Emergence of Knowledge Society: The Indian Scenario

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Abstract

Knowledge Society is characterised by recognition of knowledge as main source of efficiency, competitiveness, and economic growth. Since late 1990s, a large segment of mainstream media and economists have been obsessed with the continued run of 'Knowledge Economy' in OECD countries and its emergence in the developing countries. This new model of growth and development, depending more on human knowledge and efficiency rather than on difficult to disperse physical capital, is supposed to be more egalitarian. Proper policies in developing countries are advocated to build up large volume of 'working capital' in terms of human resource and corner a large market share of the global knowledge economy in contrast to their financial crunch and meagre stake in global goods-trade. In this paper we look at some of these issues in light of Indian experiences to bring out the inherent characteristics of the Knowledge Economy from amidst the rhetoric and underline the task ahead of us to truly transform India into a knowledge society.

EMERGENCE OF KNOWLEDGE SOCIETY: THE INDIAN SCENARIO

I. INTRODUCTION

The emerging knowledge society is characterised by recognition of knowledge as the main source of efficiency and competitiveness. A knowledge-based society relies primarily on the use of ideas and information rather than on physical or financial resources, and on technological application rather than on physical transformation of material inputs for economic growth. While knowledge has been considered a major ingredient of growth since Romer (1989) put forward his *human capital models of growth* replacing the Harrod-Domer models, it was not until the economic boom in the USA in the late 1990s that the term 'Knowledge Economy' (KE) came into vogue. Since then, a large segment of mainstream media (and economists) have been obsessed with the continued run of KE in OECD countries and its emergence in the developing countries. It is argued that this new model of growth and development is more egalitarian as it is less dependent on the physical and financial resources owned by nations or individuals that are hard to disperse. Rather, it depends more on human knowledge and efficiency that are comparatively easier to acquire and spread. It has also been argued that proper scientific and educational policies in developing countries would allow them to build up a large volume of 'working capital' in terms of human resource and use that to corner a large market share of the global knowledge economy in contrast to their financial crunch and a meagre stake in the global goods-trade. In this paper we look at some of these issues in light of experiences in India so as to bring out the inherent characteristics of the KE from amidst the rhetoric and underline the task ahead of us to truly transform India into a knowledge society.

II. THE KNOWLEDGE ECONOMY – DEFINED

There are four pillars of the KE – presence of an economic and institutional mechanism that provides incentives for efficient use of knowledge; skilled populace who can create new knowledge; a dynamic processing and dissemination system, mainly communication infrastructure; and, a large mass of users ready to assimilate knowledge and adapt it to local & individual needs. It is argued that the original knowledge revolution, that in the USA, resulted from the spurt in invention and innovation during the previous one and half decade led by the micro-chip mainly. This lagged effect of a stream of innovations was accompanied by increasing globalisation, international competition, and the urge for downsizing and cost-reduction on part of firm owners. Consequently, focus shifted from more efficient use of

materials to more efficient users of materials, and hence on human capital - embodied both in terms of knowledge and health. This gave rise to increasing interest in both health economics and knowledge economics in academic and administrative circles.

In the recent past, there have been talks of knowledge society – a society where there has been unprecedented acceleration in the speed at which knowledge is being created, dispersed, accumulated and rendered obsolete. In the KE, shelf life of information and knowledge has become too little. Therefore, sustenance of the KE needs continuous transformation of pure knowledge to a stream of commodities – transacted and utilised like any other tangibles in the economic process. This needs an army of capable and competent workers – both within firms providing knowledge services and within those dealing with more traditional products – as the processes therein have become more knowledge intensive. And since knowledge is inseparable from the human being possessing it, there arises a huge demand for able-bodied and skilled manpower. It is in this respect that the udc-s are expected to exploit the present situation. According to World Bank report (World Bank, 2005) these countries, and especially India, possess all the key ingredients of a knowledge society – skilled, trained, English-speaking workforce; low wages compared to international standards; growing ICT penetration; democratic set-up that provides stability for foreign investors; and, a bunch of specialised institutions churning out technical personnel each year. It is therefore not surprising that India and other developing nations are hoping to use this potential to leapfrog the development stages and reach higher levels within a short span of time. Recent successes of our country in this arena is projected as heralding of a new era and it is hoped that India will ride into glory with these knowledge sectors paving the way. Whether that happens or not depends on three crucial factors. First, the penetration of the KE into the society in terms of output, employment and linkage with other sectors of the economy. Second, the nature of the jobs that are being practiced in India. And third, whether the fruits of the KE are equally accessible to different groups of our society. We shall examine these issues in the subsequent sections.

III. OUTPUT, EMPLOYMENT AND LINKAGES

i) Output and Employment

When we look at the basic indicators of KE, India can claim to be in the big league only in terms of the output and growth of its ICT sector (Table 1). NASSCOM (2005) estimates the size of the industry at 28 billion USD – about 4.5 per cent of our GDP in 2004-05. The sector exports three-fourth of its output and these exports in 2004-05 was one-fifth of India's total

merchandise export. An impressive growth rate of about 30 per cent per annum during 1998-2004 also paints a rosy picture for the sector.

However, this growth has not been able to absorb much of India's teeming millions – who were expected to be utilised more fruitfully by the emergence of the KE. Employment in the ICT sector in 1999 was 0.4 million and increased to 2.7 million in 2004-05, if we also include the indirect employment created (Table 2). While only 0.1 per cent of the total workforce and 0.2 per cent of the non-agricultural workforce were employed in the KE in 1999-2000, even after the impressive growth in numbers, these figures were 0.07 per cent and 1.3 per cent only in 2004-05. Therefore, the impact of the KE on the employment market is only marginal. Also, employment growth has dragged behind output growth, indicating that the elasticity of employment with respect to output has been below unity in the KE (Table 3). This has given rise to apprehensions regarding the so-called human resource utilising nature of the KE. In any case, the euphoria that the emergence of the KE is a panacea for the labour surplus Indian economy seems to be misplaced.

ii) Linkage

In addition to the direct impact on employment, emergence of the KE can also transform a traditional economy through its linkages with other sectors of the economy. Greater efficiency in communication, distribution, supply-chain management, and production cycle through increased use of ICT are some of the positive impacts of KE that are expected to boost growth of an economy. However, in this regard too, the KE in India has lagged behind expectations.

More than three-fourth of the products and services of the Indian KE are exported. It is therefore obvious that the benefits of the products and services are reaped by the outdoor economies – many of who are our competitors. In the barrier-free world, such efficiency improvement by other economies are driving out the Indian products from the market – not only outside India, but even in India. We are however not arguing against exports, but only pointing out the limited domestic impact of the KE.

Even of the 25 per cent products that are taken up by domestic players, a majority goes to the tertiary sector – dominated mainly by the Banking and Financial sector. The improved efficiency of this sector in recent times can be directly attributed to increasing KE-based approached therein. However, given the small share of the KE sector in GDP, the overall impact on the economy is only marginal (Table 4). Another big user of ICT products is this sector itself – about 17 per cent. The government and public administration sector accounts

for another 13 per cent of KE products. The use of KE products by the major 'goods' producing sectors of the economy – manufacturing and agriculture – is quite low. It is thus quite clear that there is virtually (and really too!) very weak linkage between the KE and the aggregate economy in India. Hence the contribution of KE towards overall productivity and efficiency gains of the economy has been meagre.

If we combine this with the fact that the employment in the KE is a miniscule part of our workforce, the cascading effect due to consumption by these workers is also quite small to make any serious impact. It would therefore be safe to conclude that the KE is yet to create waves in the society.

IV. NATURE OF JOBS

The nature of jobs that have swept the KE in India also leaves much scope for improvement. If we divide the total KE into specific sectors and occupations, we find that of the 2.7 million workers herein in 2004-05, 0.7 million only are in IT software and solutions sector – the pinnacle of the new economy (Table 2, again). Another 0.35 million are in the ITeS sector. The remaining 1.65 million workers are other computer related workers. Thus, about 60 per cent of the KE workers are the likes of Computer assemblers, Data entry operators, Computer technicians and servicing personnel, etc. These workers are not much different from manufacturing workers in the shop floor in that they use their hands and physical labour far more than their pure knowledge base. The only difference is that they require substantial prior training and education compared to ordinary factory workers to perform their task properly. These groups of workers, called *'Knowledge Technologists'* by Drucker (2001) are the largest group in India and *'are likely to become the dominant force over the next decades'* (Banerjee, 2005). That the KE is not only about Silicon Valley software nerds working three-digit hours per week and earning six-digit salaries per month should be quite clear from these figures.

Even if we consider only the IT and ITeS sectors we find some large gaps between perception and reality. A primary survey in the cities of Kolkata and Delhi and secondary data from Abraham and Sharma (2005) gives us some idea about the stark conditions of the workers in this sector.

i) Skill- formation and Training

We start with the skill formation of the workers in the ICT sector through on-job training and job-oriented courses. While the former type of courses are offered by firms to attract and retain workers in the face of scarce skilled-labour, the later are taken up by prospective

workers to improve their employability prospects. It is observed that very few workers undergo any such training processes (Table 5). Even within this low average there are sufficient disparities. While incidence of on-job training is highest in Bangalore and least in Trivandrum, job-oriented courses were more frequent in Trivandrum and least in Delhi. This has direst correspondence with larger numbers of firms in Delhi and Bangalore and the inter-firm competition there to recruit & retain workers, and larger number of prospective workers and lesser number of firms in Trivandrum, increasing competition among employees therein. It is thus evident that unlike popular belief the ICT sector in India is not characterised by skill-formation and skill-upgradation of the workers. This puts up a question mark against the quality of a majority of the jobs in terms of knowledge quotient and the long run sustainability of the jobs in face of lightening speed of technology-changes.

ii) Duration of Jobs

The duration of jobs in a single firm by any employee is mostly less than one year (Table 6). At the regional level, attrition is faster in Delhi compared to Kolkata or national average. Though majority of workers are changing job because of better salary, an overwhelming 58 per cent are changing jobs in search of more challenging assignment. This shows that the skill requirement of a large number of ICT sector jobs are not satisfactory, questioning again the quality of jobs in the new economy.

iii) Working Conditions and Emoluments

Another major area of concern regarding the ICT jobs are working conditions and emoluments. About one-fourth of the workers earn more than 30 thousand rupees per month while another 40 per cent earn between 15 and 30 thousand rupees per month (Table 7). This is vastly greater compared to average salary or average income in our country no doubt, but it has to be seen against the backdrop of the working conditions in this sector. While the average working hours per employee is in excess of 50 hours per week (Table 8), in the ITeS sector 10 hours per day work schedule with no casual or medical leave are common. On the other hand, in the software sector strains are created by the Target-based nature of the jobs as most of the production is through contractual agreements with the clients and are time-bound. Workers therefore are always under pressure to complete the assignment and when deadlines come nearer, there are instances of working 16-18 hours a day and staying back in the office over weekends. It is thus not surprising that about one-third of the workers spend more than 10 hours a day in the office. This proportion is more than 65 per cent in Kolkata indicating

the grim unemployment situation and dearth of employers therein forcing existing workers to spend more time in office.

Another major factor is the shifting pattern of the work. Since work in the ITeS sector goes on round the clock, and more so when the USA sleeps, it is not surprising that in Delhi and Bangalore, most of the work is in the night shift. It is also to be noted that these working hours are thought to be compensated by high salaries. While this is true at present for a subsection of the sector no doubt, but a large part of this salary is basically a quasi-rent arising due to the substantive cost-differences between remunerations in the client nation and in India. As competition among nations to attract ICT business are increasing, with China and Philippines emerging as strong contenders to India, this cost-difference will come down and the salary levels will also flatten out to a plateau. With non-existent labour legislations, it will thus be hard days for the workers in this sector in future.

iv) Deskilling and Burn-Out

In addition there are issues of deskilling. As evident earlier, skill-upgradation within the sector is quite low, leading to obsolescence and ultimate retrenchment of workers or rather replacing them by new entrants with requisite skills. In this way the firms do not have to bear training costs and are also ensured of a continuous stream of job seekers with the latest qualifications. This combined with the monotonous and repetitive nature of the jobs lead to substantial deskilling of workers, who, once thrown out, find it hard to get new jobs in this sector. Also, due to the continuous strain in a target based atmosphere and long working hours in cramped modular offices amidst electronic pollution with fast food as staple diet, the burn-out of workers is also an emerging social issue.[1]

It thus emerges that the nature and quality of jobs and the working conditions therein leaves many unanswered questions regarding both viability and desirability of a substantial segment of the KE. The salaries are however lucrative and attracts the bright young minds. This is also leading to dearth of skilled workers in some other sectors of the economy, especially the R&D sector.

V. DISPARITY AND DIGITAL DIVIDE

The most important drawback of the KE based model of development as practiced nowadays in India and elsewhere is the highly unequal nature of the sector.

i) Hierarchical and Earning Disparity

It is observed that there is substantial disparity within this sector in terms of size-class of firms, revenue earning per worker, and salaries. While the top 5 players account for 45 per cent of IT software and services business, another 10 players enjoy further 25 per cent of the market. Thus more than 500 odd firms share only 30 per cent of the software business. Within the ITeS sector, more than 50 per cent of business is done is by Captive BPOs or subsidiaries of transnational mother companies. Another 20 per cent of the market is shared by about 50 ITeS firms, leaving again about 30 per cent of the market for small domestic firms. This inequality is reflected in revenues per worker also. While about 20 firms earn more than 4 million rupees per employee, there are about 250 firms whose earnings are less than 1 million per employee. This is mirrored in the salaries doled out by the firms, and the disparities between remunerations & benefits provided by larger and smaller firms are quite substantial. Under such circumstances smaller firms that could proliferate and effectively utilise the large pool of academically trained workers available in the country, cannot do so due to the fat pay-packets offered by big firms having deep pockets and fatter contracts. As a result, NASSCOM itself is talking of continued consolidation, merger, and polarisation of business in the ICT sector in India along the lines of Centre-Periphery relationship. There will emerge a few firms in the centre, cornering majority of the high-end, high-valued software solutions market, both domestic and external, and there will be a large number of firms in the periphery involved mainly in the ITeS business. This divide will transcend to the labour market as well where we would have a small affluent class earning at international standards, and a large group of workers who would be involved in the KE for namesake but will be earning paltry sums. According to NSSO 1999-2000 data (NSSO, 2001) the average daily earning of Computer & Related workers were Rs. 255, but more important was the frequency distribution of the earnings and the disparity therein (Table 9). It appears that 50 per cent of the workers earn less than 200 rupees per day, while only 8 per cent of the workers earn more than 600 rupees per day. Thus the earning inequality within the KE itself is also quite astounding.

ii) Regional Disparity

As far as regional distribution of KE is concerned, it is evident from Table 10 that Karnataka, Maharashtra, Delhi, Tamil Nadu, West Bengal, and Andhra Pradesh account for more than 90 per cent of the business and 80 per cent of workers (both in ICT and related jobs). Even within these states, most of the KE jobs are concentrated in and around the cities of Delhi,

Bangalore, Hyderabad, Chennai, Mumbai, and Pune. Thus the digital divide in the KE is creating new modes of inequality in the society. In addition, the scope has been limited to the urban agglomerations and its effect on the rural landscape of our society is yet to be perceived. Wherever some progress has been made, it has been observed that the role of ICT in rural development are fulfilled only if they are preceded by radical advancement in land reforms, education, rural infrastructure and credit (Thomas, 2005). In absence of these basic amenities in the countryside it is quite obvious that the majority of our population would remain outside the ambit of KE.

VI. LOOKING AHEAD

i) Reviving the Research Sector

It would be obvious by now that the transition to the Knowledge Society is not even in sight in India. The ICT sector hailed as the mainstay of the KE is highly unequal – only a few firms cater to global standards, the impact on the domestic economy is limited and the majority of firms are engaged in low-quality jobs. Instead of providing earning avenues to the masses, the KE in its present form is creating new digital divide in the society, catering to the classes.

Under such circumstances, the Research & Development sector should be brought into the centre of policy prescriptions. The main focus of the policy makers should be on efficient application of knowledge in the goods producing sector – mostly in the form of R&D aimed at improving products and processes. Rather than exporting knowledge services, it would be prudent to use that knowledge in producing better and cheaper commodities in the domestic economy and exporting them. This would enable us to move up the value chain and also disperse the impact of knowledge on a larger scale to greater number of people. However, in this regard, we are quite behind the global standards (Table 11). We are a minor spenders on R&D, our science and engineering enrolment ratio is only 25 per cent, R&D personnel are few and far between, and original invention/innovation are also quite scanty. The situation is not at all conducive for effective absorption, innovation and diffusion of knowledge in the economy. In addition, our record in terms of transmission of *'Lab to Factory'* technology is also not very satisfactory. All these have to change if we really want to transform us to a knowledge society. The critical mass of English-speaking science graduates that we have must be transformed to a bulk of knowledge workers – both in research labs and in the ICT sector, in manufacturing and in services, in agriculture and in the mines.

It must be remembered that a knowledge society does not sustain through creation of an enclave sector that rises (and falls) with global demand for knowledge services. Rather, the

knowledge content of all the sectors in the economy should be increased. And there is no other way to do that except linking research with application, academicia with industry, labs with fields. Only through continuous encouragement towards creation of applicative knowledge, incentives for technology moulded for local needs, and financial rewards for indigenous innovation can we achieve those goals.

ii) Role of State

The role of State would be very important in this transformation. The growth of the ICT sector in terms of Value has been mostly under private initiative, and this success-story is being showcased to argue for further decontrolling of the economy and the society. Even we set aside the reality that this sector is only marginal to serve as replicative example in other parts of the economy, there is no doubt that work conditions and labour treatment in this sector leaves much scope for public scrutiny and State intervention. Apart from ensuring fair labour practices, the State has the duty to look into the issues of Safety Net for workers retrenched due to technological obsolescence and lay off, as they are quite fast and frequent in this sector. In addition, the State has a major role in proliferation of knowledge in every sphere of society – through policy framing, providing incentives, and active participation in spread of education, creating research & training atmosphere, and optimally chanelising available human resource into user sectors.

There is no doubt that we can make a successful transition to a Knowledge Society where knowledge will be created, disseminated, and utilised to enhance growth, productivity, and equality for majority of our people. Building up a society is a bit different from building up a blue chip company as the profit and loss accounts are less tangible and more value-based. The key lies in putting up a broad base of education, adoption & adaptation of new technologies, strengthening private sector R&D, stimulating linkages between industry and academic institutions, and stopping to treat the ICT sector as the only blue-eyed boy of the new society.

Notes

[1] The sound pollution created in a modern office due to the continuous hum of uncountable gadgets is often underestimated, but is substantial. Add to this the effects of radiation from close encounter with all those monitors.

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Table 1

Size of the ICT Sector in India (Billion US Dollars)

Category	1999-00	2001-02	2002-03	2003-04	2004-05	2005-06 (E)
IT Software Services and Products	**na**	**na**	**9.9**	**12.8**	**16.5**	**17.5**
- Exports	na	na	7.1	9.2	12.2	13.2
- Domestic	na	na	2.8	3.6	4.3	4.3
ITeS and BPO	**na**	**na**	**2.7**	**3.9**	**5.7**	**7.2**
- Exports	na	na	2.5	3.6	5.1	6.3
- Domestic	na	na	0.2	0.3	0.6	0.9
Total Software and Services	**na**	**na**	**12.6**	**16.7**	**22.2**	**29.5**
-Exports	na	na	9.6	12.8	17.3	**23.4**
-Domestic	na	na	3.0	3.9	4.9	**6.1**
Hardware	**na**	**na**	**3.6**	**4.8**	**6.0**	**6.9**
Total ICT Industry	**10.3**	**12.5**	**16.1**	**21.5**	**28.2**	**36.3**
Percentage of GDP	**2.1**	**2.4**	**2.9**	**3.6**	**4.5**	**na**

Source: NASSCOM (2006, 2006b).

Table 2

Employment in the ICT Sector in India (in thousands)

Type of Job	1999-00	2001-02	2002-03	2003-04	2004-05
Direct ICT Sector	**284**	**522**	**670**	**841**	**1045**
Software – Exports Sector	110	170	205	270	345
Software – Domestic Sector	17	22	25	28	30
Software – In-house Captive Staff	115	224	260	290	322
ITeS and BPO	42	106	180	253	348
Other Computer related Workers	**116**	**na**	**na**	**na**	**1650**
Total Knowledge Economy Workers	**400**	**na**	**na**	**na**	**2695**

Source: Same as Table 1.

Table 3

Growth of Output and Employment in Indian ICT Sectors

	Category	2003-2004	2004-2005	1999-2004
Output	IT Software Services & Products	29.3	28.9	
	ITeS and BPO	44.4	46.2	
	Total ICT Sector	**33.5**	**31.2**	**34.8**
Employment	IT Software Services & Products	20.0	18.5	
	ITeS and BPO	40.6	37.5	
	Total ICT Sector	**25.5**	**24.3**	**52.0**
Output Elasticity of Employment	IT Software Services & Products	0.68	0.64	
	ITeS and BPO	0.91	0.81	
	Total ICT Sector	**0.76**	**0.78**	**1.52**

Source: Same as Table 1.

Table 4

Key Verticals of Domestic ICT Sector and its Impact Factor on the Indian Economy – 2004-05

Sectors	Share in ICT Output	Share in GDP	Impact Factor[a]
Internal Use – ICT Sector	**17.0**	**4.5**	**0.77**
External Use – Tertiary Sectors	**37.0**	**19.3**	**4.02**
Banking & Financial Sector	24.0	13.7	3.29
Govt & Pub Administration	13.0	5.6	0.73
External Use – Real Sectors	**10.5**	**37.2**	**1.72**
Manufacturing	10.0	16.1	1.61
Agriculture	0.5	21.1	0.11

Note: a – Impact Factor is obtained by multiplying Share in ICT output and Share in GDP.
Source: Same as Table 1, and also GOI (2005).

Table 5

In-house Training and Training Courses of Employees

City	In-house Training		Training Courses	
	Yes	No	Yes	No
Bangalore	34.0	66.0	12.0	88.0
Delhi	10.0	90.0	5.0	95.0
Kolkata	20.0	80.0	6.7	93.3
Trivandrum	16.0	84.0	22.0	78.0
Total	20.0	80.0	11.4	88.6

Source: For Delhi and Kolkata, Primary Survey by author. For Bangalore and Trivandrum – Abraham (2005).

Table 6

Duration of Jobs and Reasons for Changing Job (% of workers)

	Duration of Jobs					
Duration	**Delhi**		**Calcutta[a]**		**Total[b]**	
	Present	**Previous**	**Present**	**Previous**	**Present**	**Previous**
Less than 1 yr	60.0	80.0	86.7	20.0	46.6	54.4
1 yr – 2 yrs	40.0	20.0	13.3	13.3	28.2	18.7
2 yrs – 3 yrs	0.0	0.0	0.0	13.3	8.8	9.9
More than 3 yrs	0.0	0.0	0.0	0.0	16.4	6.4

Reasons for Changing Job (Multiple Answers)			
Better Salary	80.0	43.3	62.9
Better Firm	10.0	26.8	36.4
Challenging Work	20.0	60.0	58.4
Better Job Status	8.0	3.0	31.8

Note: a – For Calcutta, 53 per cent are first timers in this sector and had no previous job-record; b – Total includes the other two cities for which separate data are not available.
Source: Same as Table 5.

Table 7

Salary Class of Employees (Salary per month)

Salary Class	Bangalore	Delhi	Kolkata	Trivandrum	Total
< 8000	0.0	12.5	13.3	8.5	8.6
8000 to 15000	8.3	30.0	40.0	31.9	27.6
15000 to 30000	33.3	51.2	26.7	48.9	40.0
30000 to 50000	47.2	6.1	20.0	8.5	20.5
> 50000	11.1	0.2	0.0	2.1	3.4

Source: Same as Table 5.

Table 8

Hours of Work

	% of Employees by Daily hours of Work				Average Weekly Hours per Employee by Shifts		
	6 hrs	**7 hrs**	**8-9 hrs**	**10 hrs +**	**Day Shift**	**Night Shift**	**Total**
Bangalore	0.0	0.0	76.1	23.5	20.9	30.0	50.9
Delhi	13.0	24.0	39.2	24.5	7.9	40.0	47.9
Kolkata	0.0	10.0	23.2	65.4	54.8	0.0	54.8
Trivandrum	4.0	0.0	79.5	16.6	24.4	25.0	49.4
Total	1.3	8.5	54.5	32.5	27.0	23.8	50.8

Source: Same as Table 5.

Table 9

Average Daily Earning of ICT Workers – 1999-2000

Earning Class	% of Workers
< 100	22.6
100 to 199	25.9
200 to 399	28.0
400 to 600	16.0
> 600	7.5

Source: NSSO (2001).

Table 10

Regional Distribution of ICT Business and Employment

State	Share in ICT Employment	Share in other related Employment
Andhra Pr	9.7	6.3
Delhi	12.7	9.9
Gujarat	2.8	7.9
Haryana	1.0	1.0
Karnataka	14.5	12.1
Kerala	3.6	3.2
Maharastra	26.7	24.9
Tamil Nadu	10.3	10.9
Uttar Pr	3.5	9.3
West Bengal	10.3	8.2
Other States	4.9	6.3

Source: Same as Table 1.

Table 11

Research & Development in India – Global Comparison

Indicator	India	China	Japan	S Africa	USA	EU	LDCs	East Asia	World
R&D Expenditure as % of GDP	0.85	1.23	3.11	0.68	2.67	1.98	0.46	1.24	1.05
Private Sector Spending on R&D	3.80	3.60	5.80	4.10	5.90	4.37	2.94	3.88	3.34
High-Tech Exports as % of Manuf Exports	4.75	27.10	24.06	4.96	30.81	15.83	7.79	32.02	10.41
ICT Expenditure as % of GDP	3.70	5.30	7.40	8.00	8.80	5.59	5.74	6.36	5.87
Science & Engineering Enrolment % of tertiary students	20.08	n/a	20.15	17.32	n/a	23.68	22.03	27.02	22.60
R&D Personnel / million population	119.7	633.0	5084.9	192.0	4525.8	3495.7	648.2	1845.1	1606.3
Prof. and Tech. Wkrs as % of the lab force	n/a	n/a	14.3	14.7	19.4	28.9	14.9	18.1	20.5
University-Industry Research Collaboration	3.30	3.90	4.60	4.20	5.70	4.13	2.80	3.87	3.17
Patents granted by USPTO / million pop	0.35	0.46	289.87	2.52	320.70	77.91	0.52	52.15	24.48

Source: http://web.worldbank.org/wbsite/external/wbi/wbiprograms/kfdlp/extunikam