Workforce in Indian Information Technology (IT) Industry : Exploring NSS Employment and Unemployment Survey

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I. Introduction

The proponent of "new growth theory" Paul Romer has argued that ideas and knowledge, rather than scarce physical resources, increasingly fuel the economic growth (Konana and Balasubramanian, 2001). Accordingly the world economy is transforming from one of physical resource base to that of knowledge based one. It is evident particularly with the emergence of information technology (IT) industry in the world economy. Both the developed and the developing countries are witnessing such a trend. India is one of those developing countries which experienced the boom in IT industry.

Although the true impact of IT on growth and productivity is to be debated, IT sector, however, has been considered as dynamic one in nature (Mathur, 2007). India with developing country characteristics like low level of income and substantial poverty, has witnessed a dramatic growth in this sector. India's destiny as an "IT superpower" and a "knowledge-based society" is well recognized. The growth of information technology (IT) industry is seen as a shortcut to rapid economic growth and development, and the IT industry considered as a vehicle of social and economic transformation in India. The central and the respective state governments in India are investing heavily while promoting IT-based initiatives. Since mid 1990s, IT has shown remarkable growth in terms of its value added. The IT services especially software, are the fastest growing component of service sector in India. Moreover, it is observed that in the recent time, the information technology enable services (ITES) became potential factor in the growth of IT sector in India. The contribution of IT industry to the national income is significant and constantly growing, IT sector accounts for almost 4.8 per cent of India's GDP in 2005-06 and would account for 7 per cent of India's GDP by 2010 (Mathur, 2007 & 2006). Moreover it accounts about 30 per cent of the total export revenue for India (ibid). All these facts indicate the potentials of IT industry for the Indian economy.

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However, it is important to note how far the economic growth in general and IT industry in particular is translated into generation of employment opportunities. The fast growth of IT sector is in fact generating employment opportunities for the educated and skilled labour in India and abroad. The IT sector generates employment opportunities not only directly in the sector but also indirectly in those sectors linked to IT industry[1] (Mathur, 2007 & 2006). McKinsey report[2] estimates shows that Indian IT sector is likely to provide employment opportunities, directly or indirectly, for about 9 million people by 2008. Moreover, it is said that the generation of employment opportunities in the IT industry might have been more in ITES than IT as such in the recent years (Niranjan Rao, 2009).

The Central Statistical Organisation (CSO) based NSS 61st round EUS estimated that total labour inputs (in terms of jobs performed) gone to computer related activities (including hardware consultancy, software consultancy and supply, data processing, database activities, maintenance and repair of office/ accounting/ computing machinery and other computer related activities) is 0.91 million in 2004-05. The value added (GDP) of computer related activities as it is estimated is Rs. 66899 crores (including both organized and unorganized sector) in 2004-05 (CSO, 2010). It means that the gross value added (GVA) per labour input is at around Rs. 7.4 lacs.

In this context, the present paper examines the situation of software workers in India wherein the paper focuses on the disparities across sub-population distinguished socio-economic and regional characteristics and also attempt is made find the determinants of IT workforce within the household level characteristics.

II. Methodology and Data Source

To define Information technology (IT) sector, it essentially refers to the digital processing, storage and communication of information of all kinds (Singh, 2002). Within the IT sector there is a basic distinction between hardware and software where hardware refers to the physical components of processors, storage devices and communications devices and the software refers to the instructions that govern the flow and processing of information in digital form, within and between hardware devices and components. The actual production of hardware is classified within the manufacturing sector, and is more distinct from the

[1] For instance, in those sectors like power, telecom, transportation, catering etc.,
[2] Quoted in the website of Ministry of Information and Technology of India.

development of software (Singh, 2002). When we corroborate the IT industry with prime industry division, most of the software and hardware consultancy services get into Service sector and hardware manufacturing gets into Industry/manufacturing sector. One may notice in the following analysis that the contribution of manufacturing activity to the total IT industry in value and in employment is not significant. For the present paper we have consider employment in total IT industry including both the software and hardware industry.

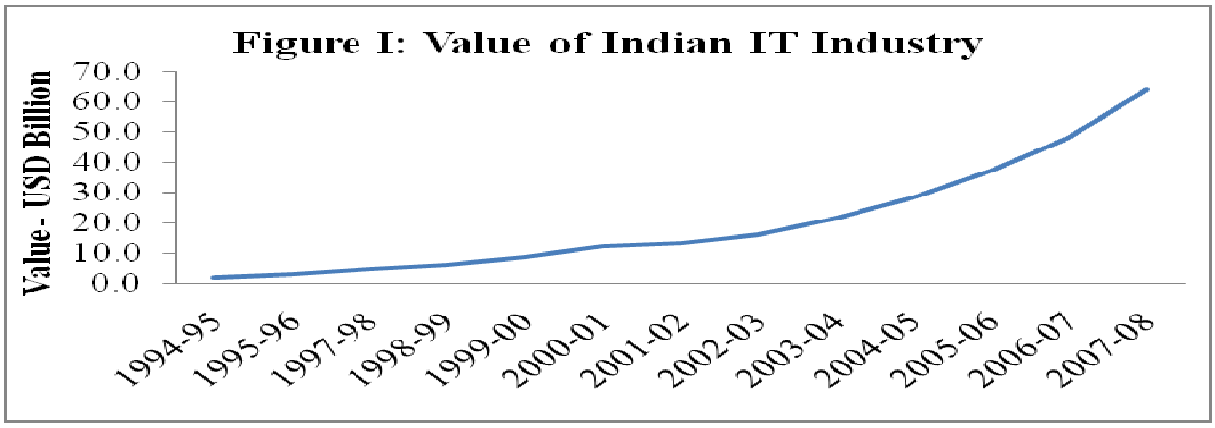
Using the unit record data of 61st round (2004-05) NSS Employment and Unemployment Survey the estimations are made. The survey follows the National Industrial Classification (NIC) while enumerating the particulars of activity in which the sample worker is engaged. In the 61st (2004-05) round survey, NSS followed NIC 1998 which is a revised Indian version[3] in consonance with the revision 3 of International Standard Industrial Classification (ISIC) made in 1990. The IT workforce is identified with the National Industrial Classification 1998 (NIC-98) code 72 at two digit level. Besides two more activities that are considered to be related to IT industry are: manufacturing of analog systems and manufacturing of computer peripherals (NIC98 code – 30005 and 30007).

However, it is to be noted that the NIC 98 could not identify all the IT related activities; particularly most of the ITES activities are not properly classified. Since NSS 61st round relies on NIC 98 and present study mostly depends on the NSS 61st round the limitations of the NIC 98 are applicable while capturing workforce in the IT related services.

III Growth of IT Industry in India

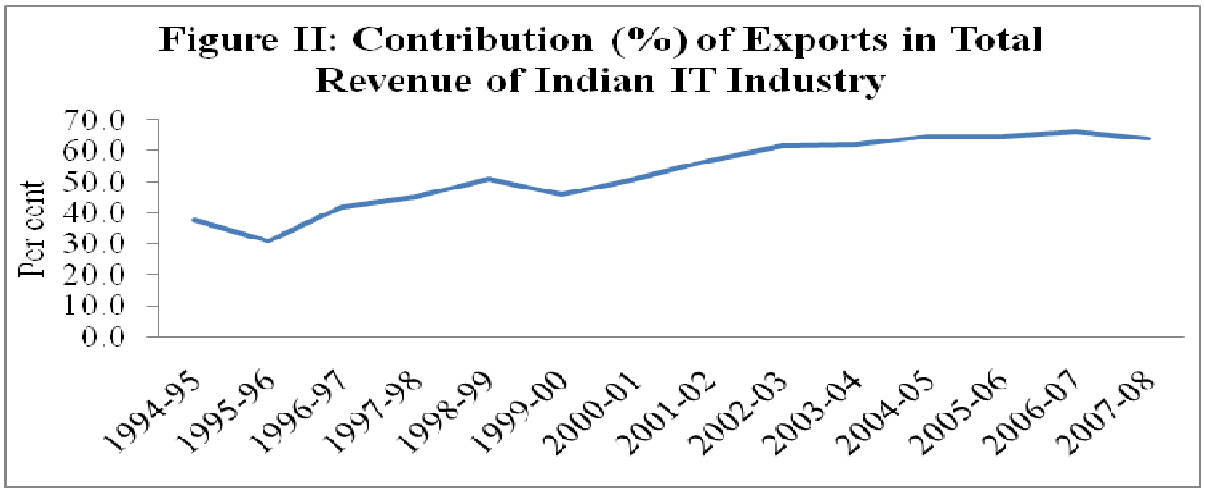
The Indian IT industry value has grown tremendously during the last one and half decade or so period, especially since early 1990s (see Figure I). Its value has grown from about 2 USD billions in 1994-95 to 64 USD billions in 2007-08 while registering 33.4 per cent growth (annual average) per annum during the period.

[3] According to the NIC 1998, all the economic activities are classified in to 17 (A to Q) tabulation categories which may be referred as **Sections**. Each section consists of one or more ***Divisions*** which are 60 in total. In turn each Division is divided into 9 ***Groups*** wherein there are a total of 159 groups in NIC 1998 and these Groups are further divided into altogether 292 ***Classes***. The ultimate category at the 5-digit level is termed as ***Sub-class*** and there are 1021 such Sub-classes.



Source: Using NAASCOM data.

Indian IT industry seems to be export oriented as most of its services especially that of software services are exported. And the export market of Indian IT industry has grown to multifold. The export market of IT industry has grown from about 1 billion USD in 1994-95 to 40 billion USD in 2007-08 and it has registered a (annual average) growth rate 39.4 per cent per annum during the period. The increase in the export market is more than that of the total revenue of IT industry in India. As a result the contribution of export market to the Indian IT industry has increased from about 37.9 per cent in 1994-95 to 63.9 per cent in 2007-08 (see Figure II).



Note:
Source: Using NAASCOM data

On an average about 53 per cent of the total revenue of the Indian IT industry is derived from its export market. And the growth of export market for IT industry contributes 64.0 per cent of the growth of total IT industry in India during the last one and half decade or so period, between 1994-95 and 2007-08.

Table 1: Value of Indian IT-BPO Sector (in USD Billion)

Details	Value (in USD Billion)					Annual Growth (%)				Average
	FY2004	FY2005	FY2006	FY2007	FY2008	2004/5	2005/6	2006/7	2007/8	(2004-08)
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
IT Services	10.4	13.5	17.8	23.5	31	29.8	31.9	32.0	31.9	31.4
Exports	7.3	10	13.3	18	23.1	37.0	33.0	35.3	28.3	33.4
Domestic	3.1	3.5	4.5	5.5	7.9	12.9	28.6	22.2	43.6	26.8
BPO	3.4	5.2	7.2	9.5	12.5	52.9	38.5	31.9	31.6	38.7
Exports	3.1	4.6	6.3	8.4	10.9	48.4	37.0	33.3	29.8	37.1
Domestic	0.3	0.6	0.9	1.1	1.6	100.0	50.0	22.2	45.5	54.4
Engineering Services and R&D, Software Products	2.9	3.8	5.3	6.5	8.6	31.0	39.5	22.6	32.3	31.4
Exports	2.5	3.1	4	4.9	6.4	24.0	29.0	22.5	30.6	26.5
Domestic	0.4	0.7	1.3	1.6	2.2	75.0	85.7	23.1	37.5	55.3
Total Software and Services	16.7	22.5	30.3	39.5	52	34.7	34.7	30.4	31.6	32.9
Exports	12.9	17.7	23.6	31.3	40.4	37.2	33.3	32.6	29.1	33.1
Domestic	3.8	4.8	6.7	8.2	11.6	26.3	39.6	22.4	41.5	32.4
Hardware	5	5.6	7.1	8.5	12	12.0	26.8	19.7	41.2	24.9
Exports	0.5	0.5	0.6	0.5	0.5	0.0	20.0	-16.7	0.0	0.8
Domestic	4.4	5.1	6.5	8	11.5	15.9	27.5	23.1	43.8	27.5
Total IT-BPO	21.6	28.2	37.4	48	64	30.6	32.6	28.3	33.3	31.2
Exports	13.4	18.2	24.2	31.8	40.9	35.8	33.0	31.4	28.6	32.2
Domestic	8.2	9.9	13.2	16.2	23.1	20.7	33.3	22.7	42.6	29.8

Note: 1. FY – Financial Year.

Source: NAASCOM (2009) Strategic Review.

India's software industry is more robust than its hardware industry, at least in certain areas. While selling packaged software to consumer (and most business) markets requires economies of scale and scope, as well as marketing and customer support muscle, project-oriented components of software development do not do so, to quite the same degree. The software development and use life cycle includes analysis and specification of requirements, design, coding, testing, installation, maintenance and support (Singh, 2002). Many of these activities, particularly coding and testing, involve relatively routine IT skills that India's workforce has in large absolute numbers (though small relative to the total population).

IV Employment in IT Sector: Observations from NSS Data

As per the NSS 61st Round (2004-05) Employment and Unemployment Survey estimates the work participation rate (WPR) in India is around 42 per cent (including usual principal and subsidiary status) and it is higher in rural areas (43.9 per cent) when compared urban area (36.5 per cent). The number of workers would be around 342 million in rural and 114 million in urban areas and together it would be 459 million during 2004-05. Of the total workforce, around 56.7 per cent engaged in primary sector i.e. agriculture related activities, and the rest 43.3 percent engaged in non-agriculture activities (secondary and tertiary sector). The share of workforce in computer related activities in total workforce in India is estimated at 0.21

percent only. Then the estimated number persons engaged/working in these computer related activities in India are 8.3 lakhs persons in 2004-05.

a. Characteristics of the IT Workers in India

An attempt is made to describe the general characteristics of IT related workforce in India. It is to be noted that the category of workers in the IT related services are not fully captured. Given the NSS 61st round (2004-05) employment and unemployment survey data set the category of workers in the IT related services are identified based on the corresponding five-digit level NIC-98 code (see Table 2).

Table 2: Distribution (%) of IT Industry Workers in Specific Activities

Sno	Details	NIC 98 Code	Distribution (%)	% of Urban
			2004-05	2004-05
1	***2***	***3***	***4***	***6***
1	Manufacturing of Analog Data-Processing Machines	30005	0.2	100
2	Manufacture of Computer Peripherals	30007	1.2	97.6
3	Hardware Consultancy	72100	2.4	100
4	Software Consultancy and Supply	72200	57.0	95.0
5	Data Processing	72300	7.4	81.9
6	Database Activities	72400	11.7	100
7	Repair and Maintenance of Computers	72501	5.3	81.8
8	Other Computer Related Activities	72900	15.0	89.0
All			***100***	***93.2***

Note: 1. Usual Activity Status – Principal and subsidiary.

Source: NSS 61st (2004-05) Round Employment and Unemployment Survey unit record data.

The distribution of workers in IT related services by selected sub-categories shows that about half of them (49 per cent) are concentrated in software consultancy and supply followed by the other computer related activities (15%) and database activities (11.7%). Most of the workforce in the IT related services is concentrated in the urban areas (93.2%); the same pattern is followed across all the IT services (Table 2).

Age Distribution of IT Workers

The share of software services in the total workforce in India by the single year shows that it was relatively high between 20 to 35 years of age (see Figure III). Though the highest share of software service at any single year age was below 1 per cent of the total workers, the highest share was observed at the age 29 years. It also shows us that it seems the entry age for the software services must 19 years and above age but not below. Of the youth age group

between 15 to 24 year age group, only those among the 20 to 24 years age have entry into the software services sector.

Based on the NSS 61st round (2004-05) employment and unemployment survey, the share of software services, a major component of broad IT sector, in the total adult workers (15 + age) was very much insignificant, about 0.18 percent only (see Table 3). Among the youth, the share of software services remained same (0.18 per cent) as the total adult workers. It was higher (0.43 per cent) among the 25 to 34 age group.

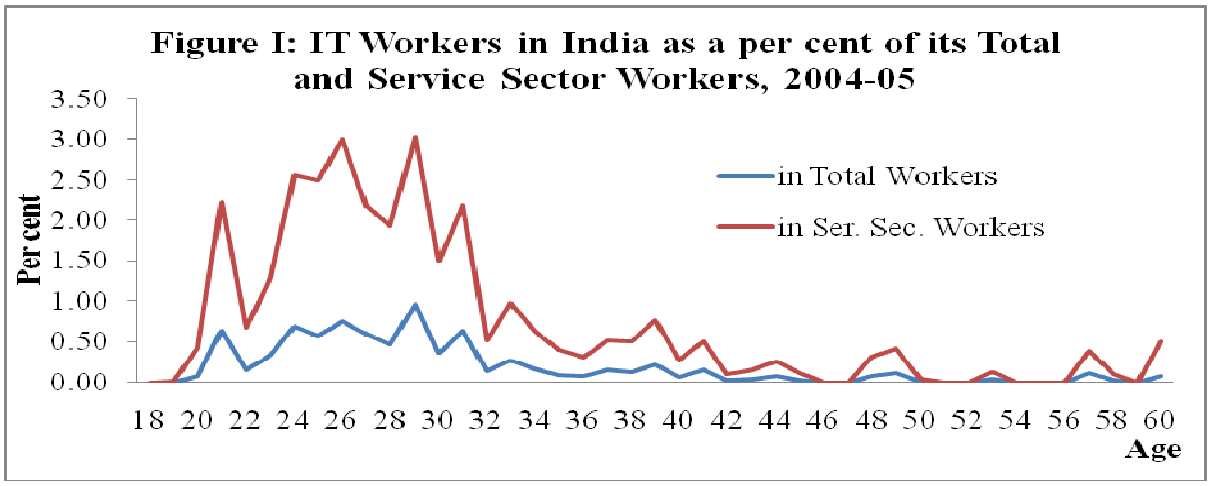


Table 3: Employment in Information Technology Industry (ITS) in India, 2004-05

Age Group	% of IT in Total Workforce			% of Urban	% of Females	% of Age group
	Rural	Urban	All			
1	*2*	*3*	*4*	*5*	*6*	*7*
15 +	0.016	0.756	0.181	93.1	18.7	100.0
15 to 24	0.031	0.747	0.180	86.6	48.7	21.0
25 to 34	0.025	1.714	0.430	95.5	12.2	62.6
15 to 34	0.028	1.317	0.319	93.3	21.4	83.6

Note: Usual status - principal and subsidiary activity.

Source: NSS 61st (2004-05) Employment and Unemployment Survey unit record data.

The lion's share (93.1 percent) of the total workers in the software services, were concentrated in urban areas (Table 3). Therefore the share of software services in the urban workforce was higher than that of the rural areas. The contribution of young workers in the software service to the total workers in the software services was around 21 per cent. It was little higher than the youth share in the total workforce (20.5 per cent) and in the total population (18.6 per cent).

Educational Levels of IT Workforce

Formal education and proper skills play crucial role in the case of knowledge economy and IT industry. Above 96 per cent of the total IT workforce in India are with educational levels secondary and above: 25.4 per cent are secondary schooling and 71 per cent are graduates (Table 4).

When we examine the possession of technical education about 98.5 per cent of the total population and 97.5 per cent of the total workforce in India do not have any kind of technical education. In case of IT workforce, majority of them are with (about 60 per cent) technical education, about 40 per cent are without any technical.

Table 4: Educational Level of the IT Workforce in India, 2004-05

Educational Level	Distribution (in %)			WPR	% of IT in total Workers
	Population	All Workers	IT Workers		
	2004-5	2004-5	2004-5	2004-5	2004-5
1	***2***	***3***	***4***	***5***	***6***
General Education					
Not Literate	40.3	39.7	0	41.2	0
Literate w/o formal Edn	2.4	2.4	0	42.2	0
Below Primary	15.8	8.8	0.5	23.3	0.01
Primary	13.8	13.9	1.9	42.2	0.03
Middle	12.5	15.2	1.3	51.1	0.02
Secondary	11.5	14.2	25.4	51.6	0.33
Graduates	3.8	5.7	71.0	62.9	2.34
Total	100	100	100	42.0	0.18
Technical Education					
None	98.5	97.5	39.6	41.3	0.08
Below Graduation	0.9	1.5	16.9	69.0	2.06
Graduation and above	0.6	1.0	43.5	70.8	7.95
Total	100	100	100	42.0	0.18

Note: **1**. Usual Status – Principal and subsidiary activity; **2**. Rural and urban combined; **3**. ***WPR*** – Work participation rate.

Source: NSS 61st (2004-05) Employment and Unemployment Survey unit record data.

Gender Disparity

In India, females are relatively disadvantaged position in most of the socio-economic phenomenon. In the skilled labour activity their disadvantage is more severe. The sex ratio in the population indicates it is against the females. Participation of women in any economically gainful activity is relatively lower than that of males and hence female work participation rate (WPR) is well below that of male. The sex ratio in the workforce is very much lower than that of the population (Table 5). In the IT workforce, females are the most disadvantaged. It

is observed that in the IT sector for every ten male workers there were about two female workers.

Table 5: Sex Ratio in the India IT Workforce, 2004-05

Sector	WPR		Sex Ratio		
	Male	Female	Population	Workers	IT Workers
	2004-5	2004-5	2011	2004-5	2004-5
1	***2***	***3***	***4***	***5***	***6***
Rural	546	327	946	566	118
Urban	549	166	901	272	232
Total	547	287	933	489	224

Note: ***WPR*** – Work Participation Rate.

Source: NSS 61st (2004-05) Employment and Unemployment Survey unit record data.

About 63.5 per cent of the rural workforce in India is male by gender and the female's contribution is 36.5 per cent in 2004-05. In the urban workforce the male and female shares are 78.2 and 21.8 per cent respectively. Altogether, the share of female in the total (rural urban combined) workforce in India is 32.5 per cent and the rest 67.5 percent is contribution of males. In case of the IT sector male and female contributions are 89.5 and 10.5 per cent in rural, 81.2 and 18.8 per cent in urban, 81.7 and 18.3 in the total IT workforce (rural urban combined) respectively. It indicates a female's negligible contribution and very high gender disparity in the IT sector.

Social Group Disparities: Caste and Religion

One may be interested in the social group particularly by caste and religion group, disparities in terms of IT sector employment. In the Indian context, ST/SCs are the most backward social groups by caste in any socio-economic phenomenon. In the case IT sector employment also they are relatively the most disadvantaged groups. Similarly, Muslims by religious group are relatively the most disadvantaged group in general and IT sector employment in particular (see Table 6).

In other words, in every thousand IT workers, only two belong to ST, 30 are of SC, 245 are of OBC and the rest 724 are of the 'other' community. When compared to respective share of each social group in population and workers, IT workers are disproportionately distributed against backward social groups. It clearly indicates a predominance of the 'others' community in the IT sector employment and disadvantages of the ST/ST communities.

Table 6: Contribution of Social groups (Caste and Religion) to the IT Workforce in India, 2004-05

Caste	Contribution in %			WPR	% of IT in total Workers
	Population	Workers	IT Workers		
	2001	2004-05	2004-05	2004-05	2004-05
1	*2*	*3*	*4*	*5*	*6*
Caste					
ST	8.4	10.1	0.2	50.1	0.004
SC	19.7	20.1	3.0	42.6	0.028
OBC	41.2	41.4	24.5	42.0	0.111
Others	36.7	28.4	72.4	38.6	0.466
Total	100	100	100	42.0	0.181
Religion					
Hindu (incl SC/ST)	81.8	84.1	85.9	43.2	0.181
Hindu (excl SC/ST)	*53.7*	*54.0*	*82.7*	42.2	0.272
Muslim	12.7	10.2	5.3	33.6	0.093
Christian	2.2	2.3	3.8	43.5	0.295
Others	3.2	3.4	5.0	44.3	0.261
Total	100	100	100	42.0	0.181

Note: 1. Usual Status – Principal and subsidiary; 2. Rural and urban combined; 3. WPR – Work participation rate.

Source: NSS 61st (2004-05) Employment and Unemployment Survey unit record data.

By religious group, the relative share of Muslim community in the IT sector employment is disproportionately against their share in population and the total workforce. In every thousand of IT workers, there are only 53 belonging to Muslim community, 38 are of Christians and 50 are of the 'other' religions but 859 belonging to Hindu community when SC/ST are included. Even if the SC/STs are excluded from the Hindu community its contribution remains significant (827 out of 1000 IT workers) because of the contribution of SC/ST communities in the IT sector employment is negligible. It indicates a predominance of the Hindu community excluding SC/STs, in the IT sector employment and the Muslims are disadvantaged.

MPCE Class distribution

The economic status of the household is important factor in workers' formal schooling and formation of skill and hence it definitely influences the worker's chance of being a highly skilled labour especially in the IT sector labour market. In this context, when examined the distribution of IT workers across monthly per capita consumption expenditure (MPCE) decile classes, it is observed that most of the software (IT) workers hailed from the higher economic classes (see Table 7).

The population of MPCE decile class households is disproportionately distributed wherein the bottom decile class households contribute more than higher decile class ones. Similarly is

the case of workforce distribution. However, distribution of population and workers indicate that lower decile class household's contribution to workers is little lesser than their contribution in terms of population and vice versa for the higher decile class. The phenomenon resulted in the work participation rate (WPR) among household increases with higher MPCE decile classes where it is least among the lower decile class and higher among the higher decile class households.

Table 7: Distribution of IT Workers in India by MPCE Decile Class, 2004-05

MPCE Decile Class	Distribution by MPCE Decile Class				WPR	% of IT to the total workers
	% of HH	% of Pop	% of Workers	% of IT Workers		
1	***2***	***3***	***4***	***5***	***6***	***7***
1	10	12.5	11.0	0.2	36.7	0.003
2	10	12.0	11.2	1.3	38.8	0.021
3	10	11.4	11.0	1.0	40.1	0.016
4	10	10.9	10.8	3.2	41.2	0.055
5	10	10.3	10.5	7.5	42.5	0.134
6	10	9.7	10.0	4.2	43.1	0.078
7	10	9.2	9.7	9.2	43.9	0.178
8	10	8.7	9.3	14.2	44.7	0.286
9	10	8.1	8.9	15.9	45.7	0.333
10	10	7.1	7.7	43.4	45.5	1.046
Total	100	100	100	100	42.0	0.187

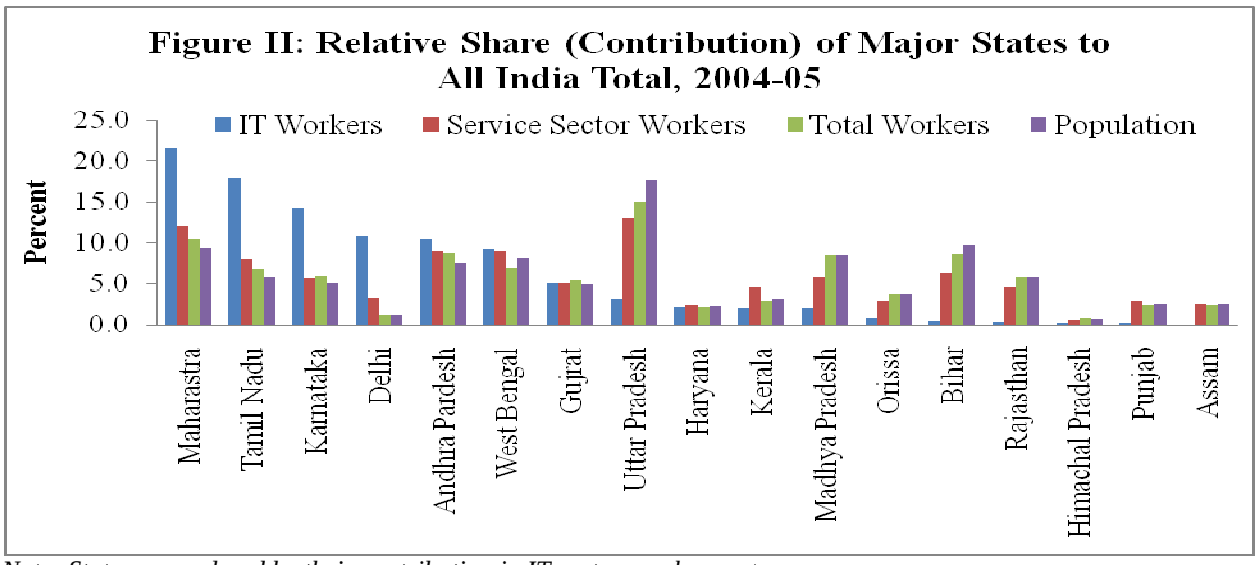
Note: 1. Usual Status – Principal and subsidiary; 2. Rural and urban combined; 3. ***WPR*** – Work Participation rate.

Source: NSS 61st (2004-05) Employment and Unemployment Survey unit record data.

The lower MPCE decile class households contribute disproportionately higher share of population and workers and vice versa. But in case of IT workers the higher MPCE decile class households that contribute the highest. The top 20 percent households in India contribute about 59.3 per cent of the IT workers in 2004-05.

b. Geographical Spread

When regional distribution of IT sector employment across major states in India is examined, it is observed that a few states dominate wherein the IT sector employment in India disproportionately in favour of half a dozen of major states in India. Six states namely Maharastra, Tamil Nadu, Karnataka, Delhi, Andhra Pradesh and West Bengal, while contributing about 36.4 per cent of the all-India population, contributed about 85 per cent of total IT sector employment in India in 2004-05. While Maharashtra contributes the highest (21 per cent) of the total workforce in IT sector in India, followed by Tamil Nadu (17 per cent), Karnataka (14 per cent), Delhi (10.8 per cent) and Andhra Pradesh (10 per cent).



Note: States are ordered by their contribution in IT sector employment.

As per the NSS 61st (2004-05) round on Employment and Unemployment[4], the IT sector in India employs around 0.181 percent of its total workforce (Table 8). Among the states, the workforce employed in IT is the highest in Delhi (1.76), followed by Tamil Nadu (0.47), Karnataka (0.43), Maharashtra (0.37) West Bengal (0.24) and in Andhra Pradesh (0.21 per cent of the total workforce).

Across state urban sector dominates over the rural and male dominates over the females while contributing the IT sector employment (Table 8). But a few states are exception to the trend especially that rural-urban distribution of IT workers, particularly states like Assam, Orissa and Himachal Pradesh. In case of Assam, urban sector contribution was only 6.7 per cent and the rest 93.3 per cent of total IT workforce in the state is located in rural sector. And the states like Punjab and Haryana seems to equalizing the distribution of IT workforce between rural and urban areas.

[4] The estimation is based on the unit record data of 61st round (2004-05) NSS Employment and Unemployment Survey. The IT workforce is identified from the National Industrial Classification 1998 (NIC-98).

Table 8: Workforce in IT Services across Major States in India, 2004-05

Sno	Major States	WPR	% of SS	% of IT in TW	% of IT in SS	% of Urban	% of Female
1	***2***	***3***	***4***	***5***	***6***	***7***	***8***
1	Andhra Pardesh	50.4	24.1	0.212	0.878	99.8	13.0
2	Assam	38.5	24.4	0.005	0.021	6.7	0.0
3	Bihar	33.5	17.1	0.010	0.060	100.0	0.0
4	Gujrat	46.7	21.4	0.165	0.771	100.0	2.2
5	Haryana	40.1	26.4	0.191	0.722	100.0	15.9
6	Himachal Pradesh	52.3	17.4	0.045	0.259	18.7	0.0
7	Karnataka	49.2	22.3	0.425	1.907	100.0	19.5
8	Kerala	39.3	37.3	0.125	0.336	65.5	24.0
9	Madhya Pradesh	44.7	16.0	0.041	0.254	100.0	33.8
10	Maharastra	46.5	27.0	0.366	1.355	96.8	20.2
11	Orissa	43.6	18.3	0.042	0.232	9.8	9.8
12	Punjab	41.6	28.1	0.014	0.050	55.7	0.0
13	Rajasthan	43.3	18.0	0.011	0.059	58.7	0.0
14	Tamil Nadu	48.5	27.4	0.467	1.705	95.0	25.0
15	Uttar Pradesh	36.6	20.2	0.037	0.183	94.9	0.0
16	West Bengal	38.0	30.3	0.238	0.786	82.3	31.8
17	Delhi	32.8	68.9	1.732	2.515	92.3	2.8
All India		42.0	23.4	0.181	0.760	93.4	18.4

Note: 1. Usual status – principal and subsidiary activity; 2. Rural and urban combined; 3. ***WPR*** – Work Participation Rate; ***% of SS*** – Service sector workers as a per cent of total workers; ***% IT in TW*** – Software (IT) workers as a percent of the total workers; ***% IT in TW*** – Software (IT) workers as a percent of the total service sector workers; 4. ***% of Urban/Female*** – the share of urban/female in the total software (IT) service related workforce.

Source: NSS 61st (2004-05) Round Employment and Unemployment Survey unit record data.

In case of female workers, their contribution to IT sector employment is disproportionately against their share in total population and workers in India and across states. At all-India level, females contribute 18.4 per cent of the total IT workers and the rest 81.6 per cent is the contribution of males. Although it is disproportionate, female worker's contribution found to be highest in Madhya Pradesh followed by West Bengal, Tamil Nadu and Kerala. In a few states like Assam, Bihar, Himachal Pradesh, Orissa, Punjab, Rajasthan and Uttar Pradesh it is nil.

V. Determinant Characteristics of IT Workers

Methodology

An attempt is also made to find the determinants characteristics of IT sector workers. For this purpose we have considered the logit model which is used for the prediction of the probability of occurrence of an event by fitting data to a logistic curve. For our analysis of determinant of IT sector workers, binary logistic regression model is used where the dependent variable is presence of IT worker in the household and the independent variables are selected personal characteristics like sex, age, resident (rural/urban) and person's

technical educational level and the household characteristics like social group, household size, household type, household's MPCE decile class.

Logit model begins with logistic function as follows

$$f(z) = \frac{1}{1 + e^{-z}} \qquad (1)$$

Given the logistic function one may derive the probability logit model. Let Y be a dependent variable with N dichotomous outcomes (1 or 0). Let Pr $(Y_i = N \mid z_i)$ be the probability of observing outcome N for an individual worker i given z_i, the set of explanatory variables. The probability model binary logit model used for the analysis can then be written as:

$$pr(y_i=1 \mid z_i) = \frac{1}{1 + e^{-z}} \qquad (2)$$

z is set explanatory variables usually defined as

$$z = b_0 + b_1x_1 + b_2x_2 + \ldots\ldots + b_nx_n \qquad (3)$$

where b_0 is intercept and b_1 .... b_n are regression coefficient of independent variables $x_1 ... x_n$ respectively;

In the binary logistic regression model the dependent variable takes dichotomous values where it takes value 1 and 0 indicating presence and absence of particular event in question. In our analysis dependent variable IT worker takes value 1 if the worker is employed in IT industry and value 0 otherwise. The present logistic regression model predicts the likeliness (probability) of an adult worker being employed in the IT sector given the selected independent variable i.e. personal and household characteristics.

For the logistic regress analysis we have used the NSS 61st (2004-05) employment and unemployment survey unit record data. Of the total number of cases we have considered the adult (15+ age) workers for this regression analysis.

Results

The logistic regression results are presented in table 9 wherein one may comfortably interpret the odds ratios in column 7. The odd ratio statistic in the table presents that number of times the chances more/less that the person is employed in IT industry with given characteristic when compared to the reference characteristic. In other words if we consider the resident of the worker, when compared rural workers (a reference group), there are 17 times more

likely/chances that the worker is employed in IT industry if the worker is located in urban areas. Likewise if we interpret the result by sex of the person male have more chances than females. By social groups when compared with workers belonging to ST community workers of all other social groups have more chances of being employed in IT industry. However, workers of Muslim community though have more chances of getting employed in IT industry when compared with ST workers they have lesser changes when compared with SCs and other religious groups.

Table 9: Logistic Regression Results

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
1	***2***	***3***	***4***	***5***	***6***	***7***
Age	-.099	.007	207.393	1	.000	.906
Age^2						
Household Size	.095	.020	21.906	1	.000	1.100
Sector (ref: rural)						
Urban	2.834	.207	188.198	1	.000	17.021
Sex (ref: female)						
Male	.254	.137	3.433	1	.064	1.289
Social Group (ref: ST)						
SC	.726	.454	2.561	1	.110	2.067
OBC Muslim	.351	.634	.307	1	.580	1.420
OBC Others	1.376	.396	12.047	1	.001	3.958
Other Muslims	.586	.498	1.382	1	.240	1.796
All Others	1.690	.388	18.965	1	.000	5.420
MPCE Decile Class (ref: MPCE 1)						
MPCE 2	-.472	.647	.533	1	.466	.624
MPCE 3	.289	.559	.268	1	.605	1.335
MPCE 4	1.301	.473	7.572	1	.006	3.674
MPCE 5	1.455	.466	9.723	1	.002	4.283
MPCE 6	1.355	.474	8.176	1	.004	3.875
MPCE 7	1.872	.455	16.954	1	.000	6.504
MPCE 8	2.214	.444	24.878	1	.000	9.157
MPCE 9	2.092	.448	21.785	1	.000	8.105
MPCE 10	2.766	.447	38.327	1	.000	15.888
Technical Education (ref: No Tech edn)						
Technical Degree	2.815	.175	257.689	1	.000	16.692
Diploma below Graduation	1.723	.158	119.008	1	.000	5.603
Diploma Graduation& above	2.334	.161	209.584	1	.000	10.322
Household Type (ref: CL)						
Self-employed	1.098	.518	4.491	1	.034	2.998
Regular Wage	1.838	.516	12.658	1	.000	6.281
Constant	-10.750	.780	190.154	1	.000	.000

Source: Using NSS 61st round unit record Data.

With technical degree a worker has 16.6 times more chances to get employed in IT industry when compared to the worker with no technical education. Though the workers with diplomas in technical education more chances of getting into IT industry when compare with those of no technical education, their chances are lesser than those with technical degree. In

terms of MPCE Decile class, the chances of getting into IT industry improves with the higher decile class. Workers belonging to household with regular salary/wage as a major source of income have higher chances (6.2 times more) of getting into IT industry when compared to those of casual labour households.

VI Conclusions

There are expectations that the growth of IT sector may solve the employment problem in India. But its contribution to the total workforce is very much minimal. Moreover, information technology is by its very nature an urban phenomenon. Skilled workers live in cities and telecommunication facilities, which are important for this sector, could be established much more easily in big cities. It was only during the past few years that conscious effort is being made to develop Tier-II cities. Another feature of IT workforce in India is disparities across sub-population groups distinguished by socio-economic characteristics such as age, sex, caste, religion, income group, educational levels and so on. Moreover, the IT workforce is concentrated in a few major states in India.

* * *

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Appendix

Table A1: Information Technology (IT) Related Activities in National Industrial Classification 1998 (NIC 98)

NIC Code	Description
30005	**Manufacture of Analog Data-processing Machines** comprising analogue elements, control elements and programming elements; additional elements for analogue computers having an input or an output function.
30007	**Manufacture of compute peripherals** like magnetic disk/floppy/Winchester disk drives, magnetic tape/cassette/cartidge drives; punch tape readers, curve followers, graph plotters; serials/daisy wheel/line printers; data entry equipment with or without visual display; magnetic or optical readers; machines for transcribing data onto data media in coded form; and so forth.
72100	**Hardware Consultancy**. [This class includes consultancy on type and configuration of hardware with or without associated software application. (Similar activities carried out by units selling computers are classified in class ***3000***)].
72200	**Software Consultancy and Supply**. [This class included activities in connection with analysis, design and programming of systems ready to use. This usually involves the analysis of the users' needs and problems, consultancy on the most economic solution and producing the necessary software to realize this solution. Also included is the simple writing of programmes following directives of the user. Specifically these activities involve development, production, supply and documentation of order-made software based on orders from specific users and easy-order and ready-made (non-customised) software. (Reproduction of non-customised software is classified in class ***2230*** and the software consultancy provided in conjunction with hardware consultancy is classified in class ***7210***)].
72300	**Data Processing**. [This includes the processing or tabulation of all types of data. Provision of such services on (i) an hourly or time-share basis, and (ii) management or operation of data processing facilities of others on a time-sharing basis; on a fee or contract basis].
72400	**Database Activities**. [This includes data base development, data storage and data base availability. The provision of data in a certain order/sequence, accessible to everybody or to limited users and can be sorted on demand. (Cmputerised documentation activities provided by libraries and archives are classified in class ***9231***)].
72501	**Repair and Maintenance of computers** and computer based systems.
72900	**Other Computer related Activities**. [For example, activities of development of multimedia presentation on account of others, maintenance of websites on account of others. (Communication through e-mail, internet and data transmission are classified in class ***6420***)].

Source: NIC 98.