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IN QUEST OF THE INFORMATION SECTOR: MEASURING INFORMATION WORKERS FOR INDIA

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ABSTRACT

The paper is based on two 1981 and 1991 general censuses. The measurement of information workers and demarcation theory has been derived from Dordick and Wang. The paper makes comparisons of information workers for different countries from different regions during 1999, and subsequently focuses on the actual scenario on India. All the eleven categories of occupations notified by Government of India have been further refined into four main categories viz. information, production, service, and farms related workers. How information workers are skewed between rural and urban area, their performance on educational level, and place of working according to industry are the main findings of this research. India had approximately 39.4 million information workers during 1991 census, which worked out to be 13.78% of main workers (285.9 million). While most of the developed and few developing countries have achieved quite considerable proportion of the information workers, India's progress in this field is far away from encouraging.

Keywords: Information sector; Information workers; Economic growth; India

INTRODUCTION

Many organizations and individuals are of the opinion that one of the parameters which determines the country's status whether it is informatized or not, is to know the 'information workforce' as proportion to total workforce in the country. Japan's premier Research Institute of Telecommunications and Economics (RITES) developed *Johoka* Index (Dordick and Wang, 1993) which advocates the theory that the proportion of service workers in the total population are important to be determined to gauge the economic activities generated by the information sector. Accordingly, Japan worked out its information workforce and found that it has over taken western countries like Germany, France and the U.K. The Organization for

Economic Co-operation Development (OECD) in its one of the documents floated an idea that information sector in its region had a huge potential for significant development and that if jobs are in fact being created, they could appear in the vast information sector only (OECD, 1981). The OECD, then in its directive to all the member nations, had asked them to find out the strength of the information workforce as a proportion to total workforce, so that appropriate policies could be framed out to boost the economies of its member countries. Thus, using the Porat's[1] methodology, the OECD took up the matter by modelling sectors of the economy to include the information sector and applied them to the main countries. It found that largest percentage increase in the information workforce in the major OECD countries occurred from 1960-70. Porat's methodology to find out the information workforce, till now remains a single methodology having a wide impact on the entire OECD region. Between 1970-84, a study by Kimbel that the total employment in service industries (leading contributor for information workforce) in the OECD region as a whole increased by 55 million, while employment in goods producing industries including agriculture decreased by 14 million (Kimbel, 1987). One of the indicators developed by Mansell shows another clear path that why professionals with qualifications such as science, math, and engineering are important to be determined since these are the people who lead the stock of information workforce (Mansell, 1998). In one of his papers, Singh specifically mentioned that the US economy is changing from being manufacturing-based to being information-based and also supplements his view that over 60% of the workforce of the US is in the information sector (Singh, 1988). Specially remembering the post industrialism of the 1960s (famous works of Bell, Porat, and Machlup are in this period), he explains that information has been emerging as a basic resource like materials and energy. It has become strategic and transforming resource of the post-industrial society, just as capital and labour have been for the industrial society. Dordick in the context of indicators of "economic parameters" along with "infrastructure parameters" and "social parameters", has appealed that the percent of information workers in a nation's workforce holds key to boost the economic growth (Dordick and Wang, 1993).

[1] M. Porat (Schement, 1990) divided information activities in the economy into primary and secondary information sector. The primary information sector included all industries that produce information goods or equipment or market information services as a commodity and the secondary sector included all information services produced for internal consumption by government and non-information firms.

Bell states that five dimensions, one of them being "occupational distribution" sheds enough light that the strength of any country hinges on the pre-eminence of the professional and technical classes (Bell, 1974). He argues in his theory that these dimensions would herald the new post-industrial society. Post-industrial society, he emphasizes, would be centred around information, like the industrial society has centred on the production of goods. Visionaries and futurists too have not left behind in forecasting the future of information workforce. Drucker states that "to make knowledge work productive will be the great managerial task of this century, just as to make manual work productive was the great managerial task of the last century" (Davenport, 2003). According to Gibbs, information related activities make a growing contribution to value additions and employment creation, as has been witnessed in the case of Western Europe (Gibbs, 1994).

The information sector not only facilitates the existing traditional sectors like agriculture, industry, and service, but also creates its niche in the market by floating the new occupations such as software writers, data bank managers, web designers, and call centre operators etc. Hufbauer, who gauges the importance of information sector, percolates his ideas that information services promise to be the growth of pole of the world economy in the twenty first century, as they permeate and facilitate all the other layers of commerce and create a new form of economic interchange (Hafbauer, 1996). Tracing the works of the economy like New Zealand, almost identical to the US in the information workforce, Engelbrecht opines that knowledge economy not only develops new knowledge intensive goods and service industries, but also helps to grow the traditional industries like agriculture and industry (Engelbrecht, 2000).

Webster too reaps on five dimensions (technological, economic, occupational, spatial and culture) to find out the role of information in the society (Webster, 2002). It could be certainly summarized that to determine the strength of the information workforce, "occupational approach" remained a single approach and methodology used by most of the information scientists. Here, too, occupational approach will remain the central theme of this paper to find out the strength of the information workforce for India.

DEFINITIONS: INFORMATION WORKERS

This section presents the definitional part of information workers. Dordick states that information workers' main tasks are to create, collect, process, and distribute

information (Dordick and Wang, 1993). Davenport defined them as people with a high degree of education or expertise whose works primarily involve the creation, distribution, or application of knowledge (Davenport, 2003). Some knowledge workers, he emphasizes, have high levels of autonomy and discretion in how they perform their work. His views almost coincide with the views of most of the theorists of information field that information workers mostly have tertiary level education (people with qualifications of graduation and above). Kim termed the activities focused on the production, processing and distribution of information as information work (Kim, 1996), while according to Boon, individuals who are concerned with the activities such as collection, storage, organizations, processing, tracing and provisions of information, are termed as information workers (Boon, Britz and Harmse, 1994). According to Szabo and Dienes theory, which states that the economically active person who is in most of his/her work time engaged in information activities, has been considered as a person, engaged in information occupation (Szabo and Dienes, 1998). While in the views of Schement, information work occurs when the worker's main task involves information processing or manipulating in any form, such as information production, recycling, or maintenance (Schement, 1990). Porat and Ruban (adopted from Engelbrecht, 2000) and architects of information workforce measurement for the OECD region, state that information workers are defined as those working in occupations whose primary purpose is an output of produced, processed or distributed information or its infrastructure support i.e. occupations primarily engaged in installing, operating and repairing information machines and technologies. Bell advocates that it is the 'professional and technical' workers who will decide the future of post-industrial society or information society. He even goes deep into this category and finds out that it is 'scientists and engineers' who will spearhead the 'post- industrial society' (Bell, 1974).

INFORMATION WORK AND ECONOMIC GROWTH

Establishing a relationship between information occupations with economic growth remained top priority for the information theorists during the last quarter of twentieth century. They clearly explained and even established that information workers have great abilities to push the economic growth rate. This relationship has already flourished in most of the developed and a few developing countries, and has also increased the annual growth rate of national Gross Domestic Product (GDP). It plays an important role in value addition as well as job creation and thereby establishing an atmosphere for better living standard. Information products and services, what are termed as information work in the vision of Szabo and Dienes, play an ever increasing role in the production, consumption and stock-accumulating

processes, exerting in this way powerful influence on the performance and efficiency of other industries i.e. agriculture, industry, and service (Szabo and Dienes, 1998). As a result of a higher development rate, they have become one of the most significant factors of economic and social restructuring processes. The intensity, with which information workers can contribute to economic growth, is clear from the difference between manual and information work. The output of manual workers (washer, drivers, janitors, repairer etc.) is often difficult to transmit over electronic circuits, thus decreasing their productivity. While on the other hand, output of information workers (scientists, engineers, architectures, chemists, doctors, etc.), can easily be transmitted on the electronic networks. This often works in their favour, thus setting the path for an increase in their productivity. Information workers‘ ability to sell their products to a wider market without incurring time expenses of making face-to-face contact is another advantage, which further pushes them towards more effectiveness.

Information workers could be linked with the productivity of a country. How much is contributed by the information workforce to the national GDP remained a separate topic to be peeped into, but one should however always keep in mind that merely having sufficient number of information workers in the nation's workforce does not necessarily bring cheers on the face of any nation, since the type of work being performed by these workers becomes the actual criterion for the overall developments and advancements. One typical example is the comparison of information workforce of Egypt and Israel. Both countries have the equal strength of information workforce in their respective national workforce, but the contribution of information workforce of Israel into the national GDP is more as compared to Egypt. The reasons, explained by Dordick, are that most of the Israeli information workers are engaged in high-tech manufacturing, exports and R&D, thereby paying the way for increased productivity (Dordick and Wang, 1993). Information workforce of Egypt is generally engaged in the government sector, providing social services for a society that is largely poor, unemployed and unlettered. To investigate the links of information work with productivity, proper placement of the information workers in high tech industries, leading to high quality exports are some of the policy matters a nation has to undertake.

INTERNATIONAL SCENARIO

The international scenario has been carved out with the help of the World Development Report 2003 categorizations of economies based on incomes (World Bank, 2003). On top of the table are high-income economies, basically from where

the concept of measurement of the information workforce was exported to rest of the world. As seen from Table 1, in 1999, Australia and Canada's information workforce has increased to around 44% of their total workforce, whereas in Japan around 48% of its workforce are employed in the information occupations. The US being the role model in the information field has highest 57% information workforce in its economy.

Table 1: Information Work Force for Selected Countries, 1999

Countries	Total workforce (million)	Information workforce (million)	Percentage
High-income			
Australia	10	4.35	43.5
Canada	17	7.55	44.4
Japan	68	32.55	47.9
Singapore	2	1.02	51.0
United States	139	79.39	57.1
Mid-income			
Brazil	79	31.12	39.4
Malaysia	9	3.26	36.2
Hungary	5	1.44	38.8
Low-income			
Egypt	24	6.23	26.13
Philippines	32	7.87	24.6
Sri Lanka (1998)	8	0.92	11.5

Note: *1. Total workforce data was derived from World Development Reports of years, 1998-99, 1999-2000, and 2000-2001.*
2. Information Work Force data was derived from International Labour Office: Yearbook of Labour Statistics 2001. As per Dordick's theory, information workforce was calculated from the first four categories of ISCO-68 (International Standard Classification of Occupations-68) in the Yearbook; category I: Professional, technical and related occupations; Category II: Administrative, technical and related workers; Category III: Clerical and related workers; Category IV: Sales workers.
3. Singapore, Canada, Hungary and Sri Lanka have used the ISCO-88. The first four categories of ISCO-88 in the Yearbook of Labour Statistics are; category I: Legislators, senior officials and managers; category II: Professionals; category III: Technicians and associate professionals; category IV: Clerks.
4. Dordick's theory of calculating percent of information workforce was considered most appropriate since when it was compared to the disaggregated method of identifying information workers, as used by Porat. His aggregate approach resulted in an error of no more than ±4%.

Singapore is another country, where information workforce has crossed a half way mark and is pegged at 51%. The single reason behind the rise of Singapore's

information workforce is its heavy entrepot service sector and the fact that it is a city base country with agriculture sector almost nil and a relatively small manufacturing sector. The secrets of high growth of the US information workforce are obvious of high quality of works initiated by information technology coupled with high ranked basic research and white-collar jobs. Scientists who have made early dent in this area to show that US was an information economy were Bell, Machlup, Porat, Williams, and Dordick. The reasons behind Japan's increased information work are of the same as in the case of US, with the support of basic research organizations. Additionally, in the other informatization parameters like newspaper, telephone, computers, Internet and high literacy (tertiary level), not only these five, but all the high-income countries have achieved exceptional fete. These are some of the important reasons, why high-income countries stayed ahead on the informatization map. The next lot of economies is from middle-income group and was selected taking one each from Latin America, Asia, and Europe so that fair results could be achieved. In these economies too, as per their middle level status, the information workforce in 1999 was 39% for Brazil, 36% for Malaysia, and 39% for Hungary, of their total workforce. Probably the facilities in the informatization parameters are available next to this group and this is a reason for their good show as far as information workforce is concerned. In the last lot of low-income group, countries were selected one each from East, Central, and South Asia. As shown in the table, information workforce represents almost a quarter of total workforce for Egypt (26.13%) and for Philippines (24.6%) respectively. Whereas in Sri Lanka, a lone economy from South Asia, there are around 11 information workers out 100 workers available in the country during the year 1998, as data for 1999 was not available. In the low-income countries, there are considerable information workers in their total workforce despite the fact that in all the above-mentioned informatization parameters, these countries comprehensively lag behind. Information technology has also not made many inroads into these low echelon countries and therefore could also be another criterion for their lesser representation in information workforce. Yet to be examined are those countries where the version of ISCO-68 and ISCO-88 (International Standard Classification of Occupations[2]) have not been implemented,

[2] International Labour Office, (ILO) circulates the International Standard Classification of Occupations (ISCO) to the entire member nations, to bring out the data on the various occupations pursued by individual nation. In its latest report, ISCO-68, and ISCO-88 versions have been circulated to collect the data on the occupational structure. ISCO-88 has been scarcely used by some individual countries, while ISCO-68, remained still widely followed classification to be used to identify the occupational classes around the world. On the same line, Government of India, Registrar General of India, pursued ISCO-68 classification and issued its own version i.e. National Classification of Occupations (NCO)-1968 in 1991 census. It has 8 broad categories, 95 sub-categories, and 512 sub-sub-categories. It includes all the new 47 sub-sub categories, which have been introduced during 1991 census.

thereby putting hurdles in the way to carve out their information workforce by information scientists. Many countries, including India, have not been figured in The ILO Yearbook of Labour Statistics, the sole source of international data on occupational structure. In fact this gave the background thinking that how important this study would be for a country like India, a home of one of the largest stock of scientific and technical manpower in the world.

Since the data for information workers for India is not available from any source, finding out the information workers for India was a major objective of this preliminary research. Data limitations remained major obstacles as far as measurement is concerned. The secondary data for entire paper was derived from Manpower Profile-2001 published by Institute of Applied Manpower Research, with support of Government of India: Registrar General and Commission of India, Census of 1981 and 1991. Since 2001 census data for occupation patterns was not available, therefore to bridge the mismatches, data prepared by Institute of Applied Manpower Research from the sources of National Sample Survey Organization (NSSO) for percent of main workers by major occupations between rural and urban from 1977-78 to 1999-2000 was used.

INDIAN SCENARIO

The census data for the Indian economy shows that the total workforce increased from 244 million in 1977-78 to 366 million in 1999-2000, and in the same time there are also some sectoral changes in employment in the three main economic activities i.e. agriculture, industry, and service. Employment shares of agriculture according to India Year Book declined from 74% in 1972-73 to 62% in 1999-2000, but on the other hand, employment in industry increased from 11% in 1972-73 to 16% in 1999-2000 and employment share of service sector bulged to 23% in 1999-2000 from the level of 15% in 1972-73 (Government of India, 2001). As evidenced in the past, the gain in the employment in service sector is the gain in the information workforce, but merely taking gain in the service sector's employment share is not enough base to determine the information workforce. As in the past, theorist like Bell too has mentioned in his thesis that service sector is an important criterion to gauge the employment in the information sector as well as other parameters like its contribution to nation's GDP. Later, he went on to demarcate the information as well as non-information sector from the traditionally existing sectors including service.

Information has already proved eyes and ears for the economies of developed world but on the other end, it is just rearing its head in developing world. With roughly 50 percent of information workers for OECD countries, India has not even enumerated its strength of information workers. There are some research studies where the subject has been quoted but not in great length. First of this is the World Bank, which termed information age as 'information economy' or 'post-industrial society' on the line of Porat or Bell, advocates that the share of information activities in national economies has steadily increased. Focusing on the role played by information for India's development, the Bank comes out with a rough estimation of information workers for India, which is worked out to be about 15 percent in the late 1980s (World Bank, 1994). With these two lines, the study ends and shows no further investigations, therefore leaving this unfinished agenda for others to do. Second, it looked from the studies of Jayant that how important was the measurement of information workforce for India. Although he, gradually progressed in his paper by mentioning the works of the US especially by Bell from 1860-1980, and afterward mentioned the information workers for India. His remarks in original form are mentioned here, since they form a vital links for current discussion. *"...an independent report issued by Ministry of Labour in 1978-79 shows that the organized sector (consisting of government and public and private sector organizations) employed over 10 million workers, out of which 2 million were in the information oriented occupations"* (Jayant, 1987). He then straight away goes to mention the importance of information sector for India and here once again Jayant's critical remarks needed to be mentioned before proceeding further. *"...a well developed information sector does not exists in India nor were there any signs of its growing between 1920 and 1970. The number of workers currently employed in electronics and data processing activities is estimated at 2 lakhs by the Manufactures Association for Information Technology (MAIT) and the number may increase from 15 to 20% per annum, since there is the conservative estimate of growth assumed by the Committee set up by the Department of Electronics, the Government of India, which studied the manpower requirements for this sector in 1985-86"* (Jayant, 1987). According to Jayant, it looks certain that carving out the information sector for the Indian economy was the need of the hour for past and even today its picture is not clear as mentioned by Jayant. Important clues emerged from his paper are that he has enumerated the total number of information workers out of organized sector only. The share of organized sector was 8% in 1978, and the rest 92%, huge unorganized sector was never counted for measuring the information workers. So there is a need to take both the sectors of the economy into consideration, and fresh pencil and paper work has to be initiated.

INFORMATION WORKFORCE: RESULTS

Bell, who set the motion of 'post-industrial society' by saying that in large extent, occupation is the most important detriment of class and stratification of the society. The expansion of the service economy, with its emphasis on office work, education, and government has naturally brought about a shift to informatized work. Machlup, too in his paper, openly exchanged knowledge-producing worker with information worker. For India, the stratification regarding information, production, service, and farm related workers have been presented in Table 2 for 1981 and 1991 general censuses respectively. The 2001 census data is still in processing stage for any further use and this is the reason that 1991census data is taken into consideration. In India, during 1991, there were 39.397 million 'information workers', which worked out to be 13.78% of total 'main workers' available in the country. A huge workforce of 190.442 million (67.90%) was still employed in the 'farm-related' occupations. 'production workers' stood at 44.396 million (15.51%), while ‘service workers' were pegged at 8.322 million, just 2.91% of total main workers of 285.932 million. After carefully seeing the growth rates of both the censuses of 1981 and 1991, one is determined to know that there are certain facts that point finger towards the growth of 'information workers' in India. Nationally, 'main workers' increased from 222.517 million in 1981 to 285.932 million in 1991, registering the growth rate of 28.50% for the period of 1981-1991. Categorywise, it is 'information workers' who registered the growth rate of 46.28% for the period of 1981-1991, a highest among four main categories. In numberwise, 'information workers' raised from 26.933 million to 39.397 million from 1981 to 1991 respectively. The startling revelations within the 'information workers' are: 'sales workers', who bulged from 10.194 million in 1981 to 16.550 million in 1991, registering the growth rate of 62.35% for the period of 1981-91; 'professional and technical workers', too gained the strength from 7.004 million to 10.157 million during the above period, registering the growth rate of 44.19%; 'administrative and managerial workers' also increased their presence from 2.365 million in 1981 to 2.923 million in 1991, with a growth rate of 23.49% during 1981-1991 period. The same is the case of 'clerical workers' who jumped from 7.330 million to 9.767 million from 1981 to 1991, with a growth rate of 33.25%. Growth rate for 'production workers' was 31.75%, while for 'service workers’, it was 23.31% for the period of 1981-1991. The 'farm-related workers', although, raised in volume from 152.817 million to 190.442 million, but its growth rate (24.91%) still stays below the national growth rate of 28.50% of 'main workers', during 1981-1991. More surprising results will come out, if we compare all the categories for 1981 and 1991. While 'information workers', increased its share in national workforce from 12.10% in 1981 to 13.78% in 1991, but on the other hand, during the same period,

there was the marginal decline for 'farm-related workers' from 68.61% to 67.90%, and for 'service workers' from 3.12% to 2.91% respectively. 'Production workers' too increased by marginally to 15.51% during 1991 from 15.14% in 1981. In over all, we must say that there are good conditions prevailing for information workers to prosper in the near future.

Table 2: Main Workers by Major Occupation Group for Indian Census (1981-1991)

Major Occupation Group	1981		1991		% change 1981-1991
	No (million)	%	No (million)	%	
Professional and Technical	7.044	3.17	10.157	3.55	44.19
Administrative, executive and managerial	2.365	1.06	2.923	1.02	23.59
Clerical	7.330	3.29	9.767	3.42	33.25
Sales	10.194	4.58	16.550	5.79	62.35
Total (I). Information workers	26.933	12.10	39.397	13.78	46.28
II) Production Workers Transport equipment operators and labourers	33.698	15.14	44.396	15.51	31.75
III) Service Workers	6.749	3.12	8.322	2.91	23.31
IV) Farmers and Fishermen	152.817	68.61	190.442	67.90	24.62
V) Workers not classified by occupation	2.3	1.03	3.3	1.15	43.48
Total (I+II+III+IV+V)	222.517	100.00	285.932	100.00	28.50

Note: Excludes Assam in 1981, and J&K in 1991. Main workers are those who work for 183 days or more in a year. Percent (%) in 3rd and 5th columns, and percent (%) change in 6th column is calculated by the author. Source: Derived from Institute of Applied Manpower Research: India Year Book 2001- Manpower Profile, Table 3.2.18, page 157.

After scaling throughout the India, it must be recognized to know whether the information workers are rural or urban phenomena. In Table 3, the data for the period of 1977-78 to 1999-2000 has been presented for rural as well as for urban for the four main categories. It shows that information workers are mainly dominated in the urban area, while its presence in rural area is miniscule. 'Information workers', as a whole, increased its share from 5.8% in 1977-78 to 9.1% in 1999-2000 in rural area, on the other side, it too increased from its substantial base of 36.8% to 43.2% for the same period in urban area. It means that information workers are increasing its strength in rural as well as in urban area. During 1999-2000, out of total 92 million workers in urban area, 43.2% were ‘information workers' followed by 'production workers' (38.8%), 'service workers' (9.7%), and 'farms related workers' (8.3%). From the above data, it is concluded that information workers are mainly urban phenomena. 'Production workers' in this period also gained importance, and therefore its share also increased from 9.3% in 1977-78 to 14.2% in 1999-2000 in

rural area. But still to see is its presence in urban area, where they did not register any decline in the growth rate and somewhat remain stable during the above period. It is once again important to mention that after the information workers, it is 'production workers', who dominate in urban, as it is pegged at 38.8% of total main workers in urban area in 1999-2000. 'Service workers' did not show any revival in rural area, and like in 1977-78, they were still at 2.5% of total main workers of rural area during 1999-2000. It is very interesting to see a marginal decline for urban region, from 11% in 1977-78 to 9.7% in 1999-2000, probably showing that there is no further space left for this occupation in both the rural and urban area. Anyhow 'service workers' looked to be working in urban area, as during 1999-2000, they were 9.7% of total urban workers (92.3 million), which worked out to be more than double of its presence in rural area (2.5% 273.8 million). The obvious choice of 'farms related workers' is in rural area only. But they too have decline over the period. They were at 82.4% of rural main workers in 1977-78, but declined to become 74.2% in 1999-2000. On the other hand, its decline in urban area, from 13.7% to 8.3% for the above period, should not be a sign of worries, since it is not an urban occupation. But one has to pick up clues that there is less space for more employment in farms related occupations not only in urban, but also in its main heartland, rural area. In these circumstances, there is a need to look for another occupation, which is full of opportunities, and for that information occupation in information sector looked to be the only choice.

When delved into the four sub-categories of information workers, some surprising results come out. As we see rural main workers increased from 197.5 million in 1977-78 to 273.8 million in 1999-2000, and registered roughly 40% growth rate. On the other hand, urban main workers rose from 46.1 million to 92.3 million during the same period, registering a growth rate of around 100%. Seeing the future of urbanization, 'professional, technical and related workers', increased it share in both the rural as well as urban area. It registered a 0.6-point increase over its share of 1.5% in 1977-78, and was pegged at 2.1% in 1999-2000 for rural area. For urban area, it jumped by 1.6 points for the same period, and was settled to become 8.9% in 1999-2000 from the level of 7.3% during 1977-78. During the same period, figures for 'administrative and managerial workers' were 0.3% and 1.4% in rural (1.1 points-increase), and 3% and 8.4% for urban area (5.4 points increase). 'Clerical workers' managed to increase its presence, roughly by doubling from 0.9% in 1977-78 to 1.5% in 1999-2000 in rural area, but it is very strange to see a marginal decline from 10.2% to 9.2% for the same period for urban area (since it is urban occupation). 'Sales workers', the last sub-category for information workers, is able to pick up some increase in rural area from 3.1% to 4.1% for the same period, but faces the

stagnation in urban area, since it has increased by only 0.4-point from 1977-78 to 1999-2000 period. In totality, except for the marginal decline in the clerical related occupations, all other three sub-occupations of information workers have shown their own way throughout the country. An area to watch is the rise of administrative and managerial related workers in the urban domain where they rose to become 8.4% during 1999-2000 from just 3% during 1977-78 of total urban workforce. 'Production workers' hold some sort of stakes in rural but however remained stagnant for the entire period from 1977-78 to 1999-2000 for urban area. 'Service workers', on the other hand, too have not increased its share in rural, and in fact decreased its share in urban area, while 'farm related workers' have actually shrunk in rural as well as urban India. All these developments give the clear path that information workers would dominate the stages for future India to come.

Table 3: Percent Distribution of Main Workers by Major Occupation Group Between Rural and Urban

Major Occupation Group	Rural					Urban				
	1977-1978	1983	1987-1988	1993-1994	1999 2000	1977-1978	1983	1987-1988	1993-1994	1999-2000
Professional and technical	1.5	2.1	1.7	2.3	2.1	7.3	8.2	8.0	9.0	8.9
Administrative, executive and managerial	0.3	0.4	0.7	0.9	1.4	3.0	4.0	5.0	5.9	8.4
Clerical	0.9	1.2	1.3	1.4	1.5	10.2	9.9	10.2	9.7	9.2
Sales	3.1	3.3	3.9	4.2	4.1	16.3	15.8	16.8	17.0	16.7
Total (I). Information workers	5.8	7.0	7.6	8.8	9.1	36.8	37.9	40.0	41.6	43.2
II. Production Transport equipment operators and labourers	9.3	10.8	12.7	12.4	14.2	38.5	39.1	38.6	38.5	38.8
III. Service	2.5	2.4	2.3	2.0	2.5	11.0	10.4	9.9	9.2	9.7
IV. Farmers and fishermen	82.4	79.8	75.1	76.8	74.2	13.7	12.6	10.7	10.7	8.3
V. Workers not classified by any occupation.			2.3					0.8		
Total (I+II+III+IV+V)	100	100	100	100	100	100	100	100	100	100
Total Employment (million)	197.5	213.6	224	255	273.8	46.1	56	65.1	76.9	92.3

Note: Workforce covers those involved in gainful activity regularly. Source: Adopted from Institute of Applied Manpower Research: India Year Book-2001-Manpower Profile, Table 3.2.14, page 154.

Next is the education level of all the main workers in the country. Since education level e.g. college education in the vision of the information theorists is crucial for the development process of main workers and ultimately leads to prosper information-oriented labour. It's the education of graduation and above that goads

more and more workers into the category of information workers. Here, data in Table 4 presents the tertiary level educated main workers in 1981 and 1991 censuses. During 1981, nationally, there were only 2.68% of total main workers, who attained the tertiary level education. While squinting within each category of 'information workers', we found that it is 'professional and technical related workers', who actually lead the chart of most tertiary level educated workers in the country. In 1981, 36.27% of all 'professional and technical workers' hold the tertiary level education, followed by 'administrative and managerial workers' (24.44%), then 'clerical workers' (21.27%), and finally 'sales workers' (3.92%). 'Information workers', as a whole hold the key as being the most educated workers in the country. In the same period, 'farms-related workers' are having the least proportion of tertiary level educated workers with just 0.25% of total farms workers. 'Production workers' with (0.93%) and 'service workers' with (1.27%) are placed better than 'farms related workers'. It is again the turn of 'professional and technical workers' as its share in tertiary level education rose to 43.88% in 1991 from the 1981 level of 36.27%. On the other hand, 'administrative and managerial workers' also increased it share by pegging at 38.56% in 1991 compared to 24.44% a decade earlier in 1981. The standard of education level also improved further in 1991, for the 'clerical workers' (30.77%), and 'sales workers' (7.84%). In fact the growth rate of 'sales workers' during 1991 was almost double as compared to the growth rate of 1981. It shows that sales workers were quick enough to increase their university level education. The dominance of 'information workers' in the higher-level education is clear from the Table itself. Total tertiary level educated workers in the country rose from being 2.68% in 1981, to 4.47% in 1991, out of which information workers constitute major percentage. An interesting equation to emerge from the data in Table 4 is the balance between 1981 and 1991 census. Percents in bracket show that during 1981, 85% tertiary level educated workers worked for information related activities, while rest 15% were disproportionately divided into 'production' (5.22%), 'service' (1.45%), and 'farm related workers' (6.41%). On the other side of the balance, during 1991, 77% tertiary level educated workers opted for information occupations, and rest 23%, for production (8.43%), service (2.20%), and farms related (10.91%) occupations respectively. Within the 'information workers', it is professional and technical related category, which maintained its clear advantage on other three sub-categories. In both the censuses of 1981 and 1991, professional and technical classes hold close to roughly 50% tertiary level educated workers among information workers. Data show the importance of these classes of occupations for India as well as for information workers. More and more educated people in the workforce mean that more and more informatised work is being done.

Table 4: Share of Main Workers by Occupation and Tertiary Education (1981-1991)

Major Occupation Group	1981			1991		
	Total main workers (Million)	Tertiary level and above (Million)	% of tertiary level main workers	Total main workers (Million)	Tertiary level and above (Million)	% of tertiary level main workers
Professional, technical and related workers	7.044	2.551 (42.69)	36.27	10.157	4.457 (34.83)	43.88
Administrative, executive and managerial workers	2.365	0.578 (9.67)	24.44	2.923	1.127 (8.81)	38.56
Clerical and related workers	7.330	1.559 (26.09)	21.27	9.767	3.005 (23.48)	30.77
Sales workers	10.194	0.400 (6.69)	3.92	16.55	1.299 (10.15)	7.84
Total (I). Information workers	26.933	5.088 (85.14)	18.89	39.397	9.888 (77.27)	25.10
II Production and related workers, transport equipment operators and labourers	33.698	0.312 (5.22)	0.93	44.396	1.079 (8.43)	2.43
III Service workers	6.749	0.086 (1.45)	1.27	8.322	0.282 (2.20)	3.39
IV Farmers, fishermen, and related workers	152.817	0.383 (6.41)	0.25	190.442	1.304 (10.19)	0.68
V Workers not classified by any occupation.	2.320	0.106 (1.77)	4.57	3.375	0.244 (1.91)	7.23
Total (I+II+III+IV+V)	222.517	5.975 (100)	2.68	285.932	12.797 (100)	4.47

Note: Excludes Assam in 1981, and J&K in 1991. Main workers are those who work for 183 days or more in a year. Percent in 3rd, 4th, 6th and 7th column is calculated by author. Vertical figures in ( ) indicate % of total tertiary level educated main workers. Source: Derived from Institute of Applied Manpower Research: India Year Book 2001-Manpower Profile, Table 3.2.18, page 157.

Although the objective of this paper is to shed light on the number of main workers according to their occupations, and from occupations it is to determine whether worker is information worker or not. It is very interesting to find here, the choice of elite ‘information workers' industry i.e. places of economic sector, where they work. In Table 5, data presented is on the distribution of main workers by industry and occupation. National Industrial Classification (NIC) in the 1991 census divulges 10 broad categories, 73 sub-categories, and 462 sub-sub categories (Government of India-Census of India, 1991). But in this paper, data has been moulded into broad categories only. After carefully scrutinizing the data, we found that 85.41% 'professional and technical workers' were employed in 'other service sector'

(financing, insurance, real estate, business services, community, social and personal services), whereas 'administrative and managerial workers' were employed in 'trade and commerce' industry (34.86%), followed by 'other service' (26.95%), and 'manufacturing other than household' sector (20.20%). The charms and place of workings of the 'clerical workers', like professional classes, are in the 'other service' sector (49.12%). Other sectors of their choice of working are 'transport, storage, and communication' (17.25%), 'trade and commerce' (17.56%) and 'manufacturing other than household' (10.26%). A huge 94.20% presence of 'sales workers' in 'trade and commerce' sector leaves no doubt that it is trade and commerce related occupations. In totality, 'information workers' work for 'trade and commerce' and 'other service' as defined in the case of professional classes, which happens to be 75% of all the 'information workers' during 1991. Other economic sectors for working for other categories are quite different. Most of the 'production workers' are employed in 'manufacturing sector' (67%), while 70% of all the 'service workers' are concerned to work for 'other service' sector. 'Farms related workers', as clear from their occupations are heavily concentrated in 'agriculture, forestry, and hunting' sector. There are certain workers not classified by their occupations, but still they love to work for 'other service' oriented sector, such as financing, insurance, real estate and business related sectors as defined above. The main objective to present this data is make clear that industries like 'construction, trade and commerce', 'transport and communication', and 'other service', are the star attractions for most information workers. 'Farms related workers' end up working only in agriculture-related sector, whereas 'production workers' are satisfied to work for manufacturing sector of the economy, as it is the domain of production workers.

One of ultimate objectives of this paper was to find the ratio between of information workers and total main workers, a barometer to gangue the knowledge strength in the country. For India, after measuring the equilibrium between the two during 1991, it was roughly 14%. The same ratios for some of the countries from high-income group during the year of 1990 were; Australia-45%, Canada-55.8%, Germany-47%, Japan-47.5%, New Zealand-52%, Singapore-46.8, and the US-56.7%. During the same period, even middle-income nation's share of information workforce was much higher than India's. Some of the countries from this income group needed to be mentioned here are Brazil-32%, Costa Rica-31.7%, Malaysia-33%, Republic of Korea-35.4%, Taiwan 38.5%, and Venezuella-40.6%. Countries from low-income group even fared better and stood higher than India. Countries worth to be mentioned here are Egypt-31.8%, Philippines 24.9%, and Thailand-18.2% (Dordick and Wang, 1993).

Table 5: Distribution of Main Workers By Industry / Occupation 1991 (In Thousands)

Industry / Occupation	Agriculture forestry, fishing & hunting	Mining & Quarrying	Manufacture household industry	Manufacture other than household industry	Construction	Trade & commerce	Transport, storage & communication	Other Service	Total
Professional, technical & related workers	122 (1.20)	54 (0.53)	13 (0.13)	475 (4.68)	166 (1.63)	533 (5.25)	119 (1.17)	8676 (85.41)	10158 (100)
Administrative, executive & managerial workers	1.6 (0.05)	29 (0.99)	26 (0.90)	590 (20.20)	298 (10.20)	1018 (34.86)	171 (5.85)	787 (26.95)	2920.6 (100)
Clerical & related workers	231 (2.37)	85 (0.87)	13 (0.13)	1002 (10.26)	238 (2.44)	1715 (17.56)	1685 (17.25)	4797 (49.12)	9766 (100)
Sales workers	187 (1.13)	10 (0.06)	72 (0.44)	422 (2.55)	25 (0.15)	15591 (94.20)	32 (0.19)	212 (1.28)	16551 (100)
Total (I). Information workers	541.6 (1.37)	178 (0.45)	124 (0.31)	2489 (6.32)	727 (1.85)	18857 (47.87)	2007 (5.09)	14472 (36.74)	39395.6 (100)
II Production & related workers, transport equipment operators & labourers	241 (0.55)	1509 (3.40)	6481 (14.60)	18836 (42.43)	4677 (10.53)	578 (1.30)	5755 (12.96)	6318 (14.23)	44395 (100)
III. Service workers	118 (1.42)	39 (0.47)	86 (1.03)	337 (4.05)	90 (1.08)	1681 (20.20)	163 (1.96)	5809 (69.79)	8323 (100)
IV. Farmers, fishermen & related workers	190324 (99.94)	1.1 (0.00)	n.a.	18 (0.01)	5 (0.00)	12 (0.01)	3 (0.00)	79 (0.04)	190442.1 (100)
V. Workers not classified by any occupation.	116 (3.44)	24 (0.70)	113 (3.35)	187 (5.54)	44 (1.30)	168 (4.98)	90 (2.67)	2634 (78.02)	3376 (100)
Total (I+II+III+IV+V)	191340.6 (66.92)	1751.1 (0.62)	6804 (2.38)	21867 (7.65)	5543 (1.94)	21296 (7.45)	8018 (2.80)	29312 (10.25)	285931.7 (100)

Note: Excludes Assam in 1981, and J&K in 1991. Main workers are those who work for 183 days or more in a year. Horizontal figures in ( ) are author's calculations and thus indicate % of main workers in each of the eight identified industrial classifications. Source: Adopted from Institute of Applied Manpower Research: India Year Book 2001-Manpower Profile, Table 3.2.17, page 156.

CONCLUSION

The following conclusions are put forward:

a) Information activities or information in the information-based era play a pivotal role similar to energy in the production of a manufacturing economy. So activities associated with information in the economy must be tracked down. Information workers' enumeration in the total workforce is the first step toward this.

b) For many years information workers' role to enhance the productivity has been ignored. These workers are very important for the success of a country like India, the 12th largest economy in the world, and leading nation in the scientific and technical manpower. By segmenting and targeting information workers, and thereby properly placing them in the right direction, we can achieve the higher economic growth.
c) The size and strength of the information workforce in the Indian economy straight away points towards the knowledge wealth of the country. With the help of various method and new demarcation process used in this study, new initiatives could be undertaken to develop the information policies that would help to optimize information as economic resources.
d) Since India belongs to the low-income economies and after comparison, it looks that there exists a wide gap between India and its counterparts from low-income countries. Country like Egypt is also better placed than India, and it seems that rich countries have information workers more than three times than that of India has. The US, richest economy in the world, has information workforce almost more than 4-fold than the India's information workforce. Almost same imbalances exist between India and middle-income economies.

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REFERENCES

Bell D. 1974. *The coming of post-industrial society*. London: Heinemann Educational Books Limited.

Boon J.A., Britz, J.J. & Harmse C. 1994. The information economy in South Africa: definition and measurement. *Journal of Information Science*, Vol. 20, no. 5: 334-347.

Davenport T. 2003. Harvard management update. *Hindustan Times*, Jan. 30.

Dordick, S.H., & Wang G. 1993. *The information society: A retrospective view*. Newbury Park (CA): Sage Publications.

Engelbrecht, H.J. 2000. Towards a knowledge economy? Changes in New Zealand's information workforce 1976-96. *Prometheus*, Vol. 18, no. 3: 264-282.

Gibbs, D. 1994. Information and communication technologies in Poland. *Telecommunication Policy*, Vol. 18, no. 5: 363-66.

Government of India. 1991. *Census of India. Economic Tables*, vol. 8 (part-1), Table B-19 (F). India, States and Union Territories.

Government of India. 2001. *India Yearbook. Manpower profile*. New Delhi: Institute of Applied Manpower Research.

Hufbauer, G. 1996. World economic integration and revolution in IT. *Technology in Society*, Vol. 18, no. 2: 165-172.

Jayant, P. 1987. Impact of information technology on productivity, training and management development: The Air India experience. In P. Sadanandan and R. Chandrasekar (Eds.). *Information technology for development*. New Delhi: Tata McGraw-Hills Publishing Company Limited.

Kim, M.J. 1996. A comparative analysis of the information sectors of South Korea, Singapore and Taiwan. *Information Processing & Management,* Vol. 32, no. 3: 357-371.

Kimbel, D. 1987. Information technology today and tomorrow. *Telecommunication Policy*, Vol. 11, no. 4: 377-389

Mansell R, & When, U. 1998. *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press.

OECD. 1981. *The potential of information technologies for job creation*. Fast occasional papers.

Schement, J.R. 1990. Porat, Bell, and the information society reconsidered: The growths of information work in the early twentieth century. *Information Processing & Management*, Vol. 26, no. 4: 449-465.

Singh, B.I. 1988. Information economies and the next presidency: Policy options for the USA. *Telecommunication Policy*, Vol. 12, no. 3: 208-211.

Szabo, J & Dienes, I. 1998. Ideas and concepts on the Hungarian information economy. *Information Processing & Management*, Vol. 24, no. 2:183-198.

Webster, Frank. 2002. *Theories of the Information Society.* Second edition. London.

World Bank. 1994. *Exploiting Information Technology for Development: A case Study of India.*

World Bank. 2003. *Selected World Development Indicators*. World Development Report.