

## Trends in women employment in India during census 1981 to 2011

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### ABSTRACT

This paper analyses the trends and pattern of women's employment in India using secondary data for the time period from Census 1981 to Census 2011. The study considers all states and union territories of India as population and seven states from high per capita income states and seven states from low per capita income states are selected as sample states for the study. Female work participation rate considering as proxy for women employment; growth rates, F-test and t-test are employed for data analysis. Our results show that percentage of female workers to total worker ratio has varied considerably across the states. Andhra Pradesh having better women employment situation among the high per capita income states, contradictory Delhi have worst situation about women employment. In low per capita income states, Nagaland having better women employment situation whereas Uttar Pradesh have poorest situation. There is significant increase in women work participation rate over a period of time in rural and urban segments of India. The growth of women work participation rate in rural higher than the urban segment and rural is confined to primary sectors while in urban is confined to service sectors in the sample states.

**Keywords:** Women, employment, trend, pattern, work participation rate

Work participation is an important indicator of growth and development. It shows the proportion of working population to the total population in an economy. The

working population considered as labour available to the society for use in the process of production. The size of labour force in a country is determined by the number of people in the age group of 15-59 years. A large proportion of female workers is directly engaged in economic activity plays a very significant role in development (Goswami & Kumar, 2013). A country's economic development crucially depends upon the participation rates of its women as they constitute around 50 percent of its labour force (NIPCCD, 2010). Not only that, women's participation in the workforce

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as compared to men is also an important determinant of their social status (Mammen & Paxson, 2000). Women's employment is crucial for raising their living standards and well-being. Economic well-being and welfare of women may not improve if they are engaged in low-paying distress-driven work (Srivastava & Srivastava, 2009). Women's participation in the workforce assumes more importance in the case of developing countries, because of its positive effects on the level of output and negative effects on population growth (Collver & Langlois, 1962). Increasing rates of women's participation have enabled developed countries to sustainance on a path of higher growth (The Economist, 2006).

### ***Women Employment Scenario of India***

As per census, India's total population was 1027,015,247 comprising 531,277,078 males and 495,738,169 females. Of them 72.2 percent reside in rural areas and 27.78 percent in the urban areas in 2001 and India's total population was 1,21,05,69,573 comprising 62,31, 21,843 males and 58,74,47,730 females. Of them 72.2 percent reside in rural areas and 27.78 percent in the urban areas in 2011 (Census Report, 2001 & 2011). Based on Labour Bureau (2013), in rural India the WPR is 71.77 per cent comprising 53.00 per cent male and 30.00 per cent female. Whereas in urban India, the work participation rate is 43.63 per cent comprising of 53.8 per cent male and 15.4 per cent female work participation rate. The temporal trend of total workers of India explains that the work participation rate has registered continuous increase in the last four decades. The total and rural work participation rate in India, only 36.8 percent of total population was economically active in 1981 which has increased to 39.8 percent in 2011. The female work participation rate is very low in comparison to male counterpart for total, rural and urban population in India. For the rural 53.8 per cent in 1981 has declined to 53.3 per cent in 2011, in urban 49.1 per cent in 1981 has increased to 53.8 per cent in 2011 and together rural and urban 52.7 per cent in 1981 has increased to 53.3 per cent in 2011 (Census 2011). It has been found that in developing countries like India, women's participation in the workforce has been remarkably low as compared

to men. However, the role of women in economic activity has been increasing in recent years. Therefore, it is important to examine magnitude and nature of work taken up by women in India.

Economic development is positively associated with female labour force participation through change in the country's occupational structure and increased educational opportunities, often accompanied by reduced fertility rates and household responsibilities. The modernization process is associated with increased demand for labour, a general social acceptance of women's education and employment, as well as lower fertility (Heckman, 1980; Standing, 1983; Bauer *et al.*, 1987). Economic policies of liberalization assume that labour is freely mobile so that resources can be shifted from one sector to another and affecting both men and women different. It is often argued that increased global competition consequent on economic restructuring will lead to feminization of workforce. But feminization takes place mostly in the informal sector through home working via worsening income distribution and increased openness (Cagatay & Ozler, 1995).

### ***Measures of women employment***

**Female Work:** Female work is defined as female participation in any economically productive activity with or without compensation, wages or profit. Such participation may be physical and/or mental in nature. Work involves not only actual work but also includes effective supervision and direction of work. It even includes part time help or unpaid work on farm, family enterprise or in any other economic activity (Census 2001).

**Female Workers or Employees:** Persons who are engaged in any economic activity or who despite their attachment to economic activity have abstained for reason of illness, injury or other physical disability, bad weather, festivals, social or religious functions or other contingencies necessitating temporary absence from work constitute workers. Unpaid helpers who assist in the operation of an economic activity in the household farm or non-farm activities are also considered as workers (NSSO, 2007).

**Female Labour Force:** Female labour force of a country consists of all those in its female working age population, who are employed or seeking employment.

**Female Work Force:** Female work force consists of all female persons who are actually working, whether in the formal or in the informal sector, i.e. labour force less unemployed.

**Female Work Participation Rate:** Female Work Participation Rate is defined as the percentage of total female workers to total female population.

### *Need for the Study*

Women constitute one half of the population but its share in labour force is only one fourth of total labour force. With the passage of time, the share of females in work participation has increased but up to what extent and in which direction this increase is still not clear. The twentieth century has witnessed rapid transformations in labour market structures in both the developed and developing countries with globalization. With effect of liberalization and globalization, the Indian economy removed physical and financial controls and it brought changes in work participation. Much of these changes are believed to have profound implications for the levels and nature of employment or participation in economic activities, particularly for the women. In this context, there is need to focus on gender bias and different dimensions of labour force. The proposed research study examines the women employment scenario with women participation rate in India as proxy for women employment considering different dimensions.

### *Objectives of the Study*

The overall objective of this paper is to analyze the women employment scenario in India the specific objective of the study are:

1. To analyze the level and nature of female labour force during the study period;
2. To measure the extent of female work participation upturn during the study period and

3. To examine the differences regarding female work participation between the high developed and less developed states.

### *Hypothesis*

1. The women work participation rate does not differ significantly between the high developed and less developed states.
2. The women work participation rate does not differ significantly between rural and urban areas.

### *Methodology*

The study is mainly based on secondary data obtained from the Government of India reports. The main sources of the data are

Statistical Profile on Women Labour, Labour Bureau, Government of India and

Selected socio – economic statistics, India, Ministry of Statistics and Programme Implementation, Government of India.

The time period we consider for our study is from 1971 census to 2011 census. The study covered 5 census rounds on women statistics from 1971 to 2011. Statistical Profile on Women Labour covered 2001-2011 years of selected sample states. The study considers all states and union territories of India as population and seven states from high per capita income states and seven states from low per capita income states are selected as sample states for the study. Sample states are selected based on gross state domestic product of the financial year 2014-15 (GOI, 2015). The details of sample states presented in below table.

Sl. No	High Per Capita Income States	Sl. No	Low Per Capita Income States
1	Andhra Pradesh	1	Bihar
2	Delhi	2	Orissa
3	Gujarat	3	Uttar Pradesh
4	Karnataka	4	Nagaland
5	Kerala	5	Tripura
6	Maharashtra	6	Manipur
7	Tamil Nadu	7	Madhya Pradesh

For assessing Women employment of sample states Growth rates, F-test and t-test are employed along with descriptive statistics for data analysis.

## RESULTS AND DISCUSSION

Women employment is an important indicator of development showing the proportion of the working population in an economy. Despite two decades of high economic growth and considerable progress towards gender equality there is gender gap in economic participation. The participation of women in labour force in developing nations has declined and the gender gap in labour participation rates is also large in India. This research article presents an overview of women's labor force participation in India considering three different dimensions: time, rural versus urban and high versus low per capita income states.

### *Women Employment in India*

The information regarding total working population in India (census 2011) presented in (Table 1). The total working population was 39.79 per cent in total population, with in total workers 53.26 per cent was male workers and 25.51 per cent was female workers. The percentage male working population was high when compared with female working population and male working population was doubled to female working population in 2011.

In the case rural India, working population was 41.83 per cent in the total population, with in total workers 53.03 per cent was male workers and 25.51 per cent was female workers in rural areas. Coming to urban India, working population was 35.31 per cent in total population, with in total workers 53.76 per cent was male workers and 15.44 per cent was female workers in urban area. Male working population was high when compared to female works in rural and urban area. As in most other parts of the world, fewer women participate in employment in India compared to men. More women are employed proportionately in the rural than urban, 30.02 per cent was relatively high in rural area than urban area was 15.44.

Information relating to Distribution of Female Workers of High Per capita Income States according to census 2010 presented in (Table 2). The percentage of female workers to total worker has varied considerably across the states. Among the seven states, Andhra Pradesh got first position with 38.6 per cent of women workers followed by Tamil Nadu with 34.82 per cent while Delhi was at the last most position with per cent of 14.77 followed by Kerala having 27.26 per cent. From the above Table it can be observed Andhra Pradesh having better women employment situation among the seven states, contradictory Delhi have worst situation regarding women employment.

**Table 1:** Total Workers in India - 2011 Census

	Population/ Workers	Persons	Male	Female
Total	Population	1,21,05,69,573	62,31,21,843	58,74,47,730
	Workers	48,17,43,311	33,18,65,930	14,98,77,381
	Percentage of Workers	39.79	<b>53.26</b>	<b>25.51</b>
Rural	Population	83,34,63,448	42,76,32,643	40,58,30,805
	Workers	34,85,97,535	22,67,63,068	12,18,34,467
	<b>Percentage of Workers</b>	<b>41.83</b>	<b>53.03</b>	<b>30.02</b>
Urban	Population	37,71,06,125	19,54,89,200	18,16,16,925
	Workers	13,31,45,776	10,51,02,862	2,80,42,914
	Percentage of Workers	35.31	53.76	15.44

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India.

**Table 2:** Distribution of female workers of high per capita income states (Census 2011)

Sl. No.	State/Union Territory	Female workers	Total workers	%
1	Andhra Pradesh	15237311	39422906	38.65
2	Delhi	825023	5587049	14.77
3	Gujarat	6766833	24767747	27.32
4	Karnataka	9602481	27872597	34.45
5	Kerala	3167494	11619063	27.26
6	Maharashtra	16811003	49427878	34.01
7	Tamil Nadu	11449703	32884681	34.82

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India.

The percentage of women workers to total workers of Low Per Capita Income States according census 2011 presented in (Table 2). The percentage of female workers to total worker ratio has varied slightly across the states. Among the seven states, Nagaland got first position with 43.81 per cent of women workers followed by Manipur with 42.59 per cent while Uttar Pradesh was at the last most position with per cent of 24.26 followed by Bihar having 27.37 per cent. It can be observed from the above Table Nagaland having better women employment situation among Low Per Capita Income States, whereas Uttar Pradesh have worst situation regarding women employment.

**Table 3:** Distribution of female workers of low per capita income states (Census 2011)

Sl. No.	State/Union Territory	Female workers	Total workers	%
1	Bihar	9502798	34724987	<b>27.37</b>
2	Orissa	5638934	17541589	<b>32.15</b>
3	Uttar Pradesh	15967953	65814715	<b>24.26</b>
4	Nagaland	426765	974122	<b>43.81</b>
5	Tripura	424195	1469521	<b>28.87</b>
6	Manipur	493590	1159053	<b>42.59</b>
7	Madhya Pradesh	11427163	31574133	<b>36.19</b>

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India.

To test the statistical significance of differences of women employment between high per capita income states and low per capita income states, we applied F-test and t-test with response variables as Female workers, Total workers and Female workers to total workers ratio and (Table 4) provides the results pertaining to these tests.

Panel-A of above Table presents the results of t-test with the null hypothesis that the estimated mean for high per capita income states and low per capita income states is not different. The null hypothesis of no difference in women employment and its distinct parameters are accepted in all the instances as calculated F-statistics are statistically not significant. Thus it shows that there were no significant mean differences between high per capita income states and low per capita income states regarding women employment. Panel-B of Table presents the results of t-test with the null hypothesis that the estimated mean of women employment between high per capita income states and low per capita income states is not different. The null hypothesis of no difference in mean of women employment and its distinct parameters are accepted in all the instances as calculated t-statistics are statistically not significant. Thus it can be conclude that there was no significant mean difference between high per capita income states and low per capita income states regarding women employment.

**Table 4:** Hypothesis testing differences in distribution of women workers between high per capita income states and low per capita income states

Parameter	Female workers	Total workers	Female workers to Total workers ratio
<b>Panel A: ANOVA Test</b>			
$H_0$ : the mean between workers High per capita income and Low per capita income in states is not different			
F-statistics	0.768	0.258	0.681
p-value	0.398	0.621	0.425
Inference	Accepted $H_0$	Accepted $H_0$	Accepted $H_0$
<b>Panel B: t-Test</b>			
$H_0$ : there is no mean difference of workers between High per capita income and Low per capita income states			
t-statistics	0.877	0.508	0.825
p-value	0.398	0.622	0.425
Inference	Accepted $H_0$	Accepted $H_0$	Accepted $H_0$

**Table 5:** Growth of female worker population by occupation during 1981 to 2011

Census Year	Percentage Female worker to Total Female Population				
	Female Main Workers	Cultivators	Agricultural Labourers	Household Industry	Other Workers
1981	13.99	4.65	6.46	0.64	2.24
1991	15.93	5.51	7.05	0.55	2.82
2001	14.68	5.11	4.51	0.95	4.11
2011	25.5	24.0	41.1	5.7	29.2
<b>CAGR</b>	<b>16.19</b>	<b>50.73</b>	<b>58.82</b>	<b>72.75</b>	<b>90.01</b>

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India. CAGR= Compound Annual Growth rate.

Percentage of female main workers to total female population under broad categories during 1981 to 2011 is presented in (Table 5). To analyze growth of women employment during 1981 to 2011 for the given categories compound Growth rate is taken for consideration. The maximum growth was witnessed by other workers i.e., 90.01 per cent followed by household industry having 72.75 per cent. There was no considerable growth in female main workers. Under the cultivators and agricultural labourers category more than 50 per cent

growth was observed and this is low when compared to Household Industry.

### ***Female Work Participation Rate***

Labour force of a country consists of all those in its working age population, who are employed or seeking employment, in this working age population the percentage of total female workers to total percentage of total female workers to total female population is female

work participation rate. Work Participation Rate (WPR) by Sex in India during 1971 to 2011 is presented in (Table 6). Over a forty years span (1971 to 2011), the workforce participation rate (WPR) of males and females shows no systematic variation. The female work participation rate for rural area was increased from 13.42 per cent in 1971 to 30 per cent in 2011 with compound annual growth of 17.46 per cent. For the urban area, female work participation rate was increased from 6.68 per cent in 1971 to 15.40 per cent in 2011 with the compound annual growth rate of 18.18 per cent per year. Together rural and urban areas were observed that the increasing trend in women work participation rate and it was increased from 12.11 per cent in 1971 to 25.50 per cent in 2011 with the compound annual growth of 16.06 per cent per year. From the above results, it can be conclude that there is significant increase in women work participation rate

over a period of time in rural and urban segments of India.

### *Women Employment in Rural and Urban Areas*

Woman's participation in work is many and diverse and includes demographic, reproductive, social, religious and cultural factors. Within demographic factors rural and urban classification have more impotent because This also shows that the fruits of years of planning development appears to have enlarged work opportunities for women in urban areas, but has had no impact in rural areas. Large variations in women's participation in work across the rural and urban areas with regard to broad categories like Cultivators, Agricultural Labourers, Household Industry and other Workers. With this background the study plans to analyze women work participation in rural and urban areas.

**Table 6:** Work participation rate (wpr) by sex in India during 1971-2011

Year	All	Males	Females	% Females WPR to All WPR	CAGR of Females WPR
Rural					
1971	34.03	53.62	13.42	39.44	17.46
1981	38.79	53.77	23.06	59.45	
1991	40.09	52.58	26.79	66.82	
2001	41.75	52.11	30.79	73.75	
2011	41.8	53.00	30.00	71.77	
Urban					
1971	29.34	48.82	6.68	22.77	18.18
1981	29.99	49.06	8.31	27.71	
1991	30.16	48.92	9.19	30.47	
2001	32.25	50.6	11.88	36.84	
2011	35.3	53.8	15.4	43.63	
All (rural + urban)					
1971	33.08	52.61	12.11	36.61	16.06
1981	36.7	52.62	19.67	53.60	
1991	37.5	51.61	22.27	59.39	
2001	39.1	51.68	25.63	65.55	
2011	39.8	53.30	25.50	64.07	

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India

CAGR= Compound Annual Growth rate

### **Women Employment in High Per Capita Income States**

The distribution of female workers in rural area of high per capita income states is presented in the (Table 7). Among the seven states, Gujarat, Maharashtra and Karnataka were having more than 70 per cent of female employment in rural areas. According to census – 2011, more than 90 per cent female cultivators were in rural area. In Gujarat highest per cent of rural women employment was observed whereas lowest per cent of rural women employment in Delhi. More than 90 per cent of women workers were cultivators and agriculture labourers in rural area of seven states against to household industry and other workers in urban areas. Women employment in Rural was confined to primary sectors in high per capita income states.

The distribution of female workers in urban area of high per capita income states is presented in the (Table 8). Among the seven states, Delhi and Andhra Pradesh were having more than 60 per cent of female employment in urban areas. According to census – 2011 more than 50 per cent female were other workers in urban area. In Delhi highest per cent of urban women employment was observed whereas lowest per cent of urban women employment in Maharashtra. More than 40 per cent of women workers were engaged household industry and other sectors in urban area of seven states against to cultivators and agriculture labour. Women employment in urban was confined to service sectors in high per capita income states.

**Table 7:** Distribution of female workers in rural areas of high per capita income states (Census 2011)

Sl. No.	State/Union Territory	Total Workers	Rural Workers to Total Workers Percentage			
			Cultivators	Agricultural Labourers	Household Industry	Other Workers
1	Andhra Pradesh	31.87	97.23	95.56	68.73	42.84
2	Delhi	2.27	39.29	25.30	3.18	1.72
3	Gujarat	79.78	97.41	96.23	47.20	48.82
4	Karnataka	74.88	97.17	95.29	61.60	41.81
5	Kerala	57.92	87.68	84.48	41.46	51.48
6	Maharashtra	75.93	98.28	95.56	50.09	25.95
7	Tamil Nadu	66.79	92.97	89.13	53.31	35.92

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India

**Table 8:** Distribution of female workers in urban areas of high per capita income states (Census 2011)

Sl. No.	State/Union Territory	Total Workers	Urban Workers to Total Workers Percentage			
			Cultivators	Agricultural Labourers	Household Industry	Other Workers
1	Andhra Pradesh	68.13	2.77	4.44	31.27	57.16
2	Delhi	97.73	60.71	74.70	96.82	98.28
3	Gujarat	20.22	2.59	3.77	52.80	51.18
4	Karnataka	25.12	2.83	4.71	38.40	58.19
5	Kerala	42.08	12.32	15.52	58.54	48.52
6	Maharashtra	24.07	1.72	4.44	49.91	74.05
7	Tamil Nadu	33.21	7.03	10.87	46.69	64.08

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India

**Table 9:** Hypothesis testing- differences in distribution of women workers between rural and urban areas in high per capita income states

Parameter	Total Workers	Cultivators	Agricultural Labourers	Household Industry	Other Workers
<b>Panel A: ANOVA Test</b>					
<i>H<sub>0</sub>: the mean of female employment between rural and urban areas of high per capita income states is same</i>					
F-statistics	0.543	42.060*	22.917*	0.381	10.033*
p-value	0.475	0.000	0.000	0.548	0.008
Inference	Accepted H <sub>0</sub>	Rejected H <sub>0</sub>	Rejected H <sub>0</sub>	Accepted H <sub>0</sub>	Rejected H <sub>0</sub>
<b>Panel B: t-Test</b>					
<i>H<sub>0</sub>: there is no mean difference of women employment between rural and urban area of high per capita income states</i>					
t-statistics	0.737	6.485*	4.787*	0.617	3.167*
p-value	0.475	0.000	0.000	0.548	0.008
Inference	Accepted H <sub>0</sub>	Rejected H <sub>0</sub>	Rejected H <sub>0</sub>	Accepted H <sub>0</sub>	Rejected H <sub>0</sub>

Note: \* Significant at 1% level.

To test the statistical significance of differences between rural and urban areas of high per capita income states, we applied F- test and t-test with response variables as total female workers, cultivators, agricultural labourers, workers in household industry and other workers. The results pertaining to these tests presented in (Table 9).

Panel-A of Table presents the results of F-test with the null hypothesis that the estimated mean between rural and urban areas of high per capita income states is not different. The null hypothesis of no difference in women employment and its distinct parameters are rejected in case of cultivators, agricultural labourers, and other workers as calculated F-statistics are significant statistically at 1% and 10% levels and accepted in the case of total female workers and workers in house hold industry as calculated f-statistics not significant. Thus it shows that there were significant mean differences between rural and urban areas of high per capita income regarding cultivators, agricultural labourers, and other workers. Panel-B of Table presents the results of t-test with the null hypothesis that the there is no mean difference of women works between rural and urban areas of high per capita income state. The null hypothesis of no difference in mean women employment and its distinct parameters are rejected in all the instances excluding female workers and workers in house hold industry as calculated t-statistics are significant statistically

with p-value are <0.01. Thus it shows that there were significant mean differences between rural and urban areas of high per capita income states regarding women employment.

#### Women Employment in Low Per Capita Income Sates

The distribution of female workers in rural area of low per capita income states is presented in the (Table 10). Among the seven states, Bihar, Orissa and Madhya Pradesh were having more than 80 per cent of rural female employment. According to census – 2011 more than 90 per cent rural women workers were cultivators and agricultural labourers. In Bihar highest per cent of rural women employment was observed whereas lowest per cent of rural women employment in Tripura. More than 90 per cent of women workers in rural area were cultivators and agriculture labourers of seven states against to other workers in urban areas. Women employment in rural was confined to primary sectors in low per capita income states.

The distribution of female workers in urban area of low per capita income states is presented in the (Table 11). Among the seven states, Manipur and 17.89 were having highest female employment in urban areas. According to census – 2011 more than 25 per cent female were engaged in household industry and other sectors of urban area. In Manipur highest per cent of urban

women employment was observed whereas lowest per cent of urban women employment in Bihar. More than 20 per cent of women workers were engaged household industry and other sectors in urban area of seven states against to cultivators and agriculture labour. Women employment in urban was confined to service sectors in low per capita income states.

To test the statistical significance of differences between rural and urban areas of low per capita income states, we applied F-test and t-test with response variables as total female workers, cultivators, agricultural labourers, workers in household industry and other workers. Table 12 provides the results pertaining to these tests.

Panel-A of Table presents the results of t-test with the null hypothesis that mean of female employment between rural and urban areas of Low per capita

income states is not different. The null hypothesis of no difference in women employment and its distinct parameters are rejected in all the instances as calculated F-statistics are significant statistically at p-value < 0.05. Thus it shows that there were significant mean differences between rural and urban areas of low per capita income states regarding female employment. Panel-B of Table presents the results of t-test with the null hypothesis that the estimated mean women employment between rural and urban area of low per capita income states is not different. The null hypothesis of no difference in mean women employment and its distinct parameters are rejected in all the instances as calculated t-statistics are significant statistically with p-value are <0.05. Thus it can be concluded that there were significant mean difference between rural and urban areas of low per capita income states regarding women employment.

**Table 10: Distribution of female workers in rural areas of low per capita income states (Census 2011)**

Sl. No.	State/Union Territory	Total Workers	Rural Workers to Total Workers Percentage			
			Cultivators	Agricultural Labourers	Household Industry	Other Workers
1	Bihar	93.90	98.16	97.98	89.82	77.26
2	Orissa	91.54	98.50	98.65	90.55	48.15
3	Uttar Pradesh	85.16	97.87	97.02	77.24	62.89
4	Nagaland	83.52	95.68	88.55	71.86	51.01
5	Tripura	82.11	98.06	97.17	83.95	65.50
6	Manipur	71.61	91.13	79.05	63.09	50.71
7	Madhya Pradesh	87.28	97.54	96.60	69.13	43.84

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India

**Table 11: Distribution of female workers in urban areas of low per capita income states (Census 2011)**

Sl. No.	State/Union Territory	Total Workers	Urban Workers to Total Workers Percentage			
			Cultivators	Agricultural Labourers	Household Industry	Other Workers
1	Bihar	6.10	1.84	2.02	10.18	22.74
2	Orissa	8.46	1.50	1.35	9.45	51.85
3	Uttar Pradesh	14.84	2.13	2.98	22.76	37.11
4	Nagaland	16.48	4.32	11.45	28.14	48.99
5	Tripura	17.89	1.94	2.83	16.05	34.50
6	Manipur	28.39	8.87	20.95	36.91	49.29
7	Madhya Pradesh	12.72	2.46	3.40	30.87	56.16

Source: Statistical Profile on Women Labour, 2012-2013, Labour Bureau, Government of India

**Table 12:** Hypothesis testing- differences in distribution of women workers between rural and urban areas in low per capita income states

Parameter	Total Workers	Cultivators	Agricultural Labourers	Household Industry	Other Workers
<b>Panel A: ANOVA Test</b>					
$H_0$ : the mean of female employment between rural and urban areas of Low per capita income states is not different					
F-statistics	324.885*	4430.275*	505.797*	97.661*	4.947**
p-value	0.000	0.0000	0.000	0.000	0.046
Inference	Rejected $H_0$	Rejected $H_0$	Rejected $H_0$	Rejected $H_0$	Rejected $H_0$
<b>Panel B: t-Test</b>					
$H_0$ : there is no mean difference of women employment between rural and urban area of low per capita income states					
t-statistics	18.025*	66.560*	22.490*	9.882*	2.224**
p-value	0.000	0.000	0.000	0.000	0.004
Inference	Rejected $H_0$	Rejected $H_0$	Rejected $H_0$	Rejected $H_0$	Rejected $H_0$

Note: \* Significant at 1% level & \*\* Significant at 5% level.

## Conclusion

The percentage male working population was high when compared with female working population and male working population was doubled to female working population. Percentage of female workers to total worker has varied considerably across the states. Andhra Pradesh having better women employment situation among the high per capita income states, contradictory Delhi have worst situation regarding women employment. In the case of low per capita income states, Nagaland having better women employment situation whereas Uttar Pradesh have poorest situation. There is significant increase in women work participation rate over a period of time in rural and urban segments of India. The growth of women work participation rate in rural higher than the urban segment. Women employment in rural is confined to primary sectors while in urban is confined to service sectors in the sample states.

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## Appendix

### Statistical Tools Description

(Kothari, 2004)

#### Percentage change:

It merely gives the percentage change over the previous year i.e.,

$$g = \left\{ \frac{k_t - k_{t-1}}{k_{t-1}} \right\} \times 100$$

Where

- g = Percentage change
- $k_t$  = value of k in the year 't'
- $k_{t-1}$  = value of k in the year 't-1'
- t = present year
- t-1 = base year

#### Compound Annual Growth Rate

It works out change for a given period on the basis of the base year to end year values i.e.,

$$g = \left[ \left\{ \frac{k_1}{k_0} \right\}^{1/t} - 1 \right] \times 100$$

Where

- g = compound growth rate
- $K_1$  = value of k in the end year
- $K_0$  = value of k in the base year
- t = Time Period+

(Gujarati, 2004)

#### Mean:

Arithmetic average is also called as mean. It is the most common type and widely used measure of central tendency or an average. Mean is defined as the quantity (figure) obtained by the number of observations. Formula of Mean:

$$\text{Mean}(\text{or } \bar{X}) = \frac{\sum X_i}{n} = \frac{X_1 + X_2 + \dots + X_n}{n}$$

Where,

- X = value of the variable
- n = total number of items

$\Sigma$  = sum of the observations of the variable

#### The F-Test or the Variance Ratio Test

The F-test is named in honor of the great statistician R.A. Fisher. The objective of the F- test is to find out whether the two independent estimates of population variance differ significantly, or whether the two samples may be regarded as drawn from the normal populations having the same variance. For carrying out the test of significance, the F test is calculated as follows:

$$F = \frac{S_1^2}{S_2^2} \text{ where } S_1^2 = \frac{\Sigma (X_1 - \bar{X}_1)^2}{n_1 - 1} \text{ And } S_2^2 = \frac{\Sigma (X_2 - \bar{X}_2)^2}{n_2 - 1}$$

It should be noted that  $S_1^2$  is always the larger estimate of variance, i.e.,  $S_1^2 > S_2^2$

$$F = \frac{\text{Larger estimate of variance}}{\text{Smaller estimate of variance}}$$

$$V_1 = n_1 - 1 \text{ and } V_2 = n_2 - 1$$

$V_1$  = Degrees of freedom for sample having larger variance.

$V_2$  = Degree of freedom for sample having smaller variance.

The calculated value of F is compared with the table value for degree of freedom of  $V_1$  and  $V_2$  at 5% or 1% level of significance. If the calculated value of F is greater than the table value, then the F ratio is considered significant and the null hypothesis is rejected. On the other hand, if the calculated value of F is less than the table value the null hypothesis is accepted and it is inferred that both the samples have come from the population having the same variance (Gupta, 2007).

#### The t-test

The t-test is applied to test the significance of various results obtained from the analysis of surveyed data in the following ways:

1. Testing difference between means of two independent samples

2. Testing difference between means of two dependent samples.

### ***Testing Difference between Means of Two Independent Samples***

The test is applied to measure the mean difference between the groups (Deepty, 2010). The null hypothesis ( $H_0$ ) is that both the samples come from the same normal population and there is no significant difference in their mean values. The alternate hypothesis ( $H_1$ ) is that there is significant difference in the mean incomes of two samples. To carry out the test, t-value is calculated as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S} \cdot \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

$$S = \sqrt{\frac{\Sigma(X_1 - \bar{X}_1)^2 + \Sigma(X_2 - \bar{X}_2)^2}{n_1 + n_2 - 2}}$$

Where:

$\bar{X}_1$  = Mean value of the first sample

$\bar{X}_2$  = Mean value of the second sample

$n_1$  = Size of first sample

$n_2$  = Size of second sample

S = Combined standard deviation of two samples

The degree of freedom is equal to  $n_1 + n_2 - 2$ .

**Results:** In order to test the set hypothesis, the calculated value of 't' is compared with the Table value for degree of freedom at certain level of significance.

If ' $t > t_{0.05 (0.01)}$ ' for  $n_1 + n_2 - 2$  then  $H_0$  is rejected and  $H_1$  accepted.

If ' $t < t_{0.05 (0.01)}$ ' for  $n_1 + n_2 - 2$  then  $H_0$  is accepted and  $H_1$  rejected.