LABOUR MARKET DEEPENING IN THE INDIAN INFORMATION TECHNOLOGY INDUSTRY: AN EXPLORATORY ANALYSIS

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Abstract

The Indian Information Technology (IT) sector has seen significant growth in terms of employment and revenue and is expected to provide quality employment to a large number of workers in the coming years. A more widespread participation of workers with different skill/education profiles, gender, regions etc. would facilitate deepening of the labour market and eventually reduce costs. The only data on the IT industry that has been analyzed so far is based on surveys conducted by the National Association of Software and Services Companies (NASSCOM). NASSCOM estimates are essentially based on data collected from its members. While the estimates are considered to be reasonably reliable, one is not sure of the coverage of IT firms by NASSCOM, particularly of small IT firms and hardware firms. Besides, the estimates may not adequately capture employment of IT workers in IT using sectors. It is, therefore, desirable to explore other data sets to analyze issues relating to the IT labour market in India. This paper is an attempt in this direction and hopes to provide a tentative understanding of the processes that have been important for the evolution of the IT labour market in India. It analyses NASSCOM and National Sample Survey (NSS) data to explore the processes that deepen the IT labour market in India. The analysis suggests that deepening is actually taking place but the pace can probably be enhanced. Transition to the off-shore model, growth of the ITES sector, competition and infrastructure led movement of IT activity to smaller cities and hiring of workers with diverse education backgrounds and of women workers has facilitated the deepening processes. These processes will need to be intensified in order to further deepen the market and enhance employment opportunities.

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I. Introduction

The Indian Information Technology (IT) sector has seen significant growth in recent years. During the 1994-2003 period, the revenue generated by the sector grew from about Rs 5,450 crores to Rs 79,337. The employment in this sector has also grown significantly. According to industry sources, there were only 6,800 IT workers in India in 1986-87. This number has gone up to 650,000 in 2002-03. The IT sector is also expected to provide quality employment to a large number of workers in the coming years. Given this context, it is important to find out if large sections of the Indian workforce would be able to participate in the IT market. A more widespread participation of workers with different skill/education profiles, gender, regions etc. would facilitate deepening of the labour market and eventually reduce costs.

This paper is an attempt to explore the processes that deepen the IT labour market in India. It is divided into four sections. We begin with a brief discussion of recent changes in industrial structure of the world economy and its links with labour market deepening in the IT sector. In Section 3 we use the information from industry sources to identify the developments that impinge on the deepening process. Section 4 uses data from the National Sample Survey Organization (NSSO) to assess the evidence on the extent of which such deepening has actually taken place. The final section pools the insights from the analyses in these two sections to provide a tentative understanding of the processes that have been important for the evolution of the IT labour market in India.

II. Changes in Global Industrial Structure and Labour Market Deepening

In each mode of development, there are different elements that foster productivity in the production process. In an agrarian economy, land and labour along with capital become the determining factor for increasing surplus. As technological or commercial improvement take place product market begins to develop and labour market undergoes a change. In the industrial economy capital and labour along with energy sources

become the main source of productivity; as capital is reproducible it expands through accumulation. In the information economy 'the sources of productivity lie in the technology of knowledge generation, information processing, and symbol communication' (Castells, 2001: 17). The main source of productivity in the informational economy is the accumulation of knowledge. However, 'the transition or shift from industrial to informational economy is not the historical equivalent of the transition from agricultural to industrial economies and cannot be equated to the emergence of service economy' (Castells, 2001: 100).

The structural change in the information economy is that it transforms the labour market and generates demands for specific skills worldwide. The character of labour undergoes a shift from manual labour to intellectual labour. In the information economy, economic growth would depend on "human capital" and less dependent on physical capital, which was dominant in the industrial economy. There is increasing importance of highly skilled labour in the information economy (Stehr, 1999). With the growth of the global "information economy", the potential of participation of developing nations in the global economic processes also increase. Besides, for developing countries with scarce capital resources, increases in productivity or growth can take place through information technology and can also speed up the developmental process (Kelkar, 1991). Investments in education and research accelerate this process.

Expansion of "informational" activities leads to the specialization of labour, and education. As the demand for certain information goods and services increases the demand for specialized labour would increase. In the information economy, there is potential for two kinds of service activities to increase namely the software and ITES services. The last decade has observed major growth of software services industry, especially in the developed countries. This led to a huge demand for software services related labour both within the developed countries and outside. With increasing competition, developed country firms are trying to outsource many of its activities to low cost developing world, where there is delivery of similar quality services at low price. Such outsourcing activity helps the labour market in the developing countries, which could take advantage of developing the right skills needed. Indian labour has

participated in a significant manner in this growing outsourcing market. The market for such information goods and services is still in its infancy in the developing world. As the market develops there would be increasing demand for such labour even within these countries. The ITES market is still growing and has a huge potential in the coming years for countries like India, which still enjoys a cost advantage and where necessary skills could be easily acquired.

The "globalization" of IT markets referred to above can potentially lead to significant deepening of labour markets in developing countries like India. Market deepening usually refers to the process where the market increasingly extends itself to new areas of human activity. Extending this idea, one can argue that as transactions in a specific market become more frequent, complex and diverse, one would say that market deepening is taking place. In a sense market deepening can be seen as a result of two simultaneously occurring phenomena. As market grows specialization takes place and diversity in the demand and supply of skills gets enhanced. We refer to this as the deepening process. But as demand for specialized skills grows, the market segment for each set of skills becomes large. The increases in scale for each skill segment make its market "thick" as more and more entities demand and supply these skills frequently. Thus, thickening and deepening of markets can be seen as two interdependent dimensions of the market expansion process and in some sense market deepening encompasses the thickening of the market as well.[1] For example, when the markets are not large or when output fluctuations are high, firms may need specialized workers but may not be able to make long-term commitments. Availability of large pools of specialized workers reduces the need to make such commitments. Similarly, if workers are to invest in specialized skills, they will either require long term employment relations or possibility of rehire with a rapid and efficient job search (Storper and Venables, 2003).

The market deepening process hinges on the interplay of the supply and demand forces. Changes in the final demand vector can change the demand for intermediate products,

[1] See Duranton (2004) for an interesting discussion of externalities arising out of thick markets of skilled labour and its potential impact on wage differentials between skilled and unskilled labour.

which in turn can influence the skill requirements of producing the final good, as well as the intermediates. Obviously, the demand for different skills will change with changes in the final demand vector. Participation of workers in this changing market place will be affected by the distribution of skills. If required skills are not available, only a small proportion of workers will be able to benefit from the new employment opportunities, at least in the short run till workers acquire such skills. In the interim, firms either train workers or adjust their production process to available skills. Lowering of infrastructure and entry costs can facilitate integration of geographically dispersed markets. This in turn can help firms make more rational choices about processes of production as they can now access geographically dispersed skills.

Specialization associated with deepening of markets usually leads to productivity benefits and cost savings. In the discussion so far, we have assumed, as in the traditional discussion on division of labour, that expansion of markets relaxes the constraints on specialization. In a very influential paper Becker and Murphy (1992) argue that often factors other than expansion of markets are more critical for specialization to take place. These factors include various costs of coordinating specialized workers who perform complementary tasks and the amount of general knowledge available. It is argued that 'principal agent conflicts, hold-up problems, and breakdowns in supply and communication all tend to grow as the degree of specialization increases', which enhance the cost of co-ordination. Besides, 'greater knowledge tends to raise the benefits from specialization, and thus tends to raise the optimal division of labour' (Becker and Murphy, 1992: 1141,1157). Thus, labour market deepening processes unleashed by market growth and expansion may be attenuated by the transaction costs associated with the co-ordination of specialized workers by firms. As an extension of this argument if workers can potentially be accessed through "sub-contracting" arrangements, firms will need to compare the co-ordination costs associated with such arrangements with the costs of coordinating workers within the firm. Differences in intra and inter-firm coordination costs will impinge on the nature of specialization in a market.[2]

[2] For example, given the schism in the labour markets in developing economies, large and small firms typically draw from different segments of the labour market, the costs for the latter being lower than for the former for the same quality of labour. In such a scenario, similar inter and intra-firm co-ordination costs can

In the context of the IT labour market, market deepening can get reflected in various forms:

1. A significant increase in the demand and/or supply (pool) of IT workers with specialized skills. The increase in demand may reflect a change in the nature and quantum of the final demand vector, while the supply changes may occur due to skill formation and/or integration of geographically dispersed markets.
2. Undertaking of IT activity (say a project) with a wider variety of workers in terms of skill profile and nature of contracts (part time/full time, home based etc.).
3. Higher use of IT workers in different industry segments. At one level, it can be seen only as diffusion of IT across industry groups. But insofar as such diffusion creates demand for segment specific IT skills, it deepens the IT labour market.
4. Larger participation of workers with different characteristics (gender, age, regional background, technical or educational background, skill profiles etc.). As a corollary, an increase in the outsourcing of IT tasks to firms of different size and/ or locations will also signify deepening as firms embody different "skills". In line with the arguments listed above, such outsourcing would depend on transaction costs associated with accessing specialized labour through inter-firm linkages vis-à-vis coordinating their work within the boundaries of the firm.[3]

All these changes suggest that the demand for IT workers is on the rise and is getting diversified in terms of characteristics of workers. Obviously, deepening of the market entails enhancement of employment opportunities. So far, the development of the IT labour market in India has been essentially driven by the integration of IT related activities globally. Demand in Western markets has been the most important component of the final demand vector faced by Indian IT firms. Due to this growing integration, the diffusion of ICT in the developed world and the associated changes in the industrial structure continuously impinge on the development of the IT labour market in India. Competitive pressures faced by Indian firms in this changing global context have also

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enhance the demand for workers hired by the small firms. In addition, if intra-firm co-ordination costs are lower for small firms, the shift in demand in favour of small firms will even be higher.

[3] A wide variety of co-ordination costs and risks are associated with outsourcing in IT industry and do indeed affect the extent of use of this activity for sourcing labour. (See Bahli and Rivard ,2003).

led to a change in hiring practices. In the near future, this trend is likely to continue although one does see emergence of domestic market based IT activity as well. The deepening of the IT labour market needs to be seen in this broad context.

III. Labour Market Deepening: Processes at Work

A large variety of processes can impinge on the way labour market operates in a particular sector. This can include the growth of the sector, changes in the composition of demand and so on. This is so because different rates and patterns of growth can have different implications for intensity of labour absorption and the type of workers that can participate in the labour market of a sector. This section pools together evidence from different sources to identify these processes for the IT labour market in India.

III.1 Growth and Export Orientation of the IT Sector

Tables 1 and 2 summarize recent trends in the growth and export orientation of the Indian IT sector. It is evident that the sector (hardware/software) has grown very rapidly in the 1990s. In fact, the growth was more than 1350% in rupee terms and 853% in US$ terms during 1994-2003. Simultaneously, the share of export market in the total sales grew rapidly from about 29 to 62 per cent. During the same period, the growth of the software and the services sector was even more dramatic (2324%). Besides, the role of the export market was even more dominant in the software & services segment (79% in 2002-03).

Interactions with the Indian IT industry personnel suggests that export market projects are often less complex than domestic projects but are more lucrative (See Basant and Chandra, 2003).[4] Over reliance on the export markets for growth in the last decade had implications for the demand patterns for IT skills. Growth in demand for low-end skills has dominated this decade. However, the Indian IT industry has seen significant

[4] One of the key reasons for this difference is that firms typically do the entire project when they are working for domestic projects, while they do only part of the project for external markets. Foreign firms in the case of an external project do the more complex task of integration.

changes in recent years and demand patterns for skills are also changing in favour of high-end skills (see discussion below).

III.2 The Transition from Onsite to Offshore Model

Table 3 shows that there has been a rapid increase in the offshore segment of the Indian software and services exports. The onsite share declined from 90% in 1990-91 to about 39% in 2002-03. The increase in the offshore segment has been quite dramatic after 2000. Presumably, the rapid increase in offshore segment after 2000 is largely due to Business Process Outsourcing (BPOs) of major companies. The country's labour arbitrage has attracted the biggest IT companies and the vast talent pool is also providing an army of number crunchers for companies to perform an array of financial tasks in Indian centres (The Economic Times, October 22, 2003). There are two kinds of outsourcing, software and business process outsourcing, services outsourcing, accountancy jobs, payroll jobs, etc. India is a major player in many of these jobs, not just due to its advantage in English language but also due to its institutional compatibility like, having similar legal and accounting systems, which gives it a comparative advantage (The Economic Times, October 23, 2003).[5]

Whatever may have been the underlying motivations, the transition from the onshore to the offshore model deepened the IT labour market in India as Indian firms could now utilize the segmentation in the labour market to their advantage. For onshore tasks, they could only hire engineers and that too from good institutions because the nature of these tasks was very diverse with complex elements. On-site these professionals have to undertake these complex tasks as well as a host of activities in the lower and medium level of the value-chain. The offshore model permits Indian firms to hire/use non-engineers and engineers from less renowned universities to undertake less complex tasks, leaving the higher-level tasks for senior and better-trained employees. This put a downward pressure on labour costs that were rising rapidly due to the growing demand and inadequate supply of people with multiple skills. Consequently, more people with different skill-sets can now participate in the IT labour markets. This in turn would lead to better allocation of resources and employment to a larger variety of IT professionals.

Of course, this transition will be affected by the costs of co-ordinating different types of labour.[6]

The changes in the composition of the IT sector combined with the offshore model can potentially create larger opportunities of employment for workers with different characteristics. The realization of this potential, however, depends on a variety of factors. For example, the possibilities of intra-country outsourcing between large firms and small firms and between firms located in the metropolises and smaller towns can impinge on the participation of various types of workers in the IT labour market. It is to the discussion of the changes in the composition of the IT sector that we now turn.

III.3 Changing Composition of the IT Sector

The composition of the IT sector has changed significantly in recent years. These changes can be seen in terms of three inter-related characteristics: types of IT activities (hardware, software etc.), the domains of IT activities (telecom, banking etc.) and the complexity of IT tasks (low-end/high end). Changes in the composition of the sector have changed the composition of demand for skills as well. We discuss each of them briefly.

Emergence of IT Enabled Services

One of the most important changes has been the emergence of information technology enabled services. Table 4 shows that while hardware segment still dominate the domestic market, the software segment has been growing at a faster pace during 1997-98 and 2002-03 (186 v/s 169 per cent). Similarly, the share of ITES is small in the domestic market (about 1.5 per cent of the domestic IT market) but has grown rapidly by about 4000 per cent during 1997-2003. The share of ITES within domestic software and services increased from about 1.6 per cent in 1998-99 to 3.7 per cent in 2002-03. The share of ITES has risen rapidly in the total software and service export revenues in

[5] The Economic Times report quotes a study conducted by Ashok Deo Bardhan and Cynthia A Kroll of the Fisher Centre for Real Estate and Urban Economics, in this regard.

[6] Another reason why workers with different skills may not be hired for offshore tasks is the insistence of foreign outsourcing firms that only engineers be hired for their projects. Moreover, getting H1B visa is easier for an engineer than a non-engineer and therefore hiring of engineers enhances the substitutability of

recent years, from about 14 per cent in 1999-00 to 24 per cent in 2002-03 (NASSCOM, 2002; 2003).

Table 5 shows that there has been a rapid rise in the employment in IT enabled services as well. It increased from about 42,000 to 160,000 during 1999-2003. According to NASSCOM estimates, average employment in ITES firms is 190 although it can range from as low as 4 to 16,000! Future growth of employment in this segment is critically dependent on the infrastructure availability and costs, especially that of telecom infrastructure. Indian ITES-BPO operating costs on average are 20 per cent of the US costs but the telecom costs in India are 155 per cent of the US costs (NASSCOM, 2002).

The shift in favour of ITES has implied that the participation in the IT labour market is no more the preserve of engineers who have been trained formally or informally to make software or hardware. Workers trained in other disciplines can now participate in the growing market, which implies widening of the labour market in terms of skills and educational background.[7]

Table 5 also shows that within the software sector, a significant share of IT professionals work in user organisations (40 per cent). This share is even higher than IT exports (32 per cent). It is evident, therefore, that a rise in IT usage can have a significant impact on demand for IT professionals. As the diffusion of IT progresses in the economy, the employment of IT workers will also rise. Diffusion of IT can take place both in the public and the private sectors. While IT investments in the private sector are largely market driven, the IT related expenditures in the public sector depend on a variety of factors including budget constraints and the priority given by the State for such investments. We shall revert to this issue in a subsequent section.

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labour for onsite and off-shore tasks and firms prefer to keep a larger pool of such workers for contingencies.

[7] In fact, the NIIT is recasting its training programmes to make them more useful for ITES jobs. It has initiated a programme called "Planetworks" for ITES aspirants, which does not focus on software languages etc. but on communcation skills, keyboard proficiency, data search and navigation skills, quality concepts and Internet skills. It has even set up E-recruitment kiosks in major cities where aspirants can rate their skills in some of these components and apply electronically (The Hindu June 16, 2003).

Composition of IT Industry by Verticals

Table 6 provides data on the IT market revenue by verticals. Interestingly, there are several similarities in the verticals of domestic and export markets: BFSI, Manufacturing and telecom are important markets in both segments.[8] This would suggest that there exist a significant potential of integration of labour markets and learning. Firms/workers can apply learning from domestic segments in the same verticals to the export segments and vice versa. Unless the tasks of the two segments in each vertical are significantly different, the same set of workers can potentially participate in the two segments. To what extent, such integration and learning do actually take place should be an interesting question for research, both from the perspective of policy and firm strategy. A better understanding of the IT labour market would also involve answering the following type of questions: Do IT firms look for multiple skills today? To what extent domain expertise remains an important asset for a worker? To what extent firms and workers specialise in verticals?

Government, education and small office/ homes are important markets for domestic IT firms. Most of this must be hardware led. IT investments for homes and small offices are increasingly becoming important. Government expenditures relating to computerisation and e-governance programmes can go a long way in enlarging the domestic market and thereby deepen the labour markets.

From Low-end to High-end Jobs

Indian IT industry was for a long time dominated by activities that are known as "staff augmentation", another name for body shopping. Many showed concern about the lack of high-end activity in the Indian IT industry. Despite concerns on the contrary, one can see a shift towards more value added services, an emerging specialization in embedded software and even a marginal shift towards products. It has been argued elsewhere that over time Indian firms have moved from less to more complex, risky, investment intensive and profitable IT activities. This transition has largely been facilitated by inter-

[8] It is not clear if the energy sector in domestic market similar to utilities in the export market.

firm alliances, including those of the outsourcing variety, without which it may not have been possible (see Basant, 2004).[9] As a consequence of this transition, the demand pattern for IT skills has been changing and it is likely to change more dramatically in the coming years. Interestingly, firms involved in high-end tasks do not face the problem of high attrition rates (see discussion below) as firms involved in low-end activities in the BPO domain. BPO firms involved in high-end niche areas like research and analytics, typically employ postgraduates, engineers, MBAs and at times Ph.Ds rather than undergraduates who are used in the BPO domain. These firms usually have low attrition rates (Economic Times, November 17, 2003).

III.4 Changing Composition of the IT Sector, Offshore Model and the Regional Divide

As mentioned above, the changes in the composition of the IT industry and the emergence of the offshore model as the dominant model should entail higher participation of workers in smaller towns. We examine this issue here with the help of NASSCOM data and will revert to it again in a later section when we analyse data from the National Sample Survey Organisation (NSSO).

Data on the distribution of IT companies by location (Table 7) clearly indicates the emergence of smaller IT centres like Pune, Ahmedabad, Kochi, and Trivandrum. According to a NASSCOM survey, in recent years, hiring of new IT professionals was highest in south India at 44 per cent and lowest in eastern India at 6 per cent (NASCOM, 2003: 138-39). This may partly be linked to inadequate availability of IT infrastructure in the Eastern region of the country. A higher rate of diffusion of IT employment can take place in these regions if infrastructure (especially telecom) improves.

The IT industry has been concentrated in a few regions reinforcing the regional inequalities. The offshore delivery of work and the emergence of the IT enabled services as an important segment of the IT market can facilitate larger participation of workers from different regions. Initially, the IT hubs in India were concentrated to very few

[9] Some evidence of this transition is also available in Venkatraman, Mukundan and Ravi Shankar (2003).

centres, largely bigger cities like Bangalore, Delhi, Hyderabad, etc. Lately, medium size cities like Ahmedabad, Pune, and Kochi among many others are emerging as new centres for outsourcing thereby penetrating smaller towns and offering employment to people from these towns. Some of the "outsourcing" takes the form of distributing work across regional centres of the same company.[10] In spite of this, except for a few isolated cases, the rural areas still remain deprived of any integration with the IT segment. Opportunities could be explored through the offshore models for further infiltration into the rural and smaller towns as this model is more integrated with the domestic economy than the on-site model.

The bigger cities like Bangalore, Delhi and Hyderabad had the advantage of having a large pool of right sort of human resources, mostly English educated and could acquire the necessary skills much more easily. This probably could be a problem for medium size cities like Kochi where there is no doubt a large pool of educated people and mushrooming of these centres, but English is not the language of speech and thought, and the English accent leaves much to be desired (The Hindu, March, 20 2003).

The underlying motive for outsourcing is driven by lower costs. The infiltration of these opportunities into the rural and smaller towns is possible if either the big Indian companies outsource their back office operations to cut costs or if certain kinds of out-sourced services like accounting, legal, etc decide to have their operations in these area to further reduce their costs. Obviously, firms need to worry about co-ordination costs in such situations, which are a function of variety of things including costs and access to good quality infrastructure. Good telecom facilities (including Internet) and power will be quite critical in this regard.

[10] The case of a company named EXLService is interesting. The firm has a small company owned recruitment office, which focuses on hiring in smaller centres. Apart from Delhi, it has set up centres in less known locations like Chandigarh, Lucknow and Kolkata and is planning one in Ahmedabad. It distributes work across these centres in a seamless manner (Economic Times, October 22, 2003). This presumably helps in better worker retention and in reducing costs. It is not clear how widespread is this phenomena. But it can certainly deepen IT labour markets in a significant way if this trend picks up.

III.5 Changing Composition of the IT Sector, Offshore Model, Gender and Age Dimensions

According to a NASSCOM survey, only about 21 per cent of software professionals in software companies were women. However, this percentage was expected to improve to 35 by 2005. Besides, the survey indicated that the ratio of male to female workers in the ITES sector was 35:65 (see for details, NASSCOM, 2003). Thus, the model of delivery and the industry composition also influences the participation by women in the IT industry. The skill profiles of large sections of women workers are often not appropriate for the high-end IT jobs. Moreover, social and other restrictions on their mobility (e.g., due to household responsibilities) reduce their ability to participate in tasks to be undertaken onsite. The offshore model and the growth of ITES segment enhance women worker's ability to participate in the IT market. The time flexibility provided by some segments of the IT market (including certain tasks in the ITES domain) also enhances the potential for women's employment in this sector.

It has also been observed that due to high attrition rates (35-40 per cent) in call centres and BPOs, there are an increased demand for housewives, as they are much more committed to work and are stable. ITES companies who are spending huge sums of money in training these personnel are looking for more consistent employees, so that they can reduce their tangible losses- both training costs and person-hours (The Economic Times, October 22, 2003). This concept is slowly catching up with some of the companies based in North India including some MNCs that have introduced it.

Another way of dealing with high attrition rates has been hiring old employees (including retired school teachers) and training them. This trend is also more dominant in North India. In fact, some companies in the NOIDA region have 8-10 per cent of their work force in the age group of 40 plus years (Economic Times, October 22, 2003).[11] According to some NASSCOM estimates the median age of the software professionals was 26.5 years and about 42 per cent of the software professionals had over 3 years of work experience. The NSSO estimates for 1999-2000 suggests that 72 percent of the IT occupation workers are below the age of 30 years and about 16 percent are above 50

[11] Also see Mehra (2003) for similar information.

years. A comparison of the age profile of the IT industry workers with those of other industries suggests that the share of young workers (less than 30 years) in the IT industry is much higher (79 per cent) than for all industries put together (42 per cent).[12] This age profile may change if preference for older employees, especially in the ITES domain picks up significantly.

Broadly then, the growing presence of outsourcing as a part of Indian software and service sector exports, therefore, holds a number of positives for better linkages with the domestic economy and prospects of employment. Two processes seem to be working simultaneously. Digital divide is excluding segments of the population from participating in the IT labour market. At the same time off-shoring and emergence of the ITES sector is creating possibilities of labour market deepening as less skilled/educated workers, women and workers from backward areas (and of older age groups) can now participate in the IT labour. What factors determine the extent of these processes of labour market segmentation and integration? Apart from other factors, the size structure of the Indian IT industry and the linkages between firms of different sizes may impinge on the segmentation and the integration process.

III.6 Size and Ownership Structure of the IT Industry

The data on the size structure of the Indian IT industry is very rudimentary. Data reported in Table 8 suggests that IT industry has a large number of small players. About 88 per cent of the total firms have a turnover of less than Rupees 10 Crores. This suggests that large shares of IT firms are small entrepreneurial ventures managed by self-employed individuals. However, the industry is highly skewed in terms of share of the market: top 5 firms had a share of 32 per cent in the revenues. The next top 47 firms with a turnover between 100 and 1000 Crores had a share of 35 per cent. Firms with turnover of less than 100 Crores (98 per cent of the total firms) had a share of only 11 per cent (NASSCOM, 2003: 39-40).

Moreover, a comparison of the size distribution of firms for recent years with some earlier years would suggest that small firms have grown slowly in recent years

[12] To save space, detailed age specific estimates are not reported here.

(NASSCOM, 2003). Besides, the share of MNCs in the IT sector increased from about 12 per cent in 1997-98 to 22 per cent in 2001-02 (Kumar, 2001, NASSCOM, 2003: 39-40). More over, MNCs have a significant share of about 45 per cent in the ITES market. These trends would suggest that the deepening of the IT labour market would significantly be affected by links (a) between MNCs and local firms and (b) between large and small IT firms. If cost pressures and extension of IT related infrastructure lead to a rise in such links whereby domestic small firms can participate in the contracts undertaken by large domestic firms and MNCs, labour market deepening would be facilitated. Except for some anecdotal evidence, there is no evidence on whether such linkages are on the rise.

IV. Patterns of Employment in the IT Sector: Some Evidence from the National Sample Survey Data

The employment surveys conducted by the National Sample Survey Organization (NSSO) are the largest employment surveys in the country. Estimates of IT related employment from these surveys have not yet been analyzed. These data can be used to generate estimates of two categories of "IT workers": (1) workers engaged in IT industry and (2) workers engaged in IT occupations. It needs to be emphasized that workers engaged in IT industry may not necessarily be those undertaking only IT occupations. Similarly, IT occupation workers may be engaged in all types of industries including IT industry.

Since we need to analyze changes in the employment of IT workers over time, we need to worry about the comparability of estimates for different years. The focus here is on the changes in the 1990s and we will essentially look at the data from the 50th (1993-94) and the 55th (1999-00) Rounds of the NSSO. A comparison of these two rounds suggests that while both rounds used the same occupational categories, the industrial categories have been made more detailed in the 55th Round. The table below provides a comparison. In order to compare the estimates of workers in the IT industry in the two time periods, we have added the two sub-categories in the first column in order to get the estimates for 1993-94 and all the six sub-categories have been added to get estimates for the year 1999-2000. Since there has not been any change in the

occupational sub-categories used in the two rounds, detailed sub-category level comparison is possible.

IT Industry Categories in the 50th and the 55th Rounds of the NSSO: A Comparison	
1993-94 (NSSO 50th Round)	1999-00 (NSSO 55th Round)
• Data Processing, software development and computer consultancy services	• Hardware consultancy • Software consultancy • Database activities • Data processing • Other computer related activities
• Repair of office and computing machinery	• Maintenance and repair

IV.1 Distribution of IT Workers by Industry and Occupations

According to the NSSO estimates (Table 9), there were about 266 thousand workers in the IT industry. The number of workers engaged in IT occupations was much higher, about 369 thousand in the same year (Table 10). Interestingly, a comparison of NSSO and NASSCOM estimates for the year 1999-2000 would suggest that NASSCOM under-estimates the number of IT occupation workers; its estimate is closer to the NSSO estimates of IT industry workers. For the year 1999-2000, according to NASSCOM, about 284 thousand workers were engaged in IT industry, which is similar to the NSSO's estimate of IT industry workers of 266 thousand, while the IT occupation workers were much higher. Similar pattern emerges if we compare the estimates for the year 1993-4. NASSCOM estimated the number to be 56,000 while the estimate for IT industry workers from NSSO was 53,000 and that of IT occupation worker was 143 thousand.

Among IT occupations, computing machine operators dominate followed by automatic data processors and systems analysts and programmers (Table 10) The share of computing machine operators among women IT occupation workers was significantly higher than among male workers. We shall see later that the share of computing machine operators has increased in the 1990s, with a 29 per cent growth, which partly reflects the emergence of the ITES segment.

IV.2 Distribution of Workers by Gender

Data reported in Tables 9 and 10 suggest that the proportion of female workers in all categories was much lower than that of males. The share of women workers was particularly low among system analysts and programmers (Table 10). The trends in the growth of women workers are also not very encouraging and reveal a clear gender divide. Growth of IT occupation workers during the 1990s was lower for women workers (17.5 per cent) than for male workers (26 per cent). Moreover, the share of female workers in total workers in IT industry has declined from about 20 to 16 per cent. Relative decline was most significant among professional workers and there was a shift of female workers in clerical and related activities (Table 11). It is quite likely that till 1999-2000, the impact of high absorption of women workers in the ITES segment had not become evident and may get reflected in the 60th Round data.

IV.3 Distribution of Workers by Education and Skill Levels

It may be recalled that in the last section, we had suggested the possibility of a bridging of the skill-education divide in the IT labour market with impending changes in the skill and education profiles of IT workers in the emerging segments like the ITES. Table 12 provides data on the distribution of IT industry workers by education categories for the year 1999-2000. As mentioned earlier, these workers are engaged in all types of industries and are not restricted to IT industry. The most interesting feature of the data is that a significant proportion of non-engineering/technology workers participate in IT occupations. This is true of even those workers with IT occupations who are engaged in IT industry (Table 12).[13] It is also worth noting that participation of workers with non-engineering/ medicine education as professionals is significant (84 per cent). Presumably, workers with diplomas from NIIT are not counted as those having engineering or technology backgrounds. It is not entirely clear from the details available from the NSSO sources, if such workers are categorized in the category of "higher

[13] A comparison of the education profiles of IT industry workers with that of all industry workers suggests that a much larger share of the IT workers are engineers and have secondary, higher-secondary and graduate education than the rest of the sectors. For example, while only 4 per cent of workers in all workers have higher secondary education, more than 17 per cent of IT workers have such education levels. Similarly, while more than 11 per cent of IT industry workers are engineers, this proportion for all workers is 0.2 per cent.

secondary", which often is a pre-requisite for NIIT like courses, or in "other subjects". The workers included in "other subjects" are those with graduate degrees in non-agricultural subjects. Whatever may be the case, the fact remains that a significant part of the professional workforce in the IT industry are with non-engineering and technology backgrounds.

We get a similar picture if we look at the education profile of workers engaged in IT occupations (Table 13a). A few additional insights seem to emerge. The share of workers with secondary and higher-secondary education in IT occupations is significantly higher for males than for females. The same is true of workers with engineering and technology backgrounds. The bulk of the IT occupation workers have studied "other subjects" which seems to be a catchall category of workers who have graduate degrees on non-agriculture subjects and those who do not fit into any of the other educational categories. Significantly, a much larger proportion of the women IT occupation workers fall in this category than male workers. A comparison of educational backgrounds of IT occupation workers in 1993-94 and 1999-2000 suggests that the share of workers with secondary and higher-secondary education has increased while of those with qualifications in other subjects and engineering/technology has decreased (Table 13a). Thus, if this phenomenon is interpreted as participation of workers in IT occupations with diverse educational backgrounds, both male and female workers are participating in this process, although the proportion of female workers in IT occupations continues to be low. This combined with the fact that the number of workers in IT occupations has increased for all educational categories (except non-literate) would suggest that some processes of deepening in the IT labour market are underway. This seems to be consistent with the fact that the new employment opportunities in recent years were created in the BPO domain, which can potentially absorb workers with less educational qualifications.

The data on the educational attainment of IT occupation workers by age groups brings out some interesting insights (Table 13b). Most (96 per cent) of the IT occupation workers in the 50+ age group only have secondary education. Most of the IT occupation workers in there 40s are categorized in "other subjects", which presumably implies that most of them are graduates in non-agricultural subjects. As significantly larger proportion of

workers who are less than 25 years old only have secondary and higher secondary education than those who are in the 25-30 years age group; the latter have a higher proportion of engineers. This suggests that a larger share of young workers who entered the IT labour market in the early 1990s were engineers than those who undertook IT occupations in the late 1990s.

IV.4 Distribution of IT Occupation Workers by Industry Groups

Which industry groups employ IT occupation workers? Table 14 provides some estimates for the year 1999-2000. In effect, these estimates capture the diffusion of IT by industry groups. It is evident that there is significant use of IT workers in sectors other than IT industry (computers etc.). Manufacturing, government and education are important segments where IT occupation workers are employed. Trade, finance, real estate and other business services are important segments absorbing women IT occupation workers. As mentioned earlier, further diffusion of IT industry groups would be critical for higher absorption of IT workers in these segments. Government and private investments would, of course, determine the rate of absorption. Such diffusion will also create sector specific IT skills that will deepen the market further.

IV.5 Distribution of IT Occupation Workers by Type of Enterprise

Interestingly, more than 38 per cent workers in IT occupations worked in small, informal enterprises in 1999-2000. The share of public and private limited companies is 25 and 28 per cent respectively (Table 15). A more detailed tabulation (not reported here) showed that small/informal sector enterprises employing IT occupation workers were mainly in the IT industry and in the manufacturing sector. The data also showed that about 13 per cent of the IT industry workers were self-employed. This suggests two things. One, given the relatively low entry barriers in IT industry, many small firms can set up enterprises in this domain. Two, small manufacturing firms are increasingly using IT for various functions which entails hiring of IT occupation workers. Thus the demand for IT occupation workers is not dominated by the large public and private limited firms; small firms also participate in the IT labour market in a significant manner. The NASSCOM estimates discussed earlier (Table 8) reflected the dominance of large firms in the revenues generated by the IT industry. It was argued that the links of these firms with smaller firms would facilitate

deepening of the IT labour market. But distribution of IT occupation workers by type of enterprise suggests that deepening of the market in the form of smaller firms participation is already taking place. While the distribution of revenues may be skewed in favour of large firms in the IT industry, the employment of IT occupation workers in IT industry and across all industry groups is fairly equally distributed across small and large enterprises. It will be interesting to find out the extent to which such "decentralization" of IT employment is due to the emergence of linkages between large and small firms.

IV.6 Regional Distribution of IT Occupation Workers

The employment of IT occupation workers is essentially an urban phenomenon with 94 per cent being located there. The regional distribution of IT workers presented in Table 16 suggests some deepening at the regional level. This is similar to NASSCOM estimates discussed earlier. The IT industry and occupation workers are largely concentrated in Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal and Delhi (Table 16). The IT industry worker in each of these states seems to be specialized in one or two IT specific activity. Hardware consultancy is largely concentrated in Maharashtra, Andhra Pradesh and Tamilnadu. Software consultancy is dominant in Maharashtra, Karnataka and Andhra Pradesh while data processing activities in Delhi, Karnataka and Maharashtra; data base activities in Tamil Nadu, Maharashtra and Karnataka; repair and maintenance and other computer related activities in West Bengal and Delhi (Table 17).

Most of the BPOs come under database and data related activities, which are largely concentrated in the northern region and are slowly spreading into the southern states also (Table 17). There is a shift in the IT occupation workers from system analysts and programmer to computing machine operators. This is particularly so among female workers and in states like Maharashtra and Delhi (Table 18). This may partly reflect that these two states are emerging as important ITES hubs and more and more women are being employed in this segment.

Participation of more and more regions in the IT labour market is also evident from software exports from states like West Bengal, which touched Rs.1200 Crores in 2002-03,

and is expected to rise by 30% in 2003-04. General Electric has set up training centers in Kolkata for prospective call center employees. Some of the states like Andhra Pradesh already have a graduate employability test to determine the suitability of an individual for the ITES and BPO industries (Economic Times, November 13, 2003). As states adopt various strategies to attract IT industry investments in their territories, one would expect the processes of regional diversification of IT related activity to become more intense.

V. Some Concluding Observations

The labour market in the Indian IT industry has largely been a creation of global changes in the structure of the IT industry and subcontracting of IT intensive activities. Adoption of IT by different industry groups including the government sector has enlarged the "domestic" component of the IT labour market. The paper has provided an analytical description of the processes that characterize labour market deepening in the Indian IT sector. It pools together available evidence to show that participation of more industrial sectors (manufacturing, trade, finance, Government and education services), smaller firms, female workers, smaller towns and somewhat less educated workers has deepened the labour market for IT occupations. These processes may still be at a nascent stage but can gain momentum if the State and the private sector enhance the availability and quality of IT related infrastructure across space. While the private sector is responding to the emerging market needs to train workers in new IT skills, the State may still have to play a role to correct a variety of market failures that still exist. Apart from creating a domestic market for IT workers, the State can contribute in the field of education.

It is now well known that policies relating to higher education in the early years of India's independent development provided the basis for the IT boom in India. It is recognized now that higher education in IT may have limited market failures and therefore limited State participation in this segment of education is desirable. Private entrepreneurship can now deliver what the market needs (Arora and Athreye, 2002). However, State intervention in other areas may still be required. Computer education and a sharper focus on the English language in primary and secondary education in mid-sized towns may not only create a domestic market for IT but may also enlarge the skill pool available for the IT sector. A focus on English and computer education in school can further deepen the IT

labour market so that for different levels of IT tasks people with different levels of training and background can be used. Besides, IT enabled services have seen significant growth in recent years and is expected to generate a large volume of jobs in the next five years (NASSCOM, 2002). In such a scenario, a focus on computer education and English language in smaller towns will create a larger pool of human power to benefit from these opportunities. Combined with good infrastructure, availability of skills in such regions can facilitate cost competitiveness of Indian firms in the IT enabled services for many years. This is not to suggest that the focus on English language is necessary for the entire country; in large parts a focus on basic numeracy and literacy would suffice. Some focus on English may, however, need to persist till domestic markets, using local languages, start to expand rapidly. The expansion of computer use in local languages is dependant on a variety of factors including general levels of education, standardization of computer interfaces for local languages and so on. Once again, the role of the State, both at the national and sub-national levels would be critical in this regard.[14]

The other role the State can play is to facilitate curricula up gradation. Large number of educational institutions is still run by the State. If the nature of courses has to be changed the government may need to take an active part in this activity. While such interventions will help deepen the labour market at the low end of the spectrum, several industry people feel that a sharper focus on microelectronics related course would facilitate India's participation in embedded software and will also create a potential of alliances in this area of IT activity. In the same vein, presence of telecom related skills might facilitate movement along the learning curve as well as provide impetus for incremental and eventually significant innovations. If telecom is seen as a major area of growth then public intervention may be required to solve the long-term supply of skilled personnel in the telecom sector. Such a focus would help deepen the IT labour market at the high end of the spectrum and will facilitate the growth of manufacturing sector.

Alliances, especially international outsourcing arrangements, have played a critical role in the deepening of the IT labour market. Over time these alliances have matured and have become more complex. Policies that enhance the potential for building such alliances

[14] For an interesting discussion of these issues, see Kumar (2004).

including the domestic ones can be very useful for capability building and deepening of the labour market. A policy focus on education along with firm level incentives for quality upgradation and training would not only enhance the potential of alliances but also improve the absorption capacity to benefit from alliances. The deepening of the labour market will be a byproduct of this process.

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Table 1: Growth and Export Orientation of the Indian IT Industry									
	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03E
Domestic Share (%)	71.4	70.7	70.7	60.1	55.2	50.8	47.8	41.8	37.9
Exports Share (%)	28.6	29.3	29.3	39.9	44.8	49.2	52.2	58.2	62.1
Total (Rs Crores)	100.0 (5,450)	100.0 (8,600)	100.0 (13,350)	100.0 (18,641)	100.0 (25,307)	100.0 (36,179)	100.0 (56,592)	100.0 (65,788)	100.0 (79,337)
Total (US$million)	1,730	2,575	3,760	5,021	6,014	8,357	12,410	13,783	16,494
Exchange Rate	31.39	33.4	35.47	37.12	42.08	43.29	45.60	48.00	48.10

Source: Calculated from NASSCOM (2002; 2003). . E: Estimated.
Note: Domestic includes hardware, software, ITES and training. Figures in parenthesis report the value of sales in Rs crores.

Table 2: Growth and Export Orientation of the Indian Software & Service Sector									
	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03E
Domestic Share (%)	37.9	39.8	40.3	40.0	35.2	28.5	25.1	23.2	20.7
Exports Share (%)	62.1	60.2	59.7	59.9	64.8	71.5	74.9	76.8	79.3
Total (Rs Crores)	100.0 (2,471)	100.0 (4,186)	100.0 (6,528)	100.0 (10,899)	100.0 (16,879)	100.0 (23,980)	100.0 (37,840)	100.0 (47,532)	100.0 (59,907)

Source: Calculated from NASSCOM (2002, 2003): pp 28, 46, 20,21. E: Estimated.
Note: Figures in parenthesis report the value of sales in Rs crores.

Table 3: Distribution of Indian Software and Service Exports Revenue by Location and Type of Work (%)							
Location	1990-91	1994-95	1998-99	1999-00	2000-01	2001-02	2002-03E
Onsite	90.0	61.0	58.2	57.4	56.1	45.2	38.9
Offshore	5.0	29.5	33.9	34.7	38.6	50.7	57.9
Product/Packages	5.0	9.5	7.9	7.9	5.3	4.1	3.2

Source: Rothboeck, Vijayabaskar & Gayathri (2002), NASSCOM (2002,2003), Kumar (2001). E: Estimated.

Table 4: The Composition of IT Industry in India (Rs Crores)			
Share (%) of	1994-95	2001-02	2002-03E
Hardware	48.4	25.4	22.4
-Domestic	NA	23.0	20.6
-Exports	NA	2.4	1.8
Software & Services	45.4	72.2	75.5
-Domestic	NA	16.7	15.6
-Exports	NA	55.5	59.9
Training	5.5	2.4	2.0
All	**100.0**	**100.0**	**100.0**

Source: Calculated from NASSCOM (2002, 2003:20) and above data. E: Estimated.
Note: Hardware includes hardware, peripherals & networking.

Table 5: Distribution of Workers in the IT Software Industry by Segments (%)				
Segment	*1999-00*	*2000-01*	*2001-02*	*2002-03 E*
Software Exports	38.7 (110.0)	37.7 (162.0)	32.6 (170.0)	31.5 (205.0)
Software Domestic	6.0 (17.0)	4.6 (20.0)	4.2 (22.0)	3.8 (25.0)
Software Captive User Organisations	40.5 (115.0)	41.4 (178.1)	42.9 (224.3)	40.0 (260.0)
IT Enabled Services	14.8 (42.0)	16.3 (70.0)	20.3 (106.0)	24.6 (160.0)
Total	**100.0 (284.0)**	**100.0 (430.1)**	**100.0 (522.3)**	**100.0 (650.0)**

Source: NASSCOM (2003: 138).
Note: Figures in parentheses report number of workers employed in thousands. In 1986-86, 1990-91 and 1996-97, the number of workers employed in the sector was 6,800, 56,000 and 160,000 respectively.

Table 6: Distribution of IT Market Revenues by Verticals (%)		
Verticals	*Export Market (2001-02)*	*Domestic Market (2002-03)*
BFSI	35	21
Manufacturing	12	15
Telecom/IT	15	22
Government	1	14
Transport, Retail & Utilities	7	NA
Health Care	3	NA
Education	NA	11
Energy	NA	6
Small Office/Home	NA	11
Others	27	NA
Total	**100**	**100**

Source: NASSCOM (2003: 36,54)
Note: Exports relate to IT software services export and BPO revenues.

Table 7: Distribution of IT Companies by Location			
Region	Location of top 600 firms (%)	Location of ITES firms	
		Number	Percentage
National Capital Region	18.5	53	19.1
Mumbai	21.8	45	16.2
Bangalore	20.3	35	12.6
Chennai	9.2	35	12.6
Kolkata	4.2	29	10.4
Hyderabad	10.7	24	8.6
Kochi	NA	10	3.6
Trivandrum	2.3	NA	NA
Ahmedabad	NA	9	3.2
Pune	3.8	6	2.2
Others	9.2	32	11.5
Total	**100.0 (600)**	**278**	**100.0**

Source: NASSCOM (2003: 61), Kumar (2001)

Table 8: Distribution of IT Firms by Sales Turnover	
Annual Turnover (Rs Crores)	Number of Companies
More than 1000	5
500-1000	5
250-500	15
100-250	27
50-100	55
10-50	220
Less than 10	2483
Total	**2805**

Source: NASSCOM (2003: 39)

Table 9: Distribution of IT Industry Workers by Industry Sub-Categories and Sex, 1999-00						
	Male	Female	Total	Male	Female	Total
Hardware Consultancy	5.0	11.0	6.0	70.6	29.4	100.0 (15.8)
Software Consultancy	49.0	34.9	46.7	88.1	11.9	100.0 (124.2)
Data Processing	21.0	24.0	21.4	82.2	17.8	100.0 (569.8)
Database Activities	11.0	9.2	10.7	86.4	13.6	100.0 (285.1)
Maintenance and Repair	8.3	7.1	8.1	86.1	13.9	100.0 (214.2)
Other Computer related Activities	5.8	13.9	7.1	68.7	31.3	100.0 (187.7)
Total	**100.0 (223.4)**	**100.0 (42.3)**	**100.0 (265.7)**	**84.1**	**15.9**	**100.0 (265.7)**

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 10: Distribution of Workers with IT Occupations with Occupational Sub-Categories and Sex, 1999-2000						
	Male	Female	Total	Male	Female	Total
Stenographers, Typists and Card and Tape Punching Operators	56.7	61.0	57.6	77.8	22.2	100.0 (501.2)
Computing Machine Operators	33.1	36.2	33.8	77.5	22.5	100.0 (293.8)
System Analysts and Programmers	10.2	2.8	8.7	93.2	6.8	100.0 (75.5)
Total	**100.0 (688.2)**	**100.0 (182.8)**	**100.0 (870.6)**	**79.1**	**20.9**	**100.0 (870.6)**
Total (excluding stenographers.)	**298.2**	**71.1**	**369.4**	**80.7**	**19.3**	**100.0**

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 11: Changes in the Occupational Distribution of IT Industry Workers, 1993-94 to 1999-2000									
	1993-94			1999-00			Growth: 1993-94 to 1999-00 (%)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Professional Workers	17.2	71.8	28.2	31.7	26.2	30.8	37.9	6.2	28.3
Administrative, Executive and Managerial Workers	20.1	12.6	18.6	11.4	15.3	12.1	18.3	26.2	19.6
Clerical and Related Workers	48.0	4.4	39.2	39.9	50.8	41.6	24.6	63.6	27.8
Sales Workers	6.4	0.0	5.1	9.1	1.1	7.8	33.5		33.9
Service Workers	4.7	0.0	3.7	1.4	0.0	1.2	7.4		7.4
Production Related Workers	3.6	11.1	5.1	6.6	6.5	6.6	37.9	14.1	31.1
Total	**100.0 (42.3)**	**100.0 (10.7)**	**100.0 (52.9)**	**100.0 (222.8)**	**100.0 (42.3)**	**100.0 (265.1)**	**27.7**	**23.0**	**26.9**

Source: NSSO, 50th and 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 12: Distribution of IT Occupation Workers by Industry and Education, 1999-2000											
	Not Literate	TLC	Primary	Middle	Secondary	Higher Secondary	Graduate and above in: agriculture	Engineering/ Technology	Medicine	Other Subjects	**Total**
Mining	0.0	0.0	0.0	0.0	0.0	28.7	0.0	71.3	0.0	0.0	**100 (.6)**
Manufacturing	2.5	0.0	0.0	0.9	12.4	27.4	2.6	1.3	0.0	52.9	**100 (71.5)**
Electricity, Gas	0.0	0.0	0.0	0.0	0.0	33.5	0.0	0.0	0.0	66.5	**100 (1.5)**
Construction	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	**100 (5.1)**
Trade	0.0	0.0	1.6	11.8	12.1	15.2	10.4	0.0	0.0	48.9	**100 (26.6)**
Transport	0.0	0.0	0.0	0.0	13.1	4.5	0.0	5.4	0.0	77.0	**100 (9.1)**
Communications	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	**100 (.9)**
Finance and Real Estate	0.0	0.0	0.0	0.0	0.0	4.0	0.0	2.8	0.0	93.3	**100 (32.9)**
Computer and Related Services	0.0	0.0	0.0	0.0	14.9	15.9	0.0	9.2	0.0	60.0	**100 (118.9)**
Other Business Services	0.0	0.0	0.0	5.1	7.0	1.1	0.0	0.0	0.0	86.8	**100 (13.9)**
Government and Education	0.0	0.2	0.0	1.0	10.1	14.2	0.2	0.0	0.0	74.3	**100 (31.9)**
Other Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5	82.5	**100 (11.7)**
Total	**0.5**	**0.0**	**0.1**	**1.5**	**10.8**	**16.9**	**1.4**	**4.2**	**0.6**	**63.8**	**100 (324.7)**

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 13a: Changes in the Distribution of IT Occupation Workers by Education (General Education)						
	1993-94			1999-2000		
	Male	Female	Total	Male	Female	Total
Not Literate	0.0	4.5	1.4	0.0	2.5	0.5
TLC	0.0	0.0	0.0	0.0	0.0	0.0
Primary	0.0	0.0	0.0	0.2	0.0	0.1
Middle	0.0	0.0	0.0	1.0	3.2	1.5
Secondary	14.9	0.0	10.2	12.9	3.3	10.8
Higher Secondary	12.3	7.8	10.9	20.0	5.5	16.9
Graduate and Above in: agriculture	0.0	0.0	0.0	1.8	0.0	1.4
Engineering Technology	11.1	1.1	7.9	5.0	1.6	4.2
Medicine	0.0	0.0	0.0	0.8	0.0	0.6
Other Subjects	61.6	86.6	69.5	58.3	84.0	63.8
All Workers	**100 (53.5)**	**100 (24.6)**	**100 (78.1)**	**100 (254.6)**	**100 (70.2)**	**100 (324.7)**

Source: NSSO, 50th and 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 13b: Distribution of IT Occupation Workers by Age and Education (General Education), 1999-2000						
	< 24	25-30	31-40	41-50	51-60	Total
TLC	0.1	0.0	0.0	0.0	0.0	0.0
Primary	0.0	0.3	0.0	0.0	0.0	0.1
Middle	0.8	2.7	0.0	0.7	0.0	1.5
Secondary	14.3	11.4	6.9	1.1	96.3	10.9
Higher Secondary	22.5	14.8	21.6	7.8	0.0	16.5
Graduate and Above in: agriculture	0.1	2.3	3.3	0.0	0.0	1.5
Engineering Technology	3.4	7.3	0.3	0.0	0.0	4.2
Medicine	0.0	1.4	0.0	0.0	0.0	0.6
Other Subjects	59.0	59.8	67.8	90.5	3.7	64.6
All Workers	**100 (84.9)**	**100 (144.7)**	**100 (39.1)**	**100 (47.8)**	**100 (3.2)**	**100 (319.9)**

Source: NSSO, 50th and 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 14: Distribution of Workers with IT Occupations by Industry categories, 1999-00			
	Male	Female	Total
Agriculture	0.0	0.0	0.0
Mining	0.1	0.7	0.2
Manufacturing	25.7	8.8	22.0
Electricity, Gas, Water	0.6	0.0	0.5
Construction	2.0	0.0	1.6
Trade	7.7	10.2	8.2
Transport	2.4	4.1	2.8
Post & Telecomm	0.3	0.2	0.3
Finance, Real Estate	6.1	24.9	10.2
Computer	38.8	28.7	36.6
R & D	0.0	0.0	0.0
Other Business Ser.	2.8	9.7	4.3
Govt. Edu.	12.2	1.2	9.8
Other Services	1.3	11.7	3.6
Total	**100 (254.6)**	**100 (70.2)**	**100 (324.7)**

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 15: Distribution of Workers with IT Occupations by Enterprise Type, 1999-2000				
Type of Enterprise	System Analysts and Programmers	Automatic Data Processing Machine Operators	Computing Machine Operators	Total
Informal (Partnership/ Proprietary)	17.4	56.4	38.8	38.2
Public Limited Co.	35.0	19.3	23.8	25.3
Private Limited Co.	35.7	18.5	29.0	28.0
Not Known	11.8	5.8	8.3	8.5
All Enterprises	**100 (75.5)**	**100 (79.8)**	**100 (169.4)**	**100 (324.7)**

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

Table 16: Distribution of IT Industry and Occupation Workers by Regions, 1999-2000		
States	IT Industry Workers	IT Occupation Workers
Andhra Pradesh	9.7	6.3
Assam	0.1	0.2
Bihar	1.2	0.7
Goa	0.7	0.4
Gujarat	2.8	7.9
Haryana	1	1.0
Himachal Pradesh	0.1	0.3
Karnataka	14.5	12.1
Kerala	3.6	3.2
Madhya Pradesh	0.8	0.8
Maharashtra	26.7	24.9
Manipur	0	0.1
Nagaland	0	0.0
Orissa	0.7	0.1
Punjab	0	1.4
Rajasthan	0.7	1.3
Tamilnadu	10.3	10.9
Tripura	0	0.1
Uttar Pradesh	3.5	9.5
West Bengal	10.3	8.2
Chandigarh	0.3	0.8
Daman & Diu	0	0.0
Delhi	12.7	9.6
Pondicherry	0.3	0.1
Total Workers	**100 (265.7)**	**100 (324.7)**

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in each category.

Table 17: Distribution of IT Industry Workers by Industry Sub-Categories, and State, 1999-2000							
	Hardware Consultancy	Software Consultancy	Data Processing	Data Base Activities	Repair and Maintenance	Other Computer Related Activities	All Activities
Andhra Pradesh	23.1	13.0	6.6	7.0	1.4	15.9	11.0
Karnataka	0.0	21.7	17.4	21.2	0.8	0.0	16.6
Maharashtra	53.2	37.9	15.8	29.8	19.7	9.6	30.4
Tamil Nadu	13.2	9.5	5.5	37.0	5.1	9.3	11.8
Uttar Pradesh	3.5	3.3	8.3	0.0	0.0	8.6	4.0
West Bengal	3.3	9.5	7.3	0.0	51.3	28.7	11.7
Delhi	3.6	5.0	39.0	5.0	21.8	27.9	14.5
Sub-total	94.3 (14.9)	90.7 (112.7)	83.3 (47.5)	94.7 (27.0)	77.0 (16.5)	75.9 (14.2)	87.6 (232.9)
Total	15.8	124.2	56.9	28.5	21.4	18.8	265.7

Source: NSSO, 55th Round, Raw data from CD

Note: Figures in parentheses report number of workers in thousands in each category.

able 18: Distribution of IT Occupation Workers by Occupation Sub-Categories, Sex and State

	System Analyst and Programmer		Automatic Data Processing		Computing Machine Operators		All Workers	
ates	1993-94	1999-2000	1993-94	1999-2000	1993-94	1999-2000	1993-94	1999-2000
ales								
ndhra Pradesh	59.2	59.4	18.5	23.0	22.2	17.6	100 (5.4)	100 (17.5)
arnataka	46.1	39.4	16.6	47.5	37.3	13.1	100 (7.5)	100 (33.8)
aharashtra	7.7	2.9	37.1	43.1	55.2	54.0	100 (15.4)	100 (42.3)
amil Nadu	50.3	20.8	0.0	30.0	49.7	49.2	100 (5.3)	100 (30.8)
ttar Pradesh	30.6	62.3	29.3	0.0	40.1	37.7	100 (3.0)	100 (30.8)
est Bengal	0.0	28.6	100.0	10.5	0.0	60.9	100 (1.0)	100 (22.9)
elhi	86.5	3.6	13.5	21.2	0.0	75.2	100 (1.9)	100 (26.2)
ub-total	33.1	28.4	25.6	27.2	41.3	44.4	100 (39.5)	100 (204.5)
otal	**33.7**	**27.7**	**29.0**	**26.2**	**37.3**	**46.1**	**100 (53.5)**	**100 (254.6)**
emales								
ndhra Pradesh	0.0	54.9	0.0	0.0	100.0	45.1	100 (.5)	100 (2.9)
arnataka	41.4	7.8	0.0	83.2	58.6	9.0	100 (2.4)	100 (5.3)
aharashtra	19.9	1.6	26.2	4.3	53.9	94.1	100 (8.2)	100 (38.4)
amil Nadu	45.5	0.0	13.1	34.7	41.5	65.3	100 (4.4)	100 (4.6)
ttar Pradesh	0.0	0.0	0.0	0.0	0.0	0.0	-	-
est Bengal	0.0	52.7	0.0	0.0	0.0	47.3	-	100 (3.7)
elhi	100.0	0.0	0.0	54.6	0.0	45.4	100 (2.3)	100 (4.9)
ub-total	39.0	7.7	15.3	17.2	45.7	75.1	100 (17.8)	100 (59.8)
otal	**43.3**	**7.3**	**17.3**	**18.6**	**39.4**	**74.1**	**100 (24.6)**	**100 (70.2)**
ll Workers								
ndhra Pradesh	54.0	58.8	16.9	19.7	29.1	21.5	100 (5.9)	100 (20.5)
arnataka	45.0	35.1	12.6	52.3	42.4	12.5	100 (9.8)	100 (39.1)
aharashtra	12.0	2.3	33.3	24.6	54.8	73.1	100 (23.6)	100 (80.7)
amil Nadu	48.1	18.1	5.9	30.6	46.0	51.3	100 (9.6)	100 (35.4)
ttar Pradesh	30.6	62.3	29.3	0.0	40.1	37.7	100 (3.0)	100 (30.8)
est Bengal	0.0	32.0	100.0	9.0	0.0	59.0	100 (1.0)	100 (26.7)
elhi	93.9	3.0	6.1	26.4	0.0	70.5	100 (4.3)	100 (31.1)
ub-total	**34.9**	**23.7**	**22.4**	**24.9**	**42.7**	**51.3**	**100 (57.3)**	**100 (264.4)**
otal	**36.7**	**23.3**	**25.3**	**24.6**	**38.0**	**52.2**	**100 (78.1)**	**100 (324.7)**

Source: NSSO, 50th and 55th Round, Raw data from CD
Note: Figures in parentheses report number of workers in thousands in each category.