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Women and access to ICT: A case study of India

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Women account for a sizeable number of Information and Communication Technologies (ICT) workforce in India. This paper makes an attempt to find out women's status in emerging areas of IT in India. This paper firstly tries to find out factors affecting women's access to ICT education in India. It also tries to find out factors affecting participation in ICT employment. The paper addresses issues regarding IT education availability for all women. Policy recommendations are given regarding women participation in IT sector.

Key words: Women, information and communication technologies (ICT), access to ICT, IT workforce.

INTRODUCTION

The Information and Communication Technologies (ICT and IT can be used interchangeably). ICT includes all aspects of Information Technology and Business Process Management (IT-BPM) firms. Since 2013, Information Technology and Business Process Outsourcing (IT-BPO) has been renamed as IT-BPM drives growth in the present era. These technologies have created new opportunities for scientific progress, economic development, education and social change. The ICTs are a significant factor in performance and growth of economies and also help advance sustainable human development. In 2014, world-wide IT-BPM spending was 2.3 trillion US\$, a growth of 4.6% over 2013. The largest market in BPM services is America with 5.1% growth (NASSCOM STR, 2015).

In India, the ICT sector has come to occupy a prominent position. The contribution of ICT is significant in terms of income and earnings.

The Indian IT-BPM industry has generated overall revenue (exports as well as domestic) of USD 146 billion in 2015, with a growth of 13% from the previous year.

This contributes 9.5% to India's Gross Domestic product (GDP) and more than 38% in total services exports. In terms of global sourcing, India has a leadership position with 55% of total market share. India's share in global offshoring market has increased from 45% in 2009 to 55% in 2014 (NASSCOM-BCG Report, 2015).

The ICT sector is the largest and most diverse employer in the private sector in India. It was estimated to provide direct employment to more than 3.5 million people and indirectly created jobs around 10 million. This includes 170000 foreign national employees and greater share of employees from non-Tier 1 (Tier 1 cities are classified on basis of (a) population, (b) infrastructure and government spending. Details are given in a note at the end) Indian cities. Women employees constitute around 34% of the total employees (NASSCOM, 2015). An abundant pool of skilled manpower has facilitated the rapid growth of ICT industry in India. Hence, the ICT workforce has come to occupy an important role in the economy.

In the ICT sector emphasis is on intellectual rather than

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physical resources. As emphasis is on knowledge, the ICT industry is considered to be non-discriminating. It is considered to be an equal opportunity employer for men and women, minorities and handicapped all alike (Gupta, 2015; Bhattacharya and Ghosh, 2012; Upadhyay, 2006; Shanker, 2008).

Women constitute half of the resources of the nation and a significant portion of IT workforce. What are the factors affecting participation of women in newly emerging areas of information technology? What is the position of women in newly emerging areas of IT in India? What problems are faced by women regarding education in ICT? Is ICT education available to all sections of Indian women or is it available to few sections of population? Is there a digital divide prevailing in Indian IT sector? Are there any problems or discrimination involved regarding women? This paper makes an attempt to find answers to these questions. Therefore, the objective of the paper is as follows: (1) to find out factors affecting women's access to ICT education in India, (2) to find out factors affecting women's participation in ICT employment in India.

Section 1 gives introduction and objectives of the study. Section 2 states the methodology formulated for the study. Section 3 discusses ICT industry in India. Section 4 deals with factors affecting women's access to ICT education. This section also discusses women's participation in ICT employment in India. Section 5 concludes the paper.

METHODOLOGY

This paper is based on secondary data. Data were mostly collected from The National Association of Software and Services Companies (NASSCOM) and The National Service Scheme (NSS), Indian government-sponsored schemes. Also, the data was compiled from various sources as World Bank, Dataquest, Human Development Index (HDI), United Nations Department of Economic and Social Affairs (UNDESA). The available data for the most recent year was compiled for the factors that affect women and their access to ICT education and job opportunities in India.

The key indicators of gender and employment (NSO, 2011; Barro and Lee, 2013; UNESCO Institute for Statistics, 2013; ILO, 2013, NSSO, 2013) included in the study are as follows:

(a) Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions of human development, a long and healthy life, knowledge and a decent standard of living.

(b) Gender Development Index (GDI) (female to male ratio of HDI): A composite measure reflecting disparity in human development achievements between women and men in three dimensions, health, education and living standards.

(c) Gender Inequality Index (GII): A composite measure reflecting inequality in achievements between women and men in three dimensions: reproductive health, empowerment and the labour market.

THE ICT INDUSTRY IN INDIA

The revenues of Indian ICT industry comes both from

exports as well as domestic market, exports constituting more than 60% of revenues, around 98 US billion \$ in 2015. India has fundamental advantages in abundant talented human resource and cost factors which are sustainable over the long term. The industry is continuously growing.

It is expected that Indian IT-BPM sector will generate revenues of USD 300 billion by 2020. BPM sector is expected to grow at a rate of 15%. There will be significant drive creation in rural and metro areas. There will be global opportunities. A major challenge faced by the industry is availability of a pool of skilled labour force.

The growth of IT-BPM sector in India can be assessed through 4 pillars of growth (NASSCOM, 2015):

1. India is the world's most attractive market in terms of (a) improving economic growth; (b) connected economy, digital ready market; (c) growing spending power of 1.2 billion people; (d) positive investment climate; and (e) unmet needs.

2. India's excellence in business delivery includes (a) optimum cost; (b) highest volume of diverse, employable talent; (c) strong network of ODCs, multi-shore presence; (d) quality infrastructure; (e) mature ecosystem; and (f) effective collaboration and partnerships.

3. India is a hub of digital skills which comprises of (a) more than 7000 firms in India focusing on digital solutions; (b) 1.5 lakh digitally skilled employees; (c) more than 2000 digitally focused start-ups; (d) 30% start-ups working on innovative solutions; and (e) enabling environment for skill-set development, focused trainings.

4. India is a leading innovator in global IT-BPM industry. This consists of (a) large firms fostering innovation, collaboration, building scale, co-creating best solutions; (b) strengthening entrepreneurial environment, rise in investments; (c) rise in technology and digital start-up, making innovation and IP available across the world.

IT-BPM sector was initially located in 7 main locations. They are Bangalore, Poona, Chennai, Delhi, Hyderabad, Bombay and Kolkata. This sector has rapidly to other locations. It is expected that 43 new locations, Tier 2 and Tier 3 cities will emerge as BPM locations and expected to contribute more than 50% of total employment by 2018 (NASSCOM, 2015).

Education requirements

As ICT is a knowledge based work, the entry to labour market is affected by many factors. The human capital variables (Becker, 1964) as education and training are critical factors in determining access to it labour market. Acquisition of human capital is in form of education, continuity of experience and on- the- job training, health and migration (Becker, 1975; Shultz, 1961; Mincer, 1974).

The knowledge or skills required in the ICT sector vary

Table 1. Supply of technically qualified talent for ICT-BPM sector in India (NASSCOM, 2012).

Numbers	2008	2009	2010	2011	2012
Total engineering graduate output	392,400	451,700	498,082	622,603	812,679
Degree (four year course)	258,800	312,200	344,258	430,323	572,329
Diploma (three year course)	133,600	139,500	153,824	192,280	240,350
Total engineering postgraduate output	61,800	62,400	72,777	87,332	104,799
MCA	47,000	46,700	54,466	65,359	78,431
Engineering Post Graduate	14,800	15,700	18,311	21,973	26,368
Technology graduate and post graduate (Computer Science, Electronics, Telecom, etc.) output	233,100	268,622	295,846	368,168	481,129
Engineering IT graduates (degree)	153,500	185,515	203,642	253,608	337,934
Engineering IT graduates (diploma)	79,600	83,107	92,204	114,561	143,195

2012 is a forecast.

according to the nature of job. Five tier hierarchy of ICT skills have been identified in the ICT sector (Chandra, 1993). They range from simple user skills to advanced user skills. Other higher level skills are system implementation, management and facilitation skills, development skills and research and innovation skills.

In India, the supply of trained manpower comes from a large number of educational institutions, formal as well as non-formal, both in the government as well as the private sector. In the formal sector, the type of courses provided range from diploma in computer programming at the polytechnics to graduation and above at the universities/institutes. Table 1 shows that many institutes provide a Master's degree in computer application. Engineering institutes provide a degree in Computer Science, Electronics and Communication.

India has a diverse employable talent in the world. It is expected that in 2015, nearly 5.8 million graduates and post graduates people will be there and out of which 1.5 million suitable people will be

hired for this industry. This is due to the growth of IT-BPM industry in size, scale, maturity, domain expertise, and focus in addressing customer business' demand (NASSCOM, 2015)

As the IT sector is growing, there is demand for specialized skills. In the IT services sector, technical graduates consist of more than 60% of employees. Business intelligence and data analytics are the most wanted skills. There is demand for cloud and mobile technology, SAP, IT developers, programmers, infrastructure managers and IT security consultants. Demand for banking and financial experts is expected to pick up. In the BPM sector, a quarter of employees are domain and technical specialists. In this sector, the top skills are domain knowledge, technical skills and soft skills.

Status of women in ICT in India

It is seen that women are now occupying a prominent position in the IT labour force in India.

The number of software professionals increased from 6800 in 1985 to 650,000 in 2003 to 2004 and further to 2.23 million in 2008 (NASSCOM, 2009). In 1993, women comprised only 10% of ICT workforce which increased to 21% in 2003. Women employees now constitute around 34% of the total employees (NASSCOM, 2015). It is expected that 50% of workforce will be women by 2020.

Women are employed in IT companies located mainly in cities as Bangalore, Poona, Chennai, Delhi, Hyderabad, Bombay, and Kolkata. More women are employed in Southern regions of the country. They belong to the younger age group (COD, 2004, Dube et al., 2012; Shanker, 2008; Agarwal, 2000).

Although women are expected to contribute around one third of the labour force, they represent only one section of the Indian society. The new knowledge based ICT are considered to be non-discriminating. However, access to ICT is not even and there persists a divide in society. It is seen that the IT workforce is largely urban and

Table 2. India, Education and human resources (2012).

Education	Actual
Adult literacy rate (% age 15 and above), 2011	74.4
Adult literacy rate (% age 15 and above), Male, 2011	82.14
Adult Literacy Rate (% age 15 and above), Female, 2011	65.46
Mean years of schooling (of adults) (years), 2013	4.4
Gross secondary enrollment rate, (% of relevant age group),2013	71
Gross tertiary enrollment rate, (% of relevant age group),2013	25
Public spending on education (total % of GDP), 2012	3.35
Quality of science and math education (1= Poor; 7=Excellent) (weighted average), 2011-12	4.66
Quality of management schools (1= Poor; 7=Excellent) (weighted average), 2011-12	4.93
Gender	
Gender development index, female to male ratio of HDI, 2013	0.828
Females labor force (% of total labor force), (ages 15 and older), 2014	24
Women in parliaments (% of total seats), 2015	12
School enrollment; secondary; female (% gross), 2010	60.4
School enrollment; tertiary; female (% gross), 2010	14.9

Source: Education stats – KAM report.

Source: Census of India, 2011 <http://www.census2011.co.in/literacy.php> last assessed on November 2, 2015.

HDI Reports, 2013; <http://hdr.undp.org/en/content/table-5-gender-related-development-index-gdi>, last assessed on October 29, 2015.

Data refer to the most recent year available.

<http://wdi.worldbank.org/table/2.11>

<http://hdr.undp.org/en/content/mean-years-schooling-adults-years>

<http://www.tradingeconomics.com/india/public-spending-on-education-total-percent-of-gdp-wb-data.html>

http://www3.weforum.org/docs/FDR/2012/15_Pillar_2_Business_environment_FDR12.pdf

<http://wdi.worldbank.org/table/2.2>

<http://wdi.worldbank.org/table/1.5>

<http://www.tradingeconomics.com/india/school-enrollment-secondary-female-percent-gross-wb-data.html>

middle and high class and hail from educated families (Upadhyay, 2006; Agarwal, 2000; Krishna and Brihamdeshan, 2006; Fuller and Narasimhan, 2006) Various factors affect women's participation in IT. The work participation rate in any country also affects their employment patterns in IT industry. Other basic questions facing women are access to IT education, employment opportunities, location of employment, work structure of IT and skill up gradation. Women have double responsibility of market based work as well as home responsibilities.

FACTORS AFFECTING WOMEN ACCESS TO ICT

Access to education

Access to education is one of the key factors affecting women's participation in IT employment. In India, IT professionals are a small group of educated urban elite, where women constitute almost one third of professionals. On a macro level, when analyzed in detail it is seen that access to IT employment is denied to a majority of population, especially women. Women IT professionals are a very tiny portion of India's large population. Lack of

access to basic education and literacy are the prime reasons affecting women's access to IT.

In India, literacy levels are relatively low. As per 2011 census, literacy levels in India are currently 74.4%, male literacy levels being 82 % while female literacy levels are just 65%. Basic literacy is low for women. Hence, less women have access to IT. The level of human resources are shown in Table 2 based on the KAM report.

On gender parameters, India ranks very low. It ranks poorly on Gender Development Index (GDI), female to male ratio of Human Development Index (HDI, 2013), scoring 0.828, a rank of 135 in the world. With respect to Gender Inequality Index, India has a score of 0.563 and a score of 0.519 for HDI, female, which has a same rank of 135 in the world (HDI, 2013). These scores lie in the medium human development category as defined by HDI.

Education is a basic human right in India. India has still a long way to go before it achieves this status. Average years of schooling are an aggregate measure of educational stock of a country. India's average year of schooling in 2013 for adults was just 4.4 years. In 2013, gross secondary enrollment rate was 71%, while gross tertiary enrollment rate was only 25%. For women, the figure was even lower. At secondary levels, enrolment ratio for women is 60.4% in 2010, while enrolment at

tertiary level is just 14.9%. As less women are enrolled in higher education, their access to ICT employment is limited.

Although the proportion of women in higher education has not reached the desirable level, the absolute number of women in higher education has been increasing over the years. The expansion of education for women has been phenomenal over the years. The number of girls enrolled in primary stages increase rapidly from 10,944 thousand in 1961 to 47,453 thousand in 1998...and increased to 62769 thousand in 2014. At senior secondary level, enrolment rates increased from 700 thousand in 1961 to 2129 thousand in 1998 and further increased to 104,00 thousand in 2014. In professional/technical/vocational education, the number of degree holders increased from 33,000 in 1961 to 285,000 in 1998. In higher education, the number of women increased from 200 thousand in 1961 to 13300 thousand in 2013 (MHRD 2014).

The number of women engineers in India has been growing over the years. Women engineers were only around 1% of the total in the eighties. Their numbers gradually increased to 15 to 20% of total engineers in 2005 (Parikh and Sukhatme, 2004). In IIT Bombay, the number of women engineers increased from 1.5% in 1972 to 8% in 2005 (Sukhatme and Parikh, 2006). In 2014 to 2015, the enrolment of women in engineering/technology institutions was 1232006 which was 9.8% of enrolment in higher education. A significant number of women engineers are specializing in computer related fields. A study by Parikh and Sukhatme (2004) showed that more than 50% engineers were specializing in Computer/Electronics field. This has been due to changing economic policies in India post 1991. Liberalization policies led to growth of IT led economy and creation of jobs in IT sector. Privatization of engineering colleges and access to engineering colleges increased women participation in engineering education (Gupta, 2015). A job in IT sector was considered a sign of status symbol, termed as symbolic capital which increased women's status in society (Shanker, 2008; Gupta, 2015). This led to parents investigating more in daughter's education.

Access to employment opportunities

Both demand and supply factors affect women's labour force participation. This is majorly affected by women's status in society. On the demand side, economic, social and cultural factors, employers' attitude and discriminatory policies all affect female work participation. The supply of female labour depends on various factors as socio-economic status of family, life cycle commitment of marriage and fertility and education levels.

The labour force participation rate (LFPR) was 40% in 2009 to 2010, 41.4% in rural areas and 36.2% in urban

areas. The International Labour Force (ILF) reported that the rate of female participation in the total labour force in India has fallen from 37% in 2004 to 2005 to 29% in 2009 and 2010. The female labor force participation (FLFP) rates are the lowest for India. FLFP is measured as a share of women that are employed or seeking work as the working age female population among emerging markets and developing countries. At around 33% rate of FLFP, around 125 million of the roughly 380 million working-age Indian females are either seeking work or are currently employed (Census of India, 2011).

Due to this, India is ranked at the lowest 11th position among 131 countries (International Labour Force, 2013). In 2011 and 2012, women comprised 24.8% of all rural workers, down from 31.8% in 1972-73. In 2011-2012, women comprised 14.7% of all urban workers, a small increase from 13.4% in 1972-73 (www.catalyst.org)

As less women are enrolled in higher education, their access to IT employment is limited. Apart from education levels, the background of an individual plays an important role on determining entry in labour market. The IT sector is elitist in nature.

Education is the key to getting entry in a knowledge based sector. As less women are enrolled in higher education, their access to IT employment is limited. Apart from education levels, the background of an individual plays an important role on determining entry in labour market. The IT sector is elitist in nature.

Various studies have shown that the people working in IT sector are mainly from urban background, especially for women. It is seen access to education and training is highly skewed towards English speaking masses and varies according to different classes (COD, 2004; Agarwal, 2000; Upadhyay, 2006). Thus, it is seen that majority of the respondents entering the IT industry belong to the upper caste and urban areas who had access to higher education related to newer technologies. The average is around 28 years. The respondents have a high socioeconomic status as measured in terms of parents' education and occupation attainments. It is also noted that women have a higher SES as compared to men. Only women from well-off families have access to IT. Similar results have been reported by Rothboeck (2001), Ramesh (2008), and Hussain (2008). Good communication skills are a necessity for entry in the IT sector (Fuller and Narasimhan, 2006). Persons from rural background and lower caste groups have an immediate disadvantage as English speaking skills are required and access to them is limited.

The results are same when analyzed on a macro level data by NSS as shown in Table 3. The NSS data shows that majority of people, more than 90% working in IT sector belong to urban areas. The figure is higher in case of women.

The majority of professionals belong to upper castes. In India, 27.8% of population live in urban areas. The socioeconomic status shows that 28% of population in

Table 3. Rural/Urban and social group-wise Composition of Workers in IT industrial Categories (%).

Variable	1999-2000			2004-05		
	Male	Female	Total	Male	Female	Total
Rural	7.9	0.2	6.8	8.1	3.4	7.3
Urban	92.1	99.8	93.2	91.9	96.6	92.7
ST	0.7	0.6	0.7	0.2	0.1	0.2
SC	2.1	13.0	3.6	3.3	1.8	3.0
OBC	16.6	5.4	14.9	24.9	40.3	27.6
Others	80.7	81.1	80.8	71.7	57.8	69.2

Source: NSSO 51st and 61st rounds (Figures are male – female share to total).

India lives below poverty. They are not represented in the IT workforce.

Employment status of women

There is a wide gap between computer education and absorption in the labour market. India has the largest number of computer educated, but unemployed women in the world. A NASSCOM-Mckinsey report states that there is a huge gap between number of women trained in IT and actual no. of women entering the labour market (1999). As per NASSCOM-Mckinsey Survey (1999), there were 50,000 women trained in IT in India. However, the number of women actually employed in IT was only 5000.

Study by Parikh and Sukhatme (2004) reports that the number of women engineers has increased rapidly. However, unemployment rates are also very high among women engineers, 20% in 1990 which increased to 35% in 1998. The figure was as high as 50% in Andhra Pradesh. Women were forced to take jobs as teachers or work in small scale industries and 50% of employed women were either underpaid or unemployed. Both social and economic reasons were stated for higher unemployment rates among women (WISE, 2010). Family background, personal commitments and priority to family were some reasons for not getting a job. Some were unwilling to relocate or travel. In some cases employers were reluctant to give jobs, and sometimes women were getting lesser salary as compared to men. Women also stated that they were getting lesser promotions as compared to men (WISE, 2010).

Women have restricted employment opportunity

Lack of mobility is cited as one of the major constraints to participate in IT workforce in India. Currently, there are very few IT job opportunities in many of the northern states, especially outside New Delhi. The IT companies are in select locations. Relocation from families is not the

norm for young women. Due to cultural traditions, women with sufficient IT education are not able to participate in the labour force. As mentioned earlier, a substantial portion of potential workers belong to Tier 2 and Tier 3 cities and rest of India.

In higher strata of society, women's participation in employment is increasing and they have more of locational mobility. Increasing economic pressure on urban middle class families and a gradual ideological change in social values increased the tendency among urban educated women to take up paid employment. However, studies show that women's careers are determined more by familial and domestic factors rather than choices available to them. 45% women are not clear about career goals as compared to 25% men. 24% women stated that they changed jobs for personal choices as compared to 5% men (Rothboeck, 2001).

Place of women in IT

The position of women is uneven in the IT sector, there is concentration of women at lower levels of jobs. Even among women who are employed, it is seen that more women are working in particular category of occupations. It is seen that more women are working in the IT enabled services sector. Unni (2008) highlights issues of gendering of ICT labour market. A Strong gender bias exists with respect to access to different jobs. 40% of men are in high end jobs while 7.3% are in IT enabled services as compared to 21% of women in high-end jobs and 21% in IT enabled services (Rothboeck, 2001).

The same results are illustrated when analyzed on a macro scale as shown in Table 4. The data shows that women are concentrated in certain occupations. A large chunk of women are employed as software professionals. Almost 20% of women are in database activities, while a negligible portion are employed in hardware.

Not only are women concentrated in particular level of occupations, they are located at lower levels of organizations. There is a glass ceiling where few women are able to reach the top only (Rothboeck, 2001). Results

Table 4. Share of workers across IT industrial categories (%).

Occupational category	1999-2000			2004-05		
	Male	Female	Total	Male	Female	Total
Hardware consultancy	5.1 (70.6)	12.7 (29.4)	6.2 (100)	2.3 (81.4)	0.7 (18.6)	2.0 (100)
Software consultancy	43.6 (88.3)	34.2 (11.7)	42.2 (100)	45.9 (81.8)	47.4 (18.2)	46.2 (100)
Data processing	19.2 (82.8)	23.6 (17.2)	19.8 (100)	5.6 (79.0)	6.9 (21.0)	5.8 (100)
Data base activities	10.8 (92.6)	5.1 (7.4)	10.0 (100)	7.5 (86.7)	20.3 (23.3)	9.8 (100)
Maintenance and repair of computers and computer based systems	6.3 (88.2)	5.0 (11.8)	6.1 (100)	4.6 (100)	0 (0)	3.8 (100)
Other computer related activities	4.5 (68.7)	9.7 (31.3)	5.3 (100)	12.6 (86.4)	9.2 (13.6)	12.0 (100)
Provision of value-added telecom services: paging, email, etc.	5.3 (86.5)	4.8 (13.5)	5.2 (100)	11.3 (87.2)	7.7 (12.8)	10.7 (100)
Total	100.0 (85.5)	100.0 (14.5)	100.0 (100)	100.0 (82.3)	100.0 (17.7)	100.0 (100)

Source: NSSO 51st and 61st rounds (Figures are male – female share to total).

of Dataquest-Jobs Ahead (2003) study conducted among 1.5 lakh Indian IT professionals found that women

constitute over 19% of the total workforce at lower levels, up to three years of experience. The number dropped to 6% at senior levels of workforce with more than 10 years of experience. NASSCOM reported that although 25% of IT workforces are women, only 3% are in senior management positions (NASSCOM, 2008). Study by NASSCOM–IIMA (2008), Agarwal (2003) and Bhattacharyya and Ghosh (2012) highlight prevalence of glass ceiling.

Work structure of IT and women

Majority of women are affected by lifecycle factors as marriage, childbirth and gender division of labour within the household. In the IT industry, career development takes place through hard work, training, application and continuity in learning. There is an aspect of learning which involves doing rather than using (Rosenberg 1993). Career development in IT takes place at a young age. IT careers are fast track careers. The

work structure in IT requires long hours and is extremely demanding and stressful. Daily work hours range from 14 to 16 h in low and medium end firms doing short duration export projects (Rothboeck, 2001).

Women's careers are affected by affected by social, gender and lifecycle factors. Family factors as marriage and children significantly affect careers of women (Johnson and Stafford, 1974; Long et al., 1993; Jones and Makepeace, 1996). Their mobility options are restricted by their husband's career location (Bielby and Bielby, 1992). Thus, married women are much less likely than married men to change jobs for improved job opportunities (Felmlee, 1982). As the family structure is virilocal (residence determined by males), there is greater pressure on the wife to follow her husband rather than vice versa (Fox and Biber, 1984). Men change jobs for better career prospects while it is not so for women.

Women's allocation of time is also different when compared to men. Married women's time is distributed between market work, nonmarket work and leisure. For men, time is divided between market work and leisure. The division of labour within the household is based on the premise of

comparative advantage in household production (Becker, 1981). Due to gender division of labour within the household, women have primary responsibility of activities as child-care and other household responsibilities (Becker, 1985). Women are similar to men regarding careers in terms of achievement and earnings. However women in general are have comparative advantage in household production (Becker, 1981). This leads to double responsibility for women.

Childbirth may lead to temporary withdrawal from the labour force for women. Children are considered as time intensive commodities especially when they are small (Becker, 1965). There is a lowering of work activity during the years of childbirth and childrearing. However for men, children were not connected with restrictions on professional activity (Elgqvist-Saltzman, 1992). The prevalence of double effort intensive responsibilities as child-care and household work may lead to married women spending less effort than married men on each hour of work on the job (Becker, 1985). This may have a direct bearing on women's performance in the workplace.

Women's productivity at work is considerably influenced by the prevalence of suitable

support system at home and division of labour between members of the family (Fogarty et al., 1972). In less developed countries, cheap surrogate care and household help provide suitable support systems which enable women to work efficiently outside home. There is an assumption that IT workers have no family and are working 24 x 7 on the job (Uma Devi, 2000). A study by COD (2004) reported that 'sixty hours a week is common. Dedicated young programmers do not hesitate at the idea of working until 2 am in the morning, surviving on sandwiches and pizza and sleeping on the floors of their offices'. It is taken for granted that employees will stay in the office at least till 7 or 8 in the evening although often they come in only at 9.30 or 10 am (Upadhyay, 2006).

However, the nature of work in IT clashes with women's lifecycle factors and household responsibilities. The discrimination lies in the male biased structure of the workplace (Agarwal, 2000). Women tend to work less longer hours as compared to men (Rothboeck, 2001; Agarwal, 2000).

A study was conducted by NASSCOM-IIMA (2008) in 85 companies to provide recommendations to organizations and women. It was found that majority of organizations had no formal mechanism to collect the views of women while framing any policy or retaining women. There was low availability of "support" policies related to part time work, work from home post maternity, and paternity, sabbatical across all levels; worse for junior level. Men find it easier to progress due to informal networks

Many companies have taken steps to promote women which affect their work participation rates. IBM India Pvt. Ltd. sends recruitment teams to suburban residential complexes for a woman-only hiring programme that seeks to bring experienced women back into the workforce. Services firm Infosys Technologies Ltd, which set up a Women's Inclusivity Network in 2003, offers connectivity at home and part-time working options to retain women at work. Vaahini, a networking forum at Accenture India Pvt. Ltd, offers mentoring and counselling options for women employees across all levels of the company. Creche for children is a facility offered by many firms. Companies as TCS, Wipro and Infosys have more than 25% women employees.

Skill upgrading

In the IT industry, Career development takes place through hard work, training, application and continuity in learning. It may also require a visit to the client side. In software engineering, there is a related aspect of learning that involves doing rather than using (Rosenberg, 1993). IT is an industry which thrives on newer and innovative ideas. This industry equates one year of progress equal to that of seven normal years, which means the last three years have actually seen changes that may have been ordinarily witnessed in 21 years. The negative side of this

is the high rate of obsolescence of skills. A break in service may cause discontinuity in learning experience (Khadria, 1984). In the software industry, output or productivity on the job is measured in terms of software development. The success of software effort depends upon the ability to meet the time schedules. Other crucial aspects are working within budgeted costs, user friendliness, flexibility of operations, quantity maintainability and efficiency of operations (Benjwal, 1998).

Women who have been out of the labour force for some time find their skills obsolete. Employees are required to constantly reconstitute their skills to keep themselves employable to be successful in IT industry, one has to be update on technology (NASSCOM, 2015). Most people update their skills through informal networks. It was seen that in Information Technology enabled Services (ITES) sector, women have less exposure to new technology (Ramesh, 2008). It was seen that less women have had training in latest technology (Shanker, 2008). In some cases, women stated that their training opportunities were not provided to them (COD, 2004). Women may have less of informal networks which may lead them to lag behind men.

SWOT analysis of women's access to ICT employment

Strength: Comfortable environment for women, large number of urban women employed, women have requisite skill sets to enter this sector,

Weakness: Occupational segregation - women employed more in ITES (low levels of skills), elitist in nature – only urban oriented, gender digital divide, women employment affected by social and cultural factors

Opportunity: Shortage of skilled labour so all groups of labor employed, Women employed in ITES sector in large nos, high growth of ITES sector so potential for women, spread to 43 tier 2 and tier 3 cities, Nasscom predicts that 40% of employment will be in these cities in 2018.

Threat: Marginalisation of women in less skilled jobs, low education levels of women.

CONCLUSION AND RECOMMENDATIONS

This paper has provided a holistic view of factors which affected participation of women in ICT employment through secondary data and a comprehensive review of literature available on women and ICT.

It is seen that women constitute a sizeable no. of workforce in IT. However, they are not representative of all women in the society. Access to ICT is restricted to a select group of women. They are a select group of women who belong to urban background with high socioeconomic status. Access to ICT employment is restricted to certain class of women as education is

restricted to only a small group of women.

Even among women who are employed in ICT jobs, women are located in specific occupations. Access to ICT employment is restricted to less skilled jobs. It is also seen that proportion of women declines as one goes up the career ladder. Women have less access to top jobs in IT sector.

It is seen that women's employment are affected by factors which are gender specific. Women have prime responsibilities of household work and childcare. They are affected by patriarchic norms prevailing in society. Job choices are affected by personal factors. Social and cultural norms limit mobility of women. The localized location of IT companies also affects women's mobility. The issues which affect access to IT employment need to be addressed to tap the existing pool of workers.

POLICY RECOMMENDATIONS

India is the second fastest growing economy in the world. It faces a shortage of manpower in IT. Women constitute a sizeable number of potential workers. Their potential can be tapped. A study by Global McKinsey stated that India could increase its GDP by 16 to 60% simply by enabling women to participate in the economy as the same footing as men (Hindustan Times, 2015). The introduction of policies as digital India campaign post 2014 has increased the demand for IT professionals.

Policies need to be taken at different levels of stakeholders. Policies needed to be framed from the viewpoint of (a) individuals (women employees), (b) organizations, (c) governments (enforcement agencies), (d) society (remedial actions).

The collaborative effort of all stakeholders can solve the problems faced by women in IT. No group can singlehandedly solve the problem. The government can make policies conducive to women and ensure implementation. Companies should gender friendly policies so as to get the best out of their workforce.

On a macro level, efforts should be made to spread education. The process should start from primary education. There should be more schemes and incentives for promoting higher education among women also. Education skillsets among women should be developed. Companies should stress on hiring from rural areas. Adequate training may be given to new recruits in terms of English speaking skills. All companies employing women should provide facilities as transport, canteens and crèches for working mothers. They should have separate mentoring teams.

Policies should be framed to make it mandatory that women constitute one third of resources in all companies, large or small. More hostels should be constructed for working women in Tier 2 and Tier 3 cities by the government. Non-governmental agencies can also be instrumental in these activities. Creating awareness about women's safety and their rights can also be done on by

societal groups. Implementation of gender inclusivity policies will go a long way in tapping more women workers and reduce attrition rates.

Conflict of interests

The author have not declared any conflict of interests.

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