the number of clerks required in the bank but can increase the demand for technicians and managers. The use of credit and debit cards, similarly have an indirect effect on employment. It increases greater accessibility to limited credit, which leads to higher consumption expenditure, greater demand and, hence higher levels of employment. There are arguments that technological progress is skill biased which makes less skilled labour redundant. There are also arguments that technology codifies knowledge and 'deskill' many of the skilled workers. The skill bias in the technology is reflected on the wages as well. The wage rates are found to be rising among the skilled workers, whose demand has increased, in comparison to the unskilled workers.

Autor, Katz and Krueger (1998) analyzed aggregate changes in the relative supplies, educational levels and wages of workers from 1940 to 1996 and found strong and persistent growth in relative demand favoring college graduates. This implies rapid skill upgrading within the industries due to the effect of computerization. Shaw ( ), using data on steel manufacturing in U.S, Japan and France, provides evidence to

show that IT use leads to increased demand for skilled personal. Rather than mechanical skills of physical dexterity, the skills needed are communication skills and problem solving skills. In a study on the automobile industry in India (Vijayabhaskar, 2002) records polarization of skills due to the introduction of computers in the production process. With the introduction of new technologies came new management technique, which placed emphasis on multi-skilling. While the unskilled workers are asked to work in other departments, the skilled workers are put to skill up gradation.

Autor, Katz and Krueger (1998) provide evidence to the argument that the use of computer has led to higher wage levels. Using four-digit NBER productivity database, the authors have argued that the within-industry wage differentials between computer users and non-users have widened. But there are diverging views on the mechanism through which ICT affects wages. The neo-classical argument is that ICT leads to a rise in productivity, which gets reflected in wage rates. Krueger (1993) argues that new technology causes wage disparities but this is not due to productivity. He attributes the wage gap to 'unobserved personal heterogeneity'. Autor, Katz and Krueger (1998) argued that it is the initial stock of computers, rather than a change in stock of computers that would explain the wage differentials better. Acemoglu (1998) contended that the wage differentials that existed between computer users and non-users were the premium for the skills acquired by the computer user. Within this framework, let us examine the emerging issues related to employment and its various dimensions in ICT sector in India.

There is no doubt that the growth and diversification of the ICT industry in India has had significant employment implications. However, more than the current level of employment, what is considered crucial is the future employment generating potential of the sector. Data pertaining to the current level of employment in the software and IT enabled sectors are depicted in Tables17 and18 (Chart 18).

Table 17

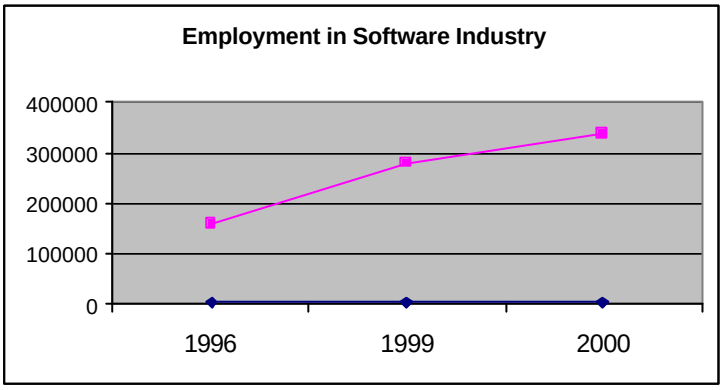
Key Characteristics of Employment in Software Industry

Parameters	1996	1999	2000
Software Professionals (including those in non-commercial organizations and user organizations)	1,60,000	2,80,000	3,40,000
Of which engaged in Software development (%) -Marketing and relationship development (%)	 70 10	 67 11	 63 14
Median Age (yrs)	28.4	26.2	25.7
Proportion of IT Degree holders (%)	75	n.a	n.a
Proportion of those having 5 yrs. Experience (%)	60	50	60
Rise in Basic Salary over previous year (%)	21	21+ESO	16+ESO*
Attrition Rate (%)	17.2	16	14

Notes: *Supplemented by Employee Stock Options. 41 companies have offered ESOs to their employees.

Source: Kumar (2000b) based on the respective Nasscom Surveys.

Chart 18



Software industry offers a significant number of job opportunities to the youngsters and over time the median age of the employees is decreasing. The compound annual growth of employment recorded at 28.5 per cent recorded over the past 3 years, though impressive from the standards of growth of jobs in the national economy, is only half of the growth of the revenues in the industry.

Table 18

Employment in IT-Enabled Sector

IT Enabled Services	1999	2008 (Projection)
Back Office Operation/ Revenue Accounting/ Data Entry/ Data Conversion	14,000	2,60,000
Remote Maintenance and Support	4,100	1,80,000
Medical Transcription/ Insurance Claim Processing	6,100	1,60,000
Call Centres	2,800	1,00,000
Data Base Services	1,400	1,00,000
Content Development	12,600	3,00,000
Total	41,000	11,00,000

Source: NASSCOM (1999), NASSCOM - Mckinsey Report, New Delhi

NASSCOM projects that the ICT sector in India would require 2.2 million IT professionals, 1.1 million in the IT proper and 1.1 million in the IT-enabled sector, by the year 2008. The Report forecasts different types of the skill requirements; Of the 2.2 million, 18 per cent of them have to have web skills, 28 per cent of them have to possess functional skills and 54 per cent of them would require technical skills.

Apart from it, there are other spillover effects like job opportunities in training and education, informatization in traditional sectors etc, which would build a steady and rising demand for IT skills in the near future. Ministry of Human Resource Development have projected that the creation of new employment opportunities would be to the tune of 7 million workers, directly or indirectly linked with the IT sector.

There is no doubt that the booming growth of ICT sector in India in the 1990s has generated large employment opportunities for the educated, especially the technically skilled, which is reflected in the decline in unemployment rates in this segment in the period 1993-94 to 1999-2000 (Table19; Chart 19).

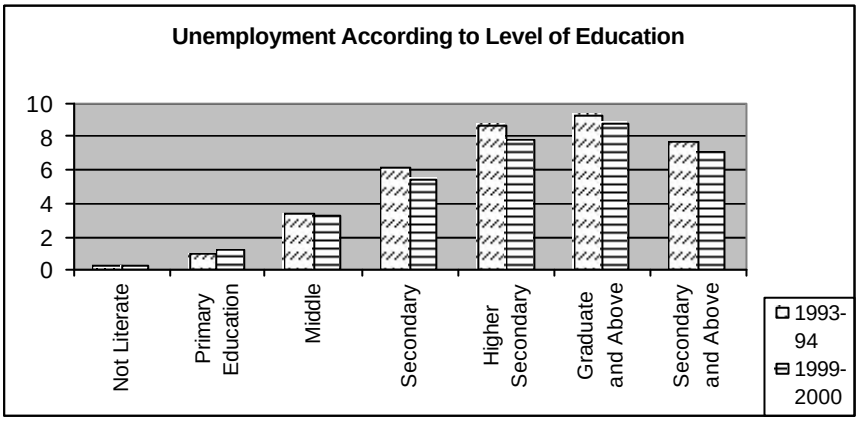
Table 19

Unemployment According to Level of Education

Level of Education	Unemployment Rates	
	1993-94	1999-2000
Not Literate	0.2	0.2
Primary Education	0.9	1.2
Middle	3.4	3.3
Secondary	6.2	5.5
Higher Secondary	8.7	7.8
Graduate and Above	9.3	8.8
Secondary and Above	7.7	7.1
ALL	1.9	2.2

Source: Dutt,(2002)
Note: Unemployment Rates Based on UPSS

Chart 19



Taking into account of the type of exports of Indian software, though India is still having a large share of low value adding exports that require low levels of skill, we can state that demand for skill requirement in the economy is rising rapidly. This trend is opposed to the apprehension that the new technologies reduce skill requirements. (Bhasker, Aranowitz and Difazic, 1994). There has been a marked decline in the 'Body shopping' form of software exports, and for the first time in 2001-02 on-site form of exports have been reported lesser than that of off-site exports. The on-site biased

structure of exports generates a gender-based division of labour, even though the technology is hailed to be gender neutral.

The new economy requires knowledge workers, with specific skills. The skill requirement of this industry is very flexible and is subjected to fast rate of obsolescence. Many firms report that they recruit new employees not on the basis of their specific IT qualifications but on the basis of their adaptability and 'learnability'. It suggests that it is possible to transform work activities into repetitive routine as proposed by the 'degradation of work thesis'.(Aranowitz and Difazic, 1994) It is essential that according to the rising demand for skills, adequate skills be developed in the economy. There were 1270 colleges in the country as on 04.05.2000 with a total intake of 205153. 1032 of these colleges offered IT courses with an intake of 66214 (37%). In addition, IITs, IIITs, IISc, Bangalore have an intake of nearly 7000.Apart from that many students from other engineering courses also migrate into the IT sector after completion of their courses. P.G. Review Committee indicated that in the case of IITs more than 90 percent of the non-IT graduates migrate to IT sector (MHRD, 2000). The Task force on HRD in IT, projected that the availability of skills in the IT sector by year 2008 would be sufficient to meet the demand projections for the year.

It should be underscored that there are certain apprehensions regarding supply of skills, the quality of skills available and prevalence of underemployment in the IT sector. Rothboeck et.al, (2001), based on field surveys in Bangalore and Delhi clearly elicits high degree of functional flexibility of the worker. It is important to examine whether such flexibility is due to the non-requirement of skill and expertise or not. The question of underemployment has also surfaced and scholars have taken up this issue. For instance, Arora et. al., (2000) reported that most software firms recruit engineering graduates although the skill is not utilized since a large share of the work is non-technical.

2.1.2. Wages, Labour Cost and Productivity in ICT sector

It is widely accepted that ICT workers earn one of the highest wages in the Indian economy. However, lower wages of Indian software developers relative to their counterparts in the US and Europe makes Indian software cheaper in the global software market (Table20). The dramatic difference in the wages between US and India explains the high demand from US. This difference in wages can be found in all professional categories. When compared to similar outsourcing competitors like Ireland, wages in India are estimated to be half to a three times lower.

Table 20

Salaries[1] of software professionals in the United States and India, 1997

	United States	India[2]
	(USD per annum)	(USD per annum)
Help-desk support technician	25000-35500	5400-7000
Programmer	32500-39000	2200-2900
Network administrator	36000-55000	15700-19200
Programmer analyst	39000-50000	54000-7000
Systems analyst	46000-57500	8200-10700
Software developer	49000-67500	15700-19200
Database administrator	54000-67500	15700-19200

1. Figures are starting salaries for large establishments employing more than 50 software professionals. They may be marginally lower for smaller firms. Salaries for a particular designation vary owing to factors such as educational and experience profile of the professional; platform of operation; nature of the assignment (contract/full-time); location of the employer; and additional technical/professional certification.
2. Converted at exchange rate of INR 41.50/USD.
Source: INFAC, Bombay quoted in OECD Information Technology Outlook, 2000

A comparison with wages for software professional of different European and other industrially advancing countries also reveal that wages in India is substantially lower (Table. 21).

Table 21

Comparison of Annual Wages in Software Industry

Country	Computer Programmer		System Analyst	
India	4002	100	5444	100
USA	46600	1164	61200	1124
Japan	51731	1293	64519	1185
Germany	54075	1351	65107	1196

France	45431	1135	71163	1307
Britain	31247	781	51488	1287
Hong Kong	34615	865	63462	1166
Mexico	26078	652	35851	658

Source: Gupta (2000) quoted in K.J. Joseph (2002), "Growth ICT and Harnessing IT for Development", background paper prepared for the OECD-IPS Workshop on Promoting Knowledge-based Economies in Asia, Singapore 21-22 November 2002, mimeo.

Taking all costs into consideration, some estimates suggest that the cost of software development in India is half of that in the US. Wage difference between different professional categories is also glaring in India (Table 22; Chart 20). However such differentials exist in other countries also. Yet the differentials are more pronounced in India. This may have implications for the relative preference for different types of expertise.

Table 22

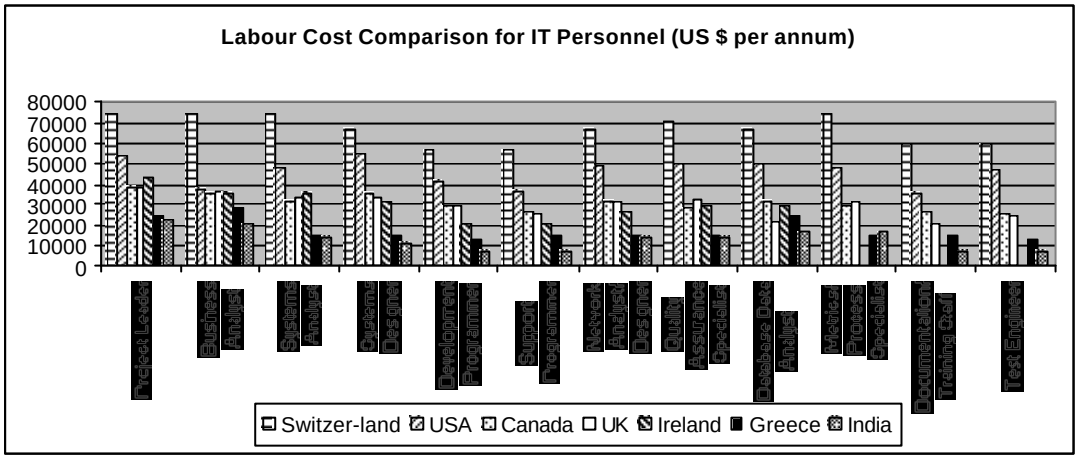
Labour Cost Comparison for IT Personnel (US $ per annum)

	Switzer-land	USA	Canada	UK	Ireland	Greece	India
Project Leader	74,000	54,000	39,000	39,000	43,000	24,000	23,000
Business Analyst	74,000	38,000	36,000	37,000	36,000	28,000	21,000
Systems Analyst	74,000	48,000	32,000	34,000	36,000	15,000	14,000
Systems Designer	67,000	55,000	36,000	34,000	31,000	15,000	11,000
Development Programmer	56,000	41,000	29,000	29,000	21,000	13,000	8,000
Support Programmer	56,000	37,000	26,000	25,000	21,000	15,000	8,000
Network Analyst/ Designer	67,000	49,000	32,000	31,000	26,000	15,000	14,000
Quality Assurance Specialist	71,000	50,000	28,000	33,000	29,000	15,000	14,000
Database Data Analyst	67,000	50,000	32,000	22,000	29,000	24,000	17,000
Metrics/ Process Specialist	74,000	48,000	29,000	31,000	Na	15,000	17,000
Documentatio	59,000	36,000	26,000	21,000	Na	15,000	8,000

n/ Training Staff						
Test Engineer	59,000	47,000	25,000 24,000	Na	13,000	8,000

Note: Figures are averages for 1995. They are likely to rise c.5-10% per annum, with rates being slightly higher in lower-income countries.
Source: Richard Heeks adapted from H.A Rubin et al. (1996) *Worldwide Benchmark Project*, Rubin Systems: Pound Ridge, NY.

Chart 20



When we compare the wages earned by software professional with those working in the conventional industries we find that wages in the software sector is higher. The higher wages earned by the software professionals in comparison to similar skilled employees in other industries ensure that there is a steady supply of skills in the industry. Latif (1997) notes , *"(It is clear that) The salary structure of the software industry exceeds other sectors of the city's economy. A software engineer in other industries in Bangalore cannot expect to earn more than half of what he would make in the software industry. This has meant that other businesses are losing out good people to the software industry."*

There are wide inter-firm variations in the wage rates for similar skills. Rothboeck et.al (2001) report that in Bangalore itself large firms producing high value added software products paid on an average Rs. 12000 to 15000 per month as wages to the professionals. The domestic firms and firms that were involved in IT-enabled services paid the least to the workers; it was only around Rs. 3000- 4000 per month (Table 23).

Table 23

Entry Level Salary in Bangalore According to Firm Type (in Rupees)

Large High end	12000-15000
Large Medium	14000
Medium High	10000-12000
Medium low End	7000
Small Medium	7000- 9000
Domestic Middle End	3500- 4000
IT enabled	3000- 4000

Source: Rothboeck et. al., (2001), pp 41-42

Wages are also extremely flexible in ICTs; as the wages are closely linked to specific projects, quantum of demand for a company's products etc, wages paid to the same category of job may vary due to external factors on which the firm may not have any control. This fluctuation is also a result of its linkage with the global market. Changes in any of the variables of the global market can influence wages in India, as this is an export led sector. For instance the September eleventh incident catalyzed considerable decline in the IT products from India. This had led to retrenchment of labour as well as wage cuts. The fluctuating wages creates considerable insecurity among the computer professionals.

Wages in the software industry had grown at over 30 percent per annum through the 1990s and attrition rates were high at 20 percent. When asked to list top 3 problems they faced, more than half of all firms selected manpower shortage and employee attrition as the most serious problem affecting them (Arora,et.al.,2001).

Is there any correspondence between increase in the wages and labour productivity? This high wage rate does not reflect the productivity of the worker, rather the short supply of certain skills in the economy. This force the producer to spent *Quasi-rent* to the professional for retaining him in the firm.

Table 24

Trends in Labour Productivity(In Rs.Lakh)

	1994	1995	1996	1997	1998	1999
Full Sample	6.21	5.52	5.33	4.46	4.81	4.58
Large Firms	7.36	5.69	5.27	4.76	5.31	5.03
Medium Sized Firms	4.15	4.68	5.22	3.71	3.80	3.72
Small Firms	10.06	9.43	7.45	6.07	4.69	4.35

Source: Kumar (2000b).

Chart 21

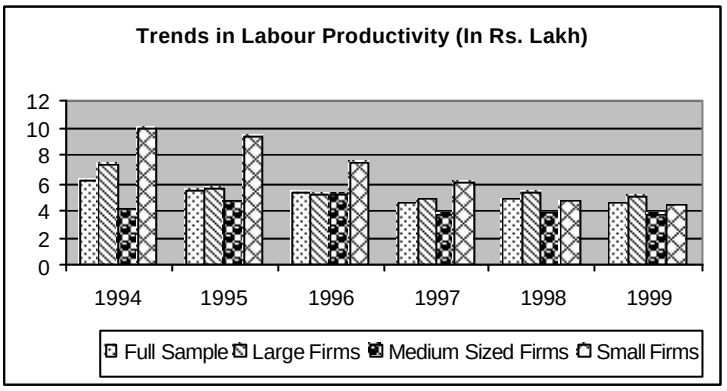


Table 24 & Chart 21 reveals that labour productivity has decreased over time and since 1997 it has stabilized at a low level. At one hand, there has been a general wage hike, but on the other hand labour productivity has decreased and remain to be much lower than the impressive productivity of 1994-5. This trend could possibly be due to the changes in the composition of firms of the sector. It is possible that low productivity activities might have been increasing relative to the high productivity activities of early nineties. But this is an issue to be analyzed in detail. Another reason could be the composition of labour at firm level. For instance, Lateef(1997) remarks, "*In some cases due to the lack of experienced personnel, 70 per cent of the revenue came from 30 per cent of the staff. If wages continue to rise unabated and there is no*

commensurate increase in productivity or shift to high value added activities India would lose out competition to other countries where wages are lower."

What is the earning level of Indian companies, given the low productivity is a question that needs to be probed at length. Yet, we have some comparisons between different countries on this issue. Arora et.al., (2000) provide a comparison of three economies that are thriving software exporters, India, Israel and Ireland. All three economies depend to a large extent on the large supply of skilled professionals. But when it comes to comparison of revenue generated per professional between the economies the Indian case is abysmally low. While Israeli and Irish firms earn as high as $100000 per employee, the Indian firms earn only around $15000 per employee.

2.1.3. Quality of Jobs and Employment Relations in ICT Sector

Most assignments this industry receive and take up are project tied. The skills required to fulfill vary vastly from project to project; the duration of them also vary. Hence employment is also mostly contractual. (Vijaybaskar,2002) The employment contracts are, therefore, flexible and unpredictable. Work in ICT provides the employer and worker time and space flexibility. Changes in the nature and place of work, theoretically, should offer the opportunity for a better balance between hours of work and hours of leisure. However, the software industry being part of the global production chain the time and space flexibility provided by the technology has only helped in increasing the work pressure on the software worker. The project tied work makes it necessary that the worker does 'time bound work' and not 'work bound time'.

Aundhkar et. al.,(2000) studying teleworking in various sectors of India reported that employers felt that the main advantage of Teleworking is the flexibility it allows and the greater ease of meeting deadlines. Production time has been cut down enormously. The main disadvantage was that employee interactions are minimal. In many sectors the superiors intervene in the process of work and provide suggestions, which is minimal if not impossible in this form of work. In the IT-enabled sector most firms have to work through the night as they cater to the day time zones of U.S.A. and Europe. In

the European countries ICT has made work more space flexible as it allows work to be carried out at home. But in developing economies, most workers do not own PCs and also there is no infrastructure to support such work. Therefore, the flexibility of space in ICT work in India remains as a theoretical possibility and not reality.

Employment relations are sensitive to the locational design of work. This becomes most critical in the case of ICT because production is possible without congregating the workers. This peculiarity of the sector reduces transaction costs as well as negative externalities. Nevertheless, it reduces the possibilities for the collectivity among the workers and leaves no space for formal and institutional forms of social protection. Further, as there is little scope for the vertical mobility, the investors adopt the strategy of increasing labour turnover rates for their sustainability. This in turn reduces scope for any collective action and social interaction among the workers. (Bhasker, 2002)

The organization of work undergoes drastic changes in the information economy by the influence of ICT as it influences the structure of the firm. First, the reorganization of work leads to a hollowing out and segmentation of career paths within organizations. Second, there is a relationship between the external fragmentation of traditional firms – through outsourcing, networking, partnerships and sub-contracting – and the formation of 'boundaryless' careers (ILO, 2001). Network enterprises produce multi-employer relations with the worker having capital stake in the firm. Cross border outsourcing are bringing in work conditions as well as affecting the conditions of work of direct employees of the firm through the outsourced work..

The worker in the IT industry is not part of any collectivity. Completely individuated, the worker negotiates with the employer at the individual level without resorting to any collective bargaining measures. This has tempted many to call the work place in IT firms ‘very cordial’. This, on the contrary, may be far from truth. The individuated worker is an isolated element, working on contract, shifting from firm to firm, and requiring learning the latest skills before it gets obsolete. Just like the IT industry, the workers also dwell in enclaves.

Rothboeck et.al., (2001) elucidates the characteristic features of the life world of the workers in the Indian Software industry as follows:

- There are no trade unions in the industry and conflicts are normally solved directly between the supervisor and the employee.
- Wage setting is linked to performance and hence is highly individualized
- Given the high inter-firm and intra-firm mobility across projects in large firms employees lack time and space for development of long term relationships and collective mobilization of any kind.
- Training and learning are highly individualized.
- Enterprises have increasingly recognized the role of pees for recruiting and career planning and provide lucrative financial incentives to their employees to function as informal recruiters for the enterprise.

Venkata Ratnam(2002) notes that direct communication, direct involvement of employees in empowered teams, voice to employees in work and work organization and share in profits through employee stock option plans (ESOPs) are the major feature of employee relations. It is further argued that modern human resource management practices, creative and innovative work practices and employee involvement and employee support programmes have contributed to sound employer-employee relation in IT industry.

Flexible organizations and flexible employment relationships involve the breakdown of the standard employment contract and its associated employment rights. Growing margin of employment assignments have become short-term and involve multi-employer relationships. In a study carried out by Samaddar (1995) shows how the Micro Electronic Technology increased the possibility of fragmentation of the labour process and segmentation of the workers. For instance, the management of several newspapers in India was able to introduce new technologies in their firms despite stiff opposition form the employees. D'Souza, Radha (1995), showed how traditional trade unions were unable to defend the real wages of the workers in the advent of

computerization. Trade Union leaders often accepted the blanket right of the management to introduce new technologies, causing retrenchment, and disruption of pattern of work.

Another aspect of the employment relations in IT sector that has been receiving increasing attention relates to the enactment of specialized labour legislation for the sector. It is contented that the prevalence of non-traditional, non-standard and atypical employment patterns and practices (including contract for service than contract of service, home work, part-time work, etc.) require different kind of regulations to govern relationships beyond traditional employment. It is argued that the IT industries should be allowed to have, among other things, flexible and longer working hours, differential approach to leave and paid holidays etc. Having already noted that the emerging employment scenario in the sector could accentuate certain types of labour market insecurities, demands for specialized treatment in the realm of labour legislations need to be handled very cautiously. This is all the more so when we consider some of the effects of ICT expansion on gender issues.

2.1.4. ICT Sector and the Gender Question

The ICT sector is hailed to be a gender-neutral industry given its almost complete dependence on knowledge skills rather than physical skills. Women, therefore have been able to join this sector in much larger scale than in other traditional industries. Women hold almost equal positions to that of men in terms of responsibilities held. But the returns to such equitable responsibilities are inequitable.

Rothboeck's study(2001) had found that women tended to cluster at the lower end of the job hierarchy leading to feminization of certain service activities. Most women and men worked for 14 to 16 hours a day in the office and 2 to 3 hours at home every night. There seems to be no balance between work and life in the case of women. While men engage in jobs at work site alone, women work at work place as well as at home. House keeping and child raring are the social responsibility of women in India. Leisure is a mirage as far as women are concerned, as they have to engage in the house

chores after work. Far from adjusting working needs to the needs of family life, there can be increasing pressure to work everywhere and all the time. While teleworking has certainly created new employment opportunities for women, the downside is that women can be excluded from better career possibilities, and instead of finding a balance; family responsibilities can be combined with paid work, so that women end up acquiring new tasks on top of the old.

More than the IT proper, female intensity is much higher in the IT- enabled industry such as call centers and Medical Transcription. Women labour is cheaper and more flexible and this suit the industry. Women with no long-term career plans are better suited for contractual employment wherein the nature of job does not impart any other marketable skills. Further, the work requires longer hours; they work at lower remuneration; they have lesser prospects for occupational mobility and demand lesser job security (Gayathri and Antony, 2002).

The Information economy has encouraged, more than any other sector, women to join the workforce. But unless this is supported by deliberate policies to ensure participation, ownership, education and ICT training for women—as well as family-friendly policies in the information economy workplace—the old gender biases will persist.

2.2. Results of the Primary Survey on Decent Work

In order to provide insights into the conditions of work and employment, a sample survey, with elements of both stratified and random sampling method, was

conducted among IT workers employed in firms at two representative clusters, namely, Bangalore, and Trivandrum.

Methodology and Sample

Firms for the sample survey were chosen on two criteria: Size of the firm and location of firm.

Size of the firm: Firm size measured in terms of revenue per annum represents many capabilities of the firm including possibilities of economies of scale and scope. In order to account for all size of firms the sample survey was stratified into three size groups, Small size firms whose annual revenue accounted less than or equal to Rs 100 million in 2003, Medium sized firms whose size was between Rs100 and Rs 500 million, and large sized firms whose size was greater than Rs. 500 million. The survey has covered workers in all three-size classification in more or less proportionate manner. These workers belonged to a total of 24 firms.

Regional location of the firm: Firms tend to concentrate at specific geographic locations as a result of increasing returns to scale as the scale of production in the region increases. Given the distribution pattern Bangalore was an obvious choice for any study on IT firms. Then, the region with the smallest agglomeration and smallest average number of products/services per software firm, Trivandrum was also chosen for study. The number of activities the software firms takes up is a signal towards its innovative capability. The study has given 3/4th weight to the sample from Bangalore, and 1/4th from Trivandrum. Thus the survey consists of 70 workers covered from Bangalore and 30 from Trivandrum.

The survey was conducted in two phases. Initially a pilot survey was conducted in Bangalore using a semi structured questionnaire. In this phase informal discussions were conducted with professionals, human resource managers, and academics. Following discussions and pilot survey the semi structured questionnaire was refined further and made a structured questionnaire. In the second phase responses to the

questionnaire was collected from 100 professionals, 70 from Bangalore and 30 from Trivandrum. These workers were selected from 24 different firms.

Employment Opportunities

ICT is one of the fastest growing sectors for both output and employment. India draws its comparative advantage from its cost effective high quality human resources. As per NASSCOM-McKinsey estimation India's demand for IT skilled labour by 2008 would rise ten fold from 280 thousand in 1998 to more than 2200 thousand workers. However the estimation is highly speculative as the methodology for arriving at the present stock as well as the future demand is not clearly spelt out. Using the NSSO employment–unemployment survey, 1999-2000 we estimate that only around 0.27 percent of the total workers (Usual Status) are in the IT sector (both skilled and semi skilled). This data reveals that IT workers are concentrated within a few states. Maharashtra alone accounted for nearly 27 percent of the workers. (Table 25) Another 15 percent of the workers were concentrated in Karnataka. Delhi, West Bengal, Tamil Nadu and Andhra Pradesh also had 10 percent or more of the share of the workers in IT. Gujarat, Kerala and U.P represented another 3 percent each. It is significant that the regional distribution is closely correlated with the presence of mega urban agglomerations. 84 percent of the workers were concentrated in the states that had the presence of mega cities such as Maharashtra, Delhi, Karnataka, Andhra Pradesh and West Bengal. Employment opportunities are strongly export driven and seem to have had low domestic linkages.

Table 25
Regional Distribution of IT workers

State	Total
Andhra Pradesh	9.7
Gujarat	2.8
Karnataka	14.5
Kerala	3.6
Maharashtra	26.7
Tamil Nadu	10.3
Uttar Pradesh	3.5
West Bengal	10.3
Delhi	12.7
others	5.9
Total	100

Source: NSSO 1999-2000, Employment -Unemployment Survey, extracted from CD-ROM

Having broadly seen employment trends at the macro level we examine now the specific micro level characteristics of the employment specially in relation to some of the indicators of decent work

Profile of the worker

Information Technology industry is usually projected as a gender-neutral technology with less of physical strain and more of work related to the intellect. However the gender structure of the workforce within the IT sector does not reflect any change form the old world work environment. This seems to reinforce the gender bias that exists in the old world economy in the emerging sectors as well. An overwhelmingly large proportion of the workers are male workers with female workers forming only 15 percent of the survey.

The nascent state of the industry is evident from the overwhelming presence of young workers in the industry. Nearly 81 percent of the workers belonged to the age group of 30 or less. This is a characteristic feature of the workforce in the IT sector. 24 percent of the total surveyed workers belonged to the age group of less than or equal to 25 years of age. A large share of the workers, 47 percent, were unmarried young workers..

Table 26
Profile of the IT worker

Demographic Characteristics	Class/Level/Type	Number	Percent
Sex	Male	85	85.00
	Female	15	15.00
	Total	100	100.00
Marital Status	Married	53	53.00
	Unmarried	47	47.00
	Total	100	100.00
Age	Less than 25	24	24.00
	25 to 30	57	57.00
	30 to 35	18	18.00
	Above 35	1	1.00
	Total	100	100

The age profile of the workforce varies across the different segment of the industry i.e hardware segment, software segment and IT enabled Services (ITES). In the ITES the workers in the age group of less than or equal to 25 years of age accounted for more than 53.3 percent of the surveyed workers while only 14 percent of the Software products & services workers belonged to that age group and only 7 percent of the workers in the hardware segment belonged to that age group. (Table26) In both hardware and software segment majority of the workers, 64 and 69 percent respectively, belonged to the age group 25-30. A quarter of the hardware workers belonged to the age group of 30 to 35. Though the age of work in the industry seems to be low within the industry the various segments of the industry has varied mean age of workers with the hardware segment having the highest and the ITES reporting the lowest mean age. This worker mean age roughly corresponds to the evolutionary path of the industry itself, with the emergence of the hardware segment initially, followed by the software segment and finally the ITES.

Table:27
Age of Worker by Industry Segment (percent)

	Type of Industry Segment

Age Group	Hardware	Software	IT Enabled Services	Total
Less than 25	7.14	14.29	53.33	24
25 to 30	64.29	69.05	33.33	57
30 to 35	25.00	16.67	13.33	18
Above 35	3.57	0.00	0.00	1
Total	100.00	100.00	100.00	100

As regards the origins of the workforce, most IT workers, prior to joining the IT industry were natives of the urban areas within the country. In fact the entire sample population (99 percent) belonged to urban areas, of which 27 percent were from the six mega cities of Delhi, Mumbai, Kolkota, Chennai, Bangalore and Hyderabad, 16 percent from the metropolitan cities excluding the mega cities and 56 percent belonging to urban areas lesser than metropolitan cities (Table 28).

Table 28

Origin of the Workforce

Mega city	27.00
Metropolitan	16.00
Urban	56.00
Rural	1.00
Total	100

If we further disaggregate the share of workers according to the place of work nearly 60 percent of the workers surveyed in Bangalore belonged to metropolitan or mega cities, while in Trivandrum the corresponding figure was nearly 10 percent, while the share of other urban workers in Trivandrum was substantial at 87 percent.

Table 29
Origin of the workforce across Locations

	Bangalore	Trivandrum	Total

Mega cities	39.13	0.00	27.00
Metropolitan cities	18.84	9.68	16.00
Urban	42.03	87.10	56.00
Rural	0.00	3.23	1.00
Total	100	100	100.00

The migratory nature of the workers is obvious from the Table 30. Of the 69 workers surveyed in Bangalore only 11 belonged to the parent state of Karnataka. The rest of them had migrated from other parts of the country with 22 workers from the neighbouring states of Kerala and Tamil Nadu. But there were also 10 workers from Delhi. In fact almost all major states are represented in the IT workforce in Bangalore . But in the case of Trivandrum, of the 31 workers interviewed, only 2 belonged to states outside Kerala. Thus Bangalore is clearly expressed as the preferred choice of IT workers in comparison to Trivandrum. This is easy to understand as the number of firms and size of firms in Bangalore are much higher than in Trivandrum, and hence the expectation of finding employment as well as higher wage/salary make Bangalore the preferred region for workers.

Table 30

Statewise Origin of Workers

	Bangalore	Trivandrum	Total
ANDHRA	3	0	3
BIHAR	1	0	1
DELHI	10	0	10
GUJARAT	2	0	2
J&K	2	0	2
JHARKAND	2	0	2
KARNATAKA	11	0	11
KERALA	10	29	39
MAHARASHTRA	1	0	1
ORISSA	4	0	4
PUNJAB	3	0	3
RAJASTHAN	1	0	1
TAMIL NADU	12	2	14

U.P.	4	0	4
W.BENGAL	3	0	3
	69	31	100

Patterns of Earnings in the ICT industry

IT industry is considered to be a high wage industry. The high wage rate in the industry ensures that there is steady flow of skills to the sector and flow from other traditional sectors. In the industry as a whole 35 percent workers received annual salary/wages in the class Rs.200, 000 –400,000 i.e. Rs2lakh-4lakh per annum. (Table 31) Around a quarter of the workers received earnings in the range Rs. 1-2 lakh per annum. 17 percent earned in the range Rs.4-6 lakh and 5 percent earned in the top bracket of Rs. 6-10 lakh per annum. There are considerable variations in earnings across the various segments of the industry. While in the software and hardware segments the modal income bracket was Rs. 3-4 lakh, in the ITES segment the overwhelming majority (73.3 percent) of the workers earned less than Rs. 2 lakh a year. On the other hand 35 percent of the workers in the software segment earned above Rs 4 lakh. The corresponding figure in the hardware segment was only 20 percent. On the whole, it can be said that a larger share of workers in the software segments earned higher wage/salary than both hardware and ITES. The wage earning s in ITES is the least with majority of workers being in relatively low wage class.

Table 31

Earnings of Workers across Industry Segments(per cent)

Salary per annum	Hardware	Software	ITES	Total
50000-1 lakh	0.00	10.81	36.67	18.29
1-2 lakh	13.33	18.92	36.67	24.39
2-4 lakh	66.67	35.14	20.00	35.37
4-6 lakh	20.00	27.03	3.33	17.07
6 – 10 lakh	0.00	8.11	3.33	4.88

Total	100.00	100.00	100.00	100.00

There are considerable locational variations in wages as well (Table 32). In general it can be said that wage differentials within the industry in Bangalore is much higher than that of Trivandrum.

Table 32

Earnings Across Locations(percent)

Salary per Annum	Bangalore	Trivandrum	Total
50000-1 lakh	21.15	13.33	18.29
1-2 lakh	19.23	33.33	24.39
2-4 lakh	28.85	46.67	35.37
4-6 lakh	25.00	3.33	17.07
6 - 10 lakh	5.77	3.33	4.88
Total	100.00	100.00	100.00

Education and Skill Profile

Educational qualification is a key determinant of earnings received in the IT sector. Workers with general education, i.e. who had done regular arts, science and commerce graduation /post graduation received wages much lower than that of technically qualified workers. More than 92 percent of the workers with general education received wages in the bracket less than 2 lakh per annum. (Table 33) On the other hand, 67 percent of the technically qualified workers earned more than Rs. 2 lakh per annum. This difference in earnings occur mainly due to the fact that most general educated workers belong to the ITES segment of the industry, while the technically qualified workers belong to the software and hardware production segments.

Table 33

Workers Salary per Annum by Type of Education

Salary per Annum	Technical Education	General Education	Total
50000-1 lakh	10.14	61.54	18.29
1-2 lakh	23.19	30.77	24.39
2-4 lakh	42.03	0.00	35.37
4-6 lakh	18.84	7.69	17.07
6 - 10 lakh	5.80	0.00	4.88
Total	100.00	100.00	100.00

Enhancing Capacities for employment

Workers employability is mostly dependent on the possession of "foundation skills" which needs regular updating and support with specific skills through training and life long learning processes. Dual labour market theorists (Doeringer and Piore, 1971) argue that entry to the primary labour market, characterized by relatively higher wages, fringe benefits, good working conditions and training, promotional path etc. is primarily determined by the type and level of education and training undergone by the workers. Level and type of education acts as a screening method for entry into the IT labour market. None of the workers interviewed had level of education less than graduation. Among the workers only 14 percent of the workers had joined the labour market after completion of general education, nearly 86 percent of the workers have had technical education before being part of the IT labour market (Table 34) In both hardware and software segment the concentration of technically trained workers are very high at more than 95 percent of the workers. But in the ITES segment the same share is at 63 percent. In the ITES segment a substantial share of workers had undergone general education. To join the IT production sector, namely hardware and software segments, technical education is indispensable. In ITES sector the major skill requirements are not the engineering skills required in the IT sector. ITES work consists of lower end outsourced tasks of a myriad group of

activities. The major skills required in such industries are certain basic skills such as language and communication skills and rudimentary mathematical skills. After a short training of two or three weeks any graduate level educated person is adept to take up employment in the ITES sector.

Table 34

Type of Education of Workers across Industry segments(percent)

	Type of Product			Total
Type of Education	Hardware	Software	ITES	
Technical	96.43	95.24	63.33	86.00
General	3.57	4.76	36.67	14.00
Total	100	42.00	30.00	100

The IT products and services industry is a knowledge intensive sector with high degree of skill intensity. The common qualification of workers in the sector is a degree or diploma in Engineering. Among the technically qualified workers the largest share of workers was with B.Tech in Electrical and Electronics Engineering and Masters in Computer Applications (MCA), recording 26 percent each. 11 percent of the workers had qualified B.Tech in Computer Engineering (Table 35) Nearly 16 percent had engineering degree in other trades. This shows the knowledge intensive production process in the software production sector.

However there are considerable inter-segmental differences in skill utilisation. In the hardware segment more than half the workers were qualified in electronics and electrical engineering graduation and another 11 percent had post graduation in the same trade. 33 percent in the hardware segment were engineering graduates in other trades than computer and electronics.

In the software segment nearly half the workers (47.5 percent) were qualified as Masters in Computer Applications (MCA).more than a quarter of the workers were graduates in computers or electrical and electronics. In the ITES sector share of workers who were technically qualified were comparatively less and even the technically qualified were in the low end skills.

Table 35

Technical Education of workers by Industry Segment

	Type of Product			Total
Education	Hardware	Software	ITES	
B.Tech (computer)	0.00	15.00	15.79	10.47
M.Tech Computer	0.00	5.00	0.00	2.33
B.Tech (Electrical and Electronics)	51.85	15.00	10.53	25.58
M.Tech Electrical and Electronics	11.11	0.00	0.00	3.49
MCA	0.00	47.50	15.79	25.58
B.Tech(others)	33.33	5.00	15.79	16.28
DCS	0.00	0.00	10.53	2.33
PGDCA	3.70	7.50	15.79	8.14
others	0.00	5.00	15.79	5.81
Total	100	100	100	100

"Reskilling" in the IT sector acquires great significance due to the fact that the industry is highly innovative and hence subjected to skill obsolescence in the short run itself. In the case of traditional manufacturing sector innovation is a slow process and skill obsolescence is not common, but in the new knowledge based industries life cycle of technologies is very short. In order to retain the workers the firms have to 'reskill' them. In the IT labour market workers opt for two choices of skill acquisition, On the –Job training and Job Oriented Courses.

On-the –Job training

On-the-Job training is an important means of reskilling workers in the IT industry. In the sample survey conducted nearly 16 percent of the workers had received training On-The–Job which is considerably higher compared to other traditional industries. More than 16 percent of the workers had attended Job oriented courses prior to joining the firm. But there are considerable differences within the various segments of the industry in the share of workers who have undergone On-the-job training. In the hardware sector , where the industry works more like a

traditional manufacturing industry ,the share of workers who had undergone on-the-job training were only about 3.5 percent. In contrast, in the software industry where technological innovations are faster than the hardware sector, a quarter of the workers, more than 26 percent, had undergone on-the-job training. In the ITES segment also, the share of workers who received training was considerable, above 13 percent. This high rate of on-the-job training in the ITES segment, however, is due to the fact that this segment of the industry is relatively new and new recruitments are almost entirely from fresh inexperienced workers, who are later trained for the industry.

Table 36

Share of Workers with On-The Job Training by Industry segment(percent)

	Hardware	Software	ITES	Total
Undergone training	3.57	26.19	13.33	16.00
Not undergone Training	96.43	73.81	86.67	84.00
Total	100.00	100.00	100.00	100.00

There are not only sectoral but also regional differences in the patterns of workers who received on-the-job training. Share of workers who received on-the- job training in Bangalore in all sector had been higher than Trivandrum. The cost of training for On-the-Job Training is usually borne by the firm. On- the–job training were concentrated in Bangalore, as there was a greater agglomeration of IT producing firms in comparison to Trivandrum which would mean relatively greater competition among the firms to attract and retain workers in the firms through various incentives, one of them being job-oriented training for the workers.

On-the Job training to the workers are provided as both in-house training and external training. The share of workers who received different sources of training; in-house training and external training were more or less equal in the sample (Table

37). Generally large sized firms have their own training institutes where fresh recruits as well as retraining are provided. Also, many large firms have arrangements with external training institutes to provide training in specific courses.

Table 37

Type of On-the Job Training Received by Workers

Type of Training	Percent
In-House Training	53.33
External Training	46.67
Total	100.00

Costs of the on-the-Job training are borne by any of the three sources; firm, the government and worker. If a company pays for education or training and if the employee subsequently leaves the firm then the company will have lost its investment. In the IT industry, especially in the software segment life cycle of skills are very short. Therefore, while training workers is in the interest of the firm funding the training is not. Only half the workers who underwent training were funded by their company. Nearly 40 per cent of the trained workers had to bear the training cost themselves. Even though the training is for the firm's production process the workers are ready to pay for the training as the skills are in demand in other firms as well. The government funded around 7 percent of the workers for their training.

Table 38

Source of Funding for the Training

Source of Funding	Percent
Company	53.33
Self	40.00
Government	6.67
Total	100.00

Firms also have the option of recruiting from jobseekers who have undergone job oriented courses. The cost of training is borne by the worker himself; hence there is

no opportunity cost of losing the trained worker. Only 15 percent of the workers had attended job-oriented courses prior to joining their current place of work. The share of workers who had undergone job oriented course prior to joining the courses were more or less equal with the hardware segment reporting 11 percent , software and ITES reporting 17 percent each. A majority of those who attended such courses had undergone long duration (6months and above)courses.

Workers had to pay heavy training fees for the job-oriented courses. More than 31 percent of the workers had to pay more than Rs. 40000 as course fees for the various job oriented courses they had attended prior to joining the current job, another 31 percent of the workers had to pay between Rs. 20000 and 40000 as course fees for training.

Firms use training facilities such as on-the –job training, with long duration to improve productivity of the worker, and at the same time as an instrument for retaining the worker. Long duration, fully funded On-The Job courses offered by the firm is an incentive for the worker to join the large sized firms and remain loyal to the firm. In the IT sector where attrition rates are reported to be high the choice of training is one of the important methods used by the firms to retain workers. Since the job oriented courses are not exclusive to the production process of firms, those firms that dependent on workers who had attended job oriented courses are always under the threat of losing their workers to other firms due to poaching and inter-firm, interregional mobility of workers, while firms which conduct on-the-job training are able to attract and retain workers. Thus training of workers in the software segment is being used as one of the modes by which firms shun attrition in the industry.

Social Protection and other Promotional Benefits

The question of social protection was the most difficult part of our survey and elicited a variety of responses. Bulks of the allowances were seen to be part of the overall salary packages. The workers and the firms preferred individual bargaining of the total earnings package, the distribution of the package was left to the discretion of the firm. The only pervasive social protective measures applied to the whole industry was Medical insurance.(88 percent of the workers surveyed). Benefits like Provident fund Maternity /Paternity allowances were available to a limited number (28 percent). Neither the firms nor the workers appear interested in conventional social security measures. None of the workers were covered under any pension schemes. This is understandable in view of the high turnover of the firms and workers and due to the rapid expansion of the IT sector. Most of the IT firms did not come under the direct purview of the protective labour laws, and that may be a strong reason for the absence of uniform conventional social security systems

Stability and Security of Work

Employment security has a very different flavour in the rapidly burgeoning IT industry. Bulk of the employees surveyed were under unspecified employment contracts (77 percent) with the provision for termination of contract with short (1 moth and less)notice period. Many workers considered this to be equal to permanent contract. Short duration and project specific contracts were also prevalent though for a smaller proportion especially among the ITEs employees. The varied nature of contract without firm commitments from either parties seem to be the prevalent mode in the current stage of IT industry. Employment contracts were not the instruments for retaining workers nor means through which workers could lay claim to social protection. The preference for contractual employment seems to have emerged as a response to a high degree of attrition in the industry. More than the firms the workers in this sector are keen on moving away from one firm to the other, searching for higher wages, better learning opportunities and improved work environment. Thus, the average duration of a worker in a single firm is much shorter in comparison to traditional industries. Only 20 percent of the workers had spent

more than 24 months, i.e., 2 years in the current firm they were working. 28 percent of the workers had spent only 1-2 years in their current firm. The majority had spent less than a year in the current employment. However these trends are not uniform across the various segments of the IT industry. The workers in the Hardware segments had a much longer duration (more than 2 years) in their work place than their counterparts in other segments.

Reasons for Preference of Employment

The choice preference of the workers exposes the modes that the firms use to persuade workers. Salary in the new firm, as expected, was the most popular reason for the worker to shift to the new firm. More than 37 percent of the workers quoted this as their priority reasons for shifting to the new firm, and another 20 percent quoted this as the second preferred reason for shifting to the new firm. However this was not the only reason for worker mobility. Another very important reason for mobility was better learning opportunities provided by the firm. Better learning opportunities include such aspects as learning–by–doing, peer support and learning, on-the job training facilities etc. Approximately 33 percent of the workers chose better learning opportunities provided in the new firms as the priority reason for shifting to the new firm, and 26 percent chose this as the second preferred reason. The chance to travel abroad from the new firm and popularity of the firms were seen as the first reason for shifting to the new firm by 9 percent of the workers each.

Work Timings

In the ICT industry, most jobs are taken up by the firm on a project basis which is time bound.. The firms are overly conscious of the reputation they build in the market, as no IT firm has any kind of permanent production process, unlike a traditional manufacturing firm where there are fixed clients, fixed output targets and a permanent production chain that cyclically produces the same good. Given this background the workers in the software segment are under tremendous work

pressure to meet the project targets within the stipulated time frame. In fact the higher wages/salary that is provided in the industry is partially to compensate for the work pressure that the worker has to undergo in these firms. In the software segment 79 percent of the workers worked for more than 8 hours of work on an average in a day. The ITES segment also works on advantage of certain time zone differential that India have with the U.S. and Europe. Most ITES segment firms cater to the US industries by providing various services such as customer care, telemarketing, data mining and storing, translation work, e-publishing etc. Most of these works needs to be done during nighttime in India and passed on-line to the US that has a 12-hour time gap with India that allows work to be done continuously.
Thus the work in most ITES segment is to be done as night shifts. Most firms have their night shifts starting its work schedule from 6.30 in the evening to 6.30 in the morning, The number of hours of work in the ITES segment are accordingly longer with 93 percent of the workers working more than 8 hours of mostly night work. The hardware segment of the industry however functions similar to the traditional industry with work timings also comparable to that of other traditional industries. All the workers had reported between 7 to 8 and 8 to 9 hours of work in their firm.

The work pressures and rhythm of work were seen by majority of workers as an important issue affecting a balanced family life. This response was the highest among the married workers (49 percent) though even among unmarried younger workers (below 25) this issue was reported to be a major concern (30 percent).

Social Dialogue and Collective Representation:

It is in the field of social dialogue and questions of collective representation that we found a complete and total deficit in terms of measures of decent work. None of the respondents (100%)mentioned any membership of any union or any previous history of membership in a union in the industry. None of the 24 firms had any unions. The landscape of IT industry seems to be completely union free. In addition to this all the

respondents answered in the negative about the prospect of their joining any union in the future too. Asked about the alternative forms of collective representations all respondents answered in the negative. Individual representations were reported to be alternatives to collective representations by 70 percent of the respondents. The rest of the respondents did not mention any occasion for individual representation. None of the respondents (100%) knew of any institution of social dialogue involving the workers, employers and the state in their industry while 50 percent of the workers were aware of existence of such institutions in other sectors.

CONCLUSIONS

Some of the major conclusions of the study are as follows.

- The ICT sector has grown strongly in the last ten years in India. This has been spurred by the growth of software exports and more recently by the expansion of the IT enabled services sector.

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- In terms of proliferation of ICT into other industries and services, the situation prevailing in India is not that impressive. Industrial applications have to gain momentum, as the infrastructure and backbone facilities are not that congenial at present. It is also true that although there are isolated attempts to develop e-governance its spread is yet to become prevalent.

- In terms of regional spread of ICT industries there are certain enclaves where the ICT industry proliferates. This has led to asymmetric regional development in terms of ICT growth performance.
- Employment is growing rapidly in the sector though there are differential growths in different industry segments. Hardware industry employment growth is the least impressive while both software and ITES segments have witnessed fast growth
- The demographic profile of the workforce is predominantly urban, male and young. The gender divide in employment patterns seen in the traditional industries has not been bridged in the fast growing ICT sector.
- The labour pool for the industry lies in a hierarchical cluster with most from urban metropolises and the least from rural non-urban locations. Thus the employment growth in the industry is aggravating the already existent labour market segmentations.
- The employment in ICT sector is characterized by relatively high earnings compared to the other manufacturing and service sector.
- There is a distinct hierarchy in average earnings in terms of the industry segment. Software manufacturing IT sector leads in average earnings and ITES sector is the least remunerative.

- Earnings are strongly determined by skill and educational levels. Technical education fetches the highest earnings.
- On the job training is preferred rather than vocational training
- The employment pattern in the industry is characterized by high labour turnover rates and low firm loyalty. This situation is the result of rapid expansion of the industry, short product cycles and the export orientation of most of the segments of the industry.
- Social protection measures are atypical with absence of conventional social security features such as pensions, provident fund and maternity benefits.
- One of the noticeable features of employment relation of this industry is that the predominance of 'spot contracts'. This has facilitated employee turn over rates. While this may be to the benefit of workers in the boom phase of the industry, absence of employment security has the grave possibility of adversely affecting workers during the downturns.
- The work time in the industry is marked by atypicality with relatively long hours, prevalence of night work and project specific work schedules. This poses problems in balancing work and family life of the workers.
- The ICT labour relation landscape is marked by complete absence of institutions of collective representation. The industry presents at the moment a union free scenario.
- Individual representation and individual bargaining seems to be the prevalent alternative to collective representation. This leads to strong voice insecurity in the employment pattern.
- Social dialogue institutions are completely absent for this industry.
- There is no vulnerability among the ICT workers in terms of safety of work.

The ICT sector is currently projected as a major growth sector of Indian economy with tremendous employment potential and opportunity. The growth trends in the employment pattern however seems to aggravate rather than alleviate the existing segmentation and imbalances in the labour market. This should be major concern for

planners and policy makers. The dominant trend in the industry is to view wages and social security in opposition to each other. Thus relatively high wages are associated with low social security. Absence of labour market institutions such as trade unions, collective bargaining, social dialogue, can in situations of downturn aggravate the vulnerabilities of the workers. Addressing these issues will be of prime importance for both the future this industry as well as for the new economy generally.

References

Abraham, Vinoj (2003), *Regional Skill Supplies and Location of Firms: The Case of Information Technology Industry in India,* Paper presented at the Student Stipendship Programme, Sarai, 29th-30th August 2003,New Delhi.

Advait Aundhkar, Nalini Vaz, Geetha A Pillai, D L N Murthy and S S Thakar(2000), "The nature of Teleworking in Key Sectors: Case Study of Financial , Media and Software Sectors of Mumbai", *Economic and Political Weekly*, Volume XXXV, No 26, June 24.

Anker et al. (2002), *Measuring Decent Work with Statistical Indicators*, ILO, Geneva.

Autor, David, H., Lawrence F. Katz and Alan B. Krueger (1998) "Computing Inequality: Have Computers Changed the Labour Market?" *Quarterly Journal of Economics*, Vol. CXIII, No.4, pp1170-1213.

Arora, A., V.S.Arunachalam, J.Asundi and Ronald Fernandes (2000), "The Indian Software Industry", *Research Policy*, Vol.30, pp 1267-87.

Brunner, Hans-Peter (1995), *Closing the Technological Gap: Technological Change in India's Computer Industry,* Sage Publications, New Delhi.

Chandrasekhar, C.P. (2001), *ICT in a Developing Country Context: An India Case Study,* Background Paper for the Human Development Report, 2001, Geneva, ILO.

Chandrasekhar, C.P. (2002); " The Diffusion of Information Technology and The Implications for Global Development: A Perspective Based on The Indian Experience", Paper presented in the *International Seminar on ICTs And Indian Development: Processes, Prognoses and Policies,* Bangalore, 9-11 December 2002, Institute of Social Studies, The Hague and Institute for Human Development, New Delhi.

D'Souza, Radha (1995), "The Introduction of Microelectronics Technology and its Impact on Collective Bargaining in the Bombay Region", in *New Technology and the workers response: Microelectronics, Labour and Society*, edited by Amiya Kumar Bagchi, Sage Publications, New Delhi.

Department of Information Technology (2003), website dated, March 18th, 2003.

Dutt. Ruddar, (2002), "Economic Liberalization and its Implications for Employment in India*",* in *Economic Liberalisation and its Implications for Employment,* in Ashok Mathur and P.S.Raikhy(eds.), Deep and Deep Publications Pvt. Ltd., New Delhi.

Gayathri V. and Piush Antony (2002), "Ricocheting Gender Equations: Women and ICT Careers", Paper presented in the *International Seminar on ICTs And Indian Development: Processes, Prognoses and Policies*, Bangalore, 9-11 December 2002, Institute of Social Studies, The Hague and Institute for Human Development, New Delhi.

Ghai, Dharam (2002), *Decent Work: Concepts, Models and Indicators*, DP 139/2002, International Institute for Labour Studies, Geneva.

Heeks R. (1995), *India's Software Industry: State Policy, Liberalization and Industrial Development,* Sage Publications, New Delhi, Thousand Oaks, London.

ILO (2001), *World Employment Report*, 2001, ILO, Geneva.

Jorgenson, W. Dale and Kevin J.Stiroh (1999), "Information Technology and Growth", *American Economic Review*, Vol 89, No.2, May.

Joseph K. J. and K. N. Harilal (2001), "Structure and Growth of India's IT Exports: Implications of an Export Oriented Growth Strategy", *Economic and Political Weekly*, Vol. 36, No. 34.

Kraemer, K.L, and Jason Dedrick,(2001), *Payoffs From Investment In Information Technology; Lessons from the Asia-Pacific Region*, WP file,April.

Kumar, Nagesh (2001), "Indian Software Development- International and National Perspective," *Economic and Political Weekly*, Vol. XXXVI, No.45

Kumar, Nagesh (2002), "Developing Countries in International Division of Labour in Software and Service Industry: Lessons from Indian Experience", Paper presented in the *International Seminar on ICTs And Indian Development: Processes, Prognoses and Policies*, Bangalore, 9-11 December 2002, Institute of Social Studies, The Hague and Institute for Human Development, New Delhi.

Lateef, Asma (1997), *Linking Up the Global Economy: A Case Study of the Bangalore Software Industry*, New Industrial Organisation Programme, International Institute for Labour Studies, Geneva.

MAIT(2000), *IT Industry Performance Mid-Year Review, 1999-2000*, New Delhi January.

Ministry of Human Resource Development, Government of India (2000), *IT Manpower Challenge and Response*, Interim Report of the Task Force on HRD in IT, Government of India, New Delhi

NASSCOM (1999), *NASSCOM - Mckensey Report*, New Delhi

NASSCOM (2002), *IT Sector in India,* http://nasscom.org/, 18/02/02

Oliner, D. Stephen and Daniel E. Sichel, (2000), "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?", *Journal of Economic Perspectives*, Vol. 14, Number 4, fall.

Pal, Joyojeet (2003), "The Developmental Promise of Information and Communications Technology in India", *Contemporary South Asia,* Vol.12, No.1, March.

Rothboeck,S., M.Vijayabaskar and V. Gayathri (2001), *Labour in The New Economy; The Case of The Indian Software Industry,* International Labour Organization, New Delhi.

Samaddar, Ranabir (1995), "New Technology at the Shop Floor Level: The Story of Deunionisation in Some Indian Newspapers", in *New Technology and the workers response: Microelectronics, Labour and Society*, edited by Amiya Kumar Bagchi, Sage Publications, New Delhi.

Soete, Luc (2001), "ICTs, Knowledge Work and Employment: The Challenge of Europe, *International Labour Review*, Volume 140, No.2.

Sood, Aditya Dev (2001), "How to Wire Rural India: Problems and Possibilities of Digital Development", *Economic and Political Weekly,* October 27th.

Sreekumar T.T. (2002); "ICTs and Civil Society: Assessing the Indian Experience", Paper presented in the *International Seminar on ICTs And Indian Development: Processes, Prognoses and Policies,* Bangalore, 9-11 December 2002, Institute of Social Studies, The Hague and Institute for Human Development, New Delhi.

Tulpule, Bagaram and Ramesh C. Dutta (1995), "New Technology: Productivity, Employment and Workers' Response", in *New Technology and the workers response: Microelectronics, Labour and Society*, edited by Amiya Kumar Bagchi, Sage Publications, New Delhi.

Vijayabaskar, M (2002), "ICTs and Transformation of Traditional Workplaces : The Case of the Automobile Industry in India", Paper presented in the *International Seminar on ICTs And Indian Development: Processes, Prognoses and Policies,* Bangalore, 9-11 December 2002, Institute of Social Studies, The Hague and Institute for Human Development, New Delhi.

Venkata Ratnam, C.S. (2002), "Human Resource Practices and Employment Relations in ICT", Paper presented in the *International Seminar on ICTs And Indian Development: Processes, Prognoses and Policies,* Bangalore, 9-11 December 2002, Institute of Social Studies, The Hague and Institute for Human Development, New Delhi.

World Economic Forum (2003), *Global Information Technology Report 2002-2003*, OUP,New York.