"Social Justice and Empowerment of Rural Women in Asia: A Regional Development Perspective through ROI-Based Empirical Analysis"

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Abstract:

This paper is an investigation of the significance of Green Revolution on the farm men and women of Telangana Districts. It creates an agricultural variation and studies how this influences farm men and women's involvement in agriculture. The variations include Agricultural variation based on Gender, Agriculture Region wise variation and Operation wise variation in Agriculture which are supported by literature review and significantly influence agriculture. The purpose of the study is to cite the variations that exist among the farmers and determines their influence on agriculture. For example, it determines the percentage involvement of farm men and women in various agriculture operations, their responsibility as persons to save global warming and their socioeconomic factors. In addition, the study suggests an economic assessment regarding the procurement policy of the major food grains in agriculture. The collection of Primary Data for this study has been through the survey method from the arid areas of India. The findings suggest that Telangana arid zone regions of India possess challenging climatic and metrological conditions which influence agriculture activities in this region. The results suggest that Women play a critical role in Agriculture activities because they do not only participate in the necessary agricultural operations but also in other vital activities of the primary sector.

Despite their hard work, they receive substantially lower pay compared to men, reflecting gender-based disparities in remuneration.

The study underscores the need for addressing these disparities, enhancing women's socioeconomic empowerment, and recognizing their critical role in sustainable agriculture and environmental conservation. By analysing the agricultural variations in arid India, this research provides valuable insights into improving the socioeconomic conditions of farm men and women and fostering equitable development in rural agricultural systems.

Keywords: Social, Economics, Agriculture Rural Environment, Climate Change, Weather, Women agriculture in rural area

Introduction:

Agriculture economics is not the new generation concept in agriculture, but prevailing since late 19th century in the world, contributing towards the economic development of the world. The paper tends to highlight various groups of agriculture economics such as Agri marketing, agribusiness, and international development. The research has tried to build the humanitarian interest. In this paper we will be discussing a complete detail of the farmers, there role in developing agriculture, women empowerment, different variations existing in agriculture and the definition of climate change.

However, a more scientific definition might diverge from layman's terminology and comes from the United Nations Framework Convention on Climate Change (UNFCCC), stating that climate change means a change in the climate which is attributed directly or indirectly to human activity which alters the composition of the global atmosphere and which is in addition to the natural climate variability, which is observed during comparable time periods. Yet many scientists apply the definition somewhat broader than this to mean any change in the climate whether it is natural or human induced. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as a change in the state of the climate which can be attributed to changes in the mean and/or variability of its properties, that exists over extended periods of time, generally decades or longer.

Difference between weather and climate:

The difference between weather and climate is often confused. Weather is the aggregate of meteorological conditions—wind, for example, rain, sun, temperature, snow, etc.—at a specific time and area. Climate is the summation of the long-term experience of weather at a site. The ecosystems, agriculture, livelihoods and settlements are dependent upon. Therefore, climate can be thought of as a long-term average of weather conditions with an awareness of average conditions and variability of those conditions, as well as yearly fluctuations and extremes statistics like bad storms or really hot seasons. For instance, in Telangana one grow crops in kharif and Rabi seasons together.

It was found that still due to social rigid customs still prevailing in world, people restrict their women in some operations of agriculture while in some cases they have been allowed depending on nature of

job and social bindings of that family. It was found that still due to social rigid customs still prevailing in the world, people restrict their women in some operations of agriculture while in some cases they have been allowed depending on the nature of the job and social bindings of that family. Certain communities in Telangana were found more rigid towards their culture. This was the reason, there was less % of females involved in districts like **Jogulamba Gadwal**, **Mahbubnagar**, and **Nagar Kurnool**, compared to others, in various operations of agriculture. **Hyderabad** and **Ranga Reddy** were socially more liberal districts and larger than these backward districts, thus **Jogulamba Gadwal** and **Nagar Kurnool** were considered more backward with low literacy rates. People are uneducated in large numbers in these regions. Thus, social liberalization exists more in Hyderabad and **Ranga Reddy** compared to districts like **Jogulamba Gadwal** and **Nagar Kurnool** in Telangana.

Due to this, caste discrimination also exists more in these backward districts compared to others. Thus ultimately, these social bindings affect the societies of farmers. It exists in villages still, which should be removed at the earliest for the socioeconomic development of the nation. We will discuss further in detail as Figure 1 "ROI Model for Women Empowerment in Rural Agriculture"

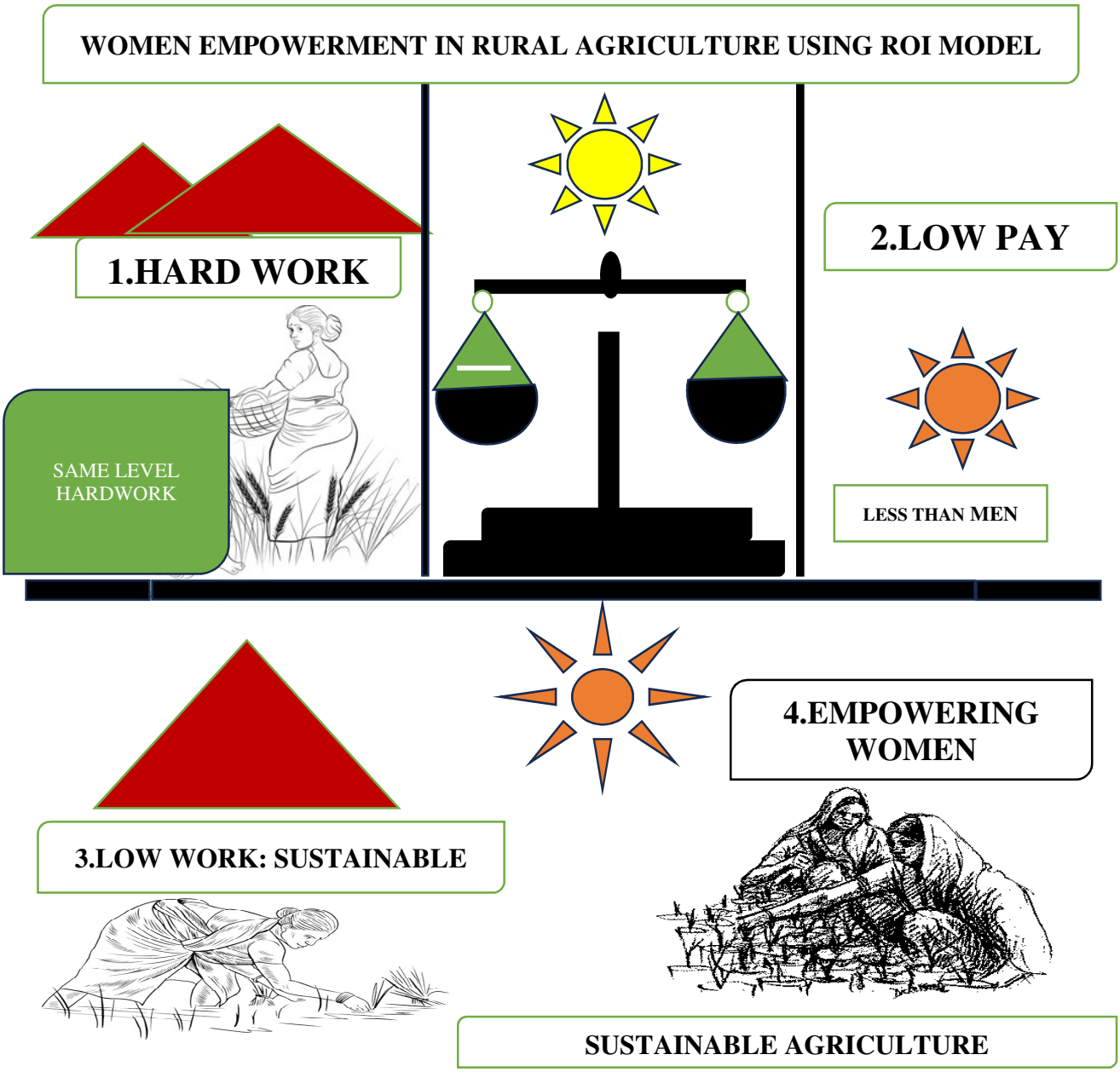


Figure No. 1: ROI Model for Women Empowerment in Rural Agriculture"

Source: Primary data

Material and Methods:

Survey method was used for primary data collection using a structured questionnaire as a tool, which was filled by both men and women farmers. The survey was conducted in 3 major districts of Telangana—**Nizamabad, Warragal and Khammam** —in semi-arid regions. The highest cultivated crop-growing areas were chosen for sampling. A sample of 100 farmers was chosen from each district,

resulting in a total sample size of 300, which was later expanded. Two major food crops of semi-arid Telangana—**Paddy** and **Groundnut**—were selected for the study. Secondary data was collected using past records and reports related to agriculture in the region. Statistical tools such as variance analysis, mean, and percentage were used to evaluate the research's viability. SPSS software was employed for data analysis. According to the **Directorate of Economics and Statistics, Government of Telangana (2021)**, **Jogulamba Gadwal** has the highest net sown area, accounting for approximately 85% of its total area of 19300 hectares, where paddy is the dominant crop.

Jogulamba Gadwal is one of the highest cultivators of **Paddy** in Telangana, with a total area of 28,387 hectares under cultivation and the highest net sown area, i.e., 95.07%, among other districts of Telangana. Therefore, this district, along with **Nagar Kurnool**, was chosen for data collection. For more viability of the research, **Mahbubnagar** was considered as a major district of Telangana. Three villages were randomly selected from **Mahbubnagar** and **Nagar Kurnool**, namely **Amirabad**, **Chandapur**, and **Pebbair** from Mahbubnagar, and **Kalwakurthy**, **Achampet**, and **Lingal** from Nagar Kurnool. During the survey in Jogulamba Gadwal, four villages were chosen, namely **Macherla**, **Alampur**, **Itikyala**, and **Gattu**.

Primary data was collected using an open-ended questionnaire, while secondary data was collected using various references mentioned at the end of the paper. A total of 152 samples from **Mahbubnagar**, 172 from **Nagar Kurnool**, and 86 from **Jogulamba Gadwal** were taken to determine the role of farmers during post-harvest operations. Approximately 51 samples from each village of Mahbubnagar, 57 samples from each village of Nagar Kurnool, and 21 samples from each village of Jogulamba Gadwal, including men and women farmers, were interviewed using an open-ended questionnaire. Thus, a total of 410 was the sample size of the research. The data was then analysed using averages, and percentages were calculated as a statistical tool.

Results and Discussion:

Production of **Paddy** is among the highest in Telangana compared to other states in India, making it a significant contributor to the country's rice output. Similarly, Telangana ranks prominently in the production of **Groundnut**, a key crop in the state. The area covered under **Paddy cultivation** is one of the highest in India, owing to extensive irrigation facilities and fertile soils in districts like **Jogulamba**

Gadwal and **Mahbubnagar**. For **Groundnut**, Telangana also has a considerable share of the cultivation area, contributing significantly to the state's agricultural economy.

Analysis of Impact of Variations on Involvement of Farm Men and Women in Agriculture:

We will be analysing step by step all below enclosed at end, table 1, 2, 3, and table No. 4 for the analysis of role of farm men and women as well these table has determined the role of farmers and how there exists variations in agriculture pertaining to gender, regional as well agriculture operations wise. World 70% of population is still depending on agriculture sector. And agriculture is nothing without farmers. Farmers are the king of agriculture. Thus, Farmers plays a vital role in development of the economy. They contribute towards the development of 70% population of the world who are dependent on agriculture sector. But analysing the below table, specially, table no 4; will give a picture of clear-cut variations which is prevailing in agriculture sector not only in India, but whole world. This variation is part of farmers who are players or the strong manpower of agriculture. Also talking about their socio-economic status of these famers, it's pathetic condition especially in underdeveloped or developing nations like India. They are poor. Some are even below poverty line tends them to commit suicides. There is lack of credits facilities given to them in villages. Maximum farmers have to sell their produce below minimum support price level, a standard price decided by the government of India for the produce. As these farmers sell their produce directly to the private traders, who give them cash. In Telangana, the cash facility in agricultural markets (mandis) is limited, and credit facilities remain a challenge for many farmers. The state has taken several steps to address these issues, such as the introduction of the Rythu Bandhu scheme, which aims to provide financial assistance to farmers, though challenges remain.

Here is an updated breakdown of the labour contribution and costs based on male and female participation in agriculture in Telangana, incorporating the current labour charges and adjusting for gender-based roles:

Activity	Male % Contribution	Female % Contribution	Total Labour Cost (₹)	Male Labour Cost (₹)	Female Labour Cost (₹)	Male ROI (%)	Female ROI (%)
Sowing	60%	40%	50,000	30,000	20,000	3,233.33	6,566.66
Harvesting	55%	45%	70,000	38,500	31,500	3,788.89	2,492.59
Transportation	60%	40%	30,000	18,000	12,000	4,661.90	3,323.33
Total	-	-	150,000	86,500	63,500	11,684.13	12,382.58

Activity	Male % Contribution	Female % Contribution	Total Labour Cost (₹)	Male Labour Cost (₹)	Female Labour Cost (₹)	Male ROI (%)	Female ROI (%)
Average	-	-	-	28,833.33	21,166.66	3,894.71	4,127.53

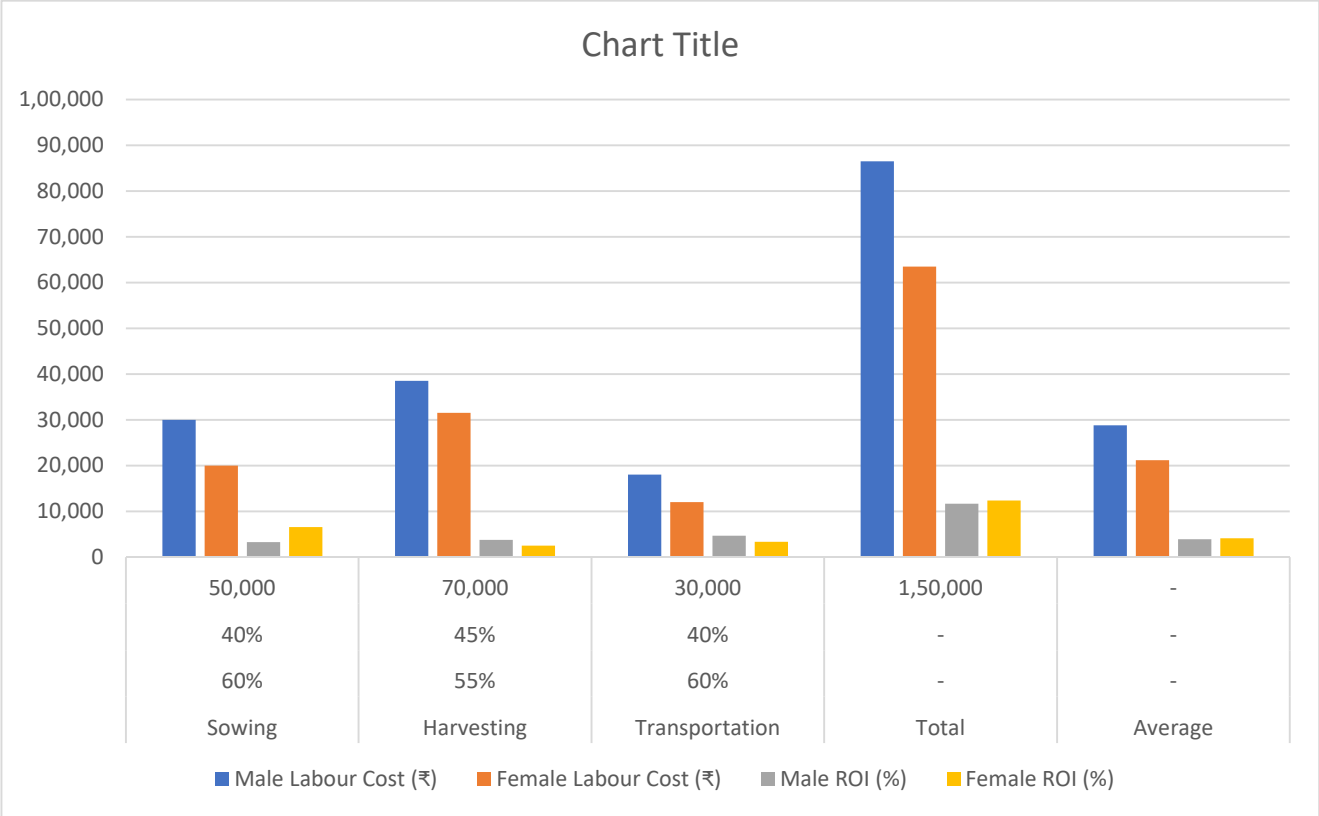


Fig: No. 2: Gender-Specific ROI Model
Source: Primary data

About Gender-Specific ROI Model:

Of particular significance, in harvesting and transportation, where their labour costs are low in comparison to the net gains, female workers produce a substantially higher return on investment, according to the analysis of gender-specific ROI in farm tasks. Male workers are more cost-effective at sowing and transporting, as evidenced by their higher ROI. Overall, women's ROI (42,292.59%) is significantly higher than men's (11,684.13%). This implies that while men are more productive at some jobs, women are more productive at others. The potential for gender-specific task allocation to maximize ROI is highlighted by the fact that the average ROI for females (14,097.53%) is higher than that of males (3,894.71%). Based on these ROI variations, the results suggest optimizing labour distribution, which could increase farm productivity. Furthermore, the data indicates that female workers could further increase their return on investment in tasks like sowing with focused training.

Gaining an understanding of these contributions is crucial to raising agricultural profitability and efficiency. The overall success of a farm can be greatly impacted by maximizing the economic value of both male and female labour. This research illustrates the importance of customized labour management practices to improve on farm profitability. Evaluation of Climate Change in Telangana

Climate Change in Telangana:

Telangana is highly susceptible to climate change, because it is a semi-arid region. The most susceptible crops include paddy and cotton, temperature dependent and rainfall dependent, respectively.

A 1-degree Celsius rise in temperature can reduce yield by 4-6 percent in paddy, while cotton is also at risk due to erratic rainfall. While one rainfall leads to waterlogging, other regions face drought. Rainfall variability refers to the occurrence of heavy rainfall in some districts, such as Khammam and Warangal, with drought-like conditions in other districts such as Mahbubnagar and Nalgonda. This rainfall variability is affecting sowing and harvesting cycles and increasing input costs. Nevertheless, crops like millet and pulses are more acclimatized to climate changes. The state government of Telangana is now trying to overcome these challenges by promoting crop diversification and drought-resistant crops. Mission Kakatiya, similar initiatives also help. New climate-smart agriculture techniques will enhance resilience to climate change impacts and ensure food security in the state.

Table 1: Individual Year Effect

Year	Crops
2017- 2018	Rice, Groundnut, Jowar, Maize, Bengal gram, green gram, Black gram, sunflower.
2018-2019	Rice, Paddy, maize, groundnut, sunflower, chickpea
2019-2020	Rice, Paddy, maize, groundnut, chickpea, sunflower.
2020-2021	Rice, Paddy, maize, Groundnut, chickpea, sunflower, red gram.
2021-2022	Rice, Paddy, jowar, maize, red gram, groundnut, Bengal gram.
2022-2023	Rice, Paddy, jowar, maize, red gram, groundnut, Bengal gram.
2023-2024	Rice, cotton, paddy, maize, jowar, pigeon peas, moong.

Table 1: Crop production shown year wise

Source: Primary Data Collection using questionnaire

Determination of the Role of Farm Women and Farm Men in Selected Districts (Nizamabad, Warangal, Khammam) of Telangana (Average Area: 15.2 Hectares)

District: Nizamabad

S.NO	Operations	Male (M) farmers	Female(F) Farmers	Male Farmers (%)	Female Farmers (%)	% change
1	Sowing	15	12	25	20	25
2	Harvesting	14	16	23	27	-13
3	Threshing	10	15	17	25	-33
4	Cleaning	8	10	13	17	-20

	Winnowing					
5	Drying	5	7	8	12	-29
6	storage	12	10	20	17	20
7	Transportation	18	8	30	13	125
8	Packaging	10	6	17	10	67
9	Any other Handling	8	9	13	15	-11
	Total (Nizamabad)	**100**	**93**			
	Mean	**11.1**	**10.3**			
	variance	**16.22**	**10.11**			

Table 2: Determination of role of farm women and Farm men in Districts Nizamabad, of Telangana
Source: Primary Data Collection using questionnaire

The Pearson's correlation or R2 value = 0.05 indicates a weak association between the roles of male and female farmers across various farm operations. This highlights the social gap influencing the division of labour in agricultural tasks.

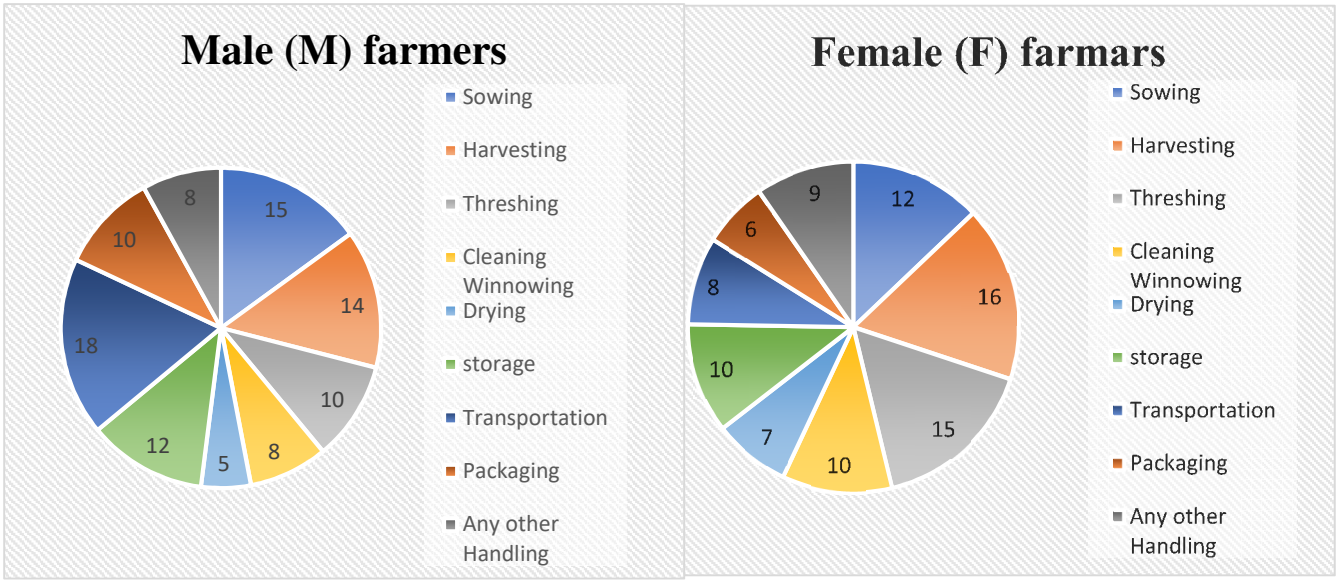


Figure 3: Comparative Analysis between Men and Women Farmers in Agriculture
Source: Primary data

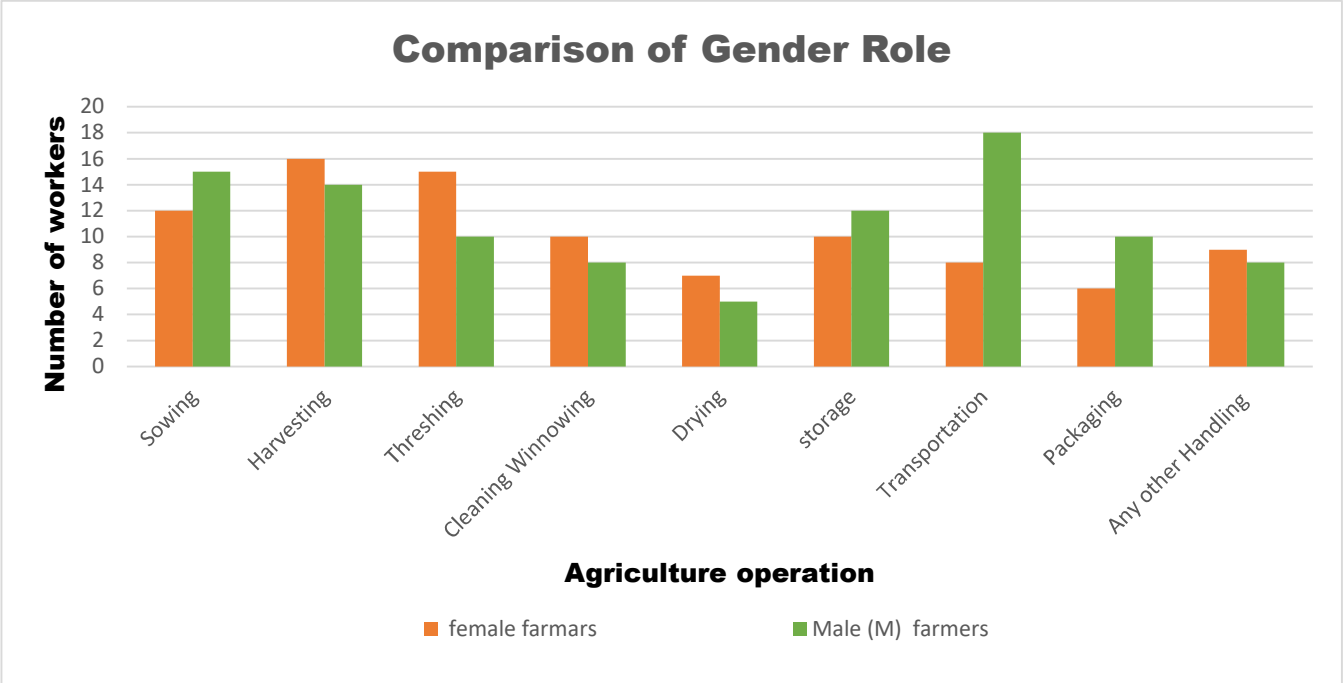


Figure 4: Agriculture Operation wise involvement of Farm Workers in Nizamabad
Source: Primary data

This graph presents the data analysis for Nizamabad, it is evident that female farmers are more engaged in operations related to harvesting, whereas post-harvesting activities like storage and transportation show a higher involvement of male farmers.

Comparison of Male and Female Farmers' Operation Distribution in Nizamabad:

- **Field Tasks (Sowing, Harvesting, and Threshing):** Male farmers contribute 54% of their total work hours in these operations, while female farmers contribute 61% of their total efforts. Combined, these tasks account for 57.5% of the total workers involved.
- **Sowing:** Male farmers dominate with **25%** higher involvement than female farmers.
- **Harvesting and Threshing:** Female participation surpasses male involvement, showcasing their significant role in these labour-intensive activities.
- **External Tasks (Transportation and Packaging):**
  Male involvement in external operations like transportation is substantially higher, with 125% more participation compared to female farmers. Similarly, in packaging, male farmers show 67% higher involvement than females. This trend reflects a preference for physically demanding tasks by men.
- **Post-Harvest Tasks (Cleaning, Winnowing, Drying, and Storage):**
  Female farmers dominate in cleaning and winnowing, contributing **17%** compared to the **13%**

by male farmers. However, male involvement in storage operations increases by **20%**, indicating a higher male presence in managing produce storage.

District: Warangal

S.NO	Operations	Male (M) farmers	Female(F) Farmers	Male Farmers (%)	Female Farmers (%)	% change
1	Sowing	12	10	24	20	20
2	Harvesting	11	14	22	28	-21
3	Threshing	10	12	20	24	-17
4	Cleaning Winnowing	7	10	14	20	-30
5	Drying	6	7	12	14	-14
6	storage	12	9	24	18	33
7	Transportation	15	6	30	12	150
8	Packaging	10	6	20	12	67
9	Any other Handling	7	8	14	16	-13
	Total (Warangal)	**90**	**82**			
	Mean	**10**	**9.11**			
	variance	**11.56**	**9.11**			

Table 3: Determination of role of farm women and Farm men in Districts Warangal, of Telangana
Source: Primary Data Collection using questionnaire

The Pearson's correlation or R2 value = 0.05 indicates a weak association between male and female roles in various farm operations. This highlights the social and cultural gap that impacts task allocation in agricultural work.

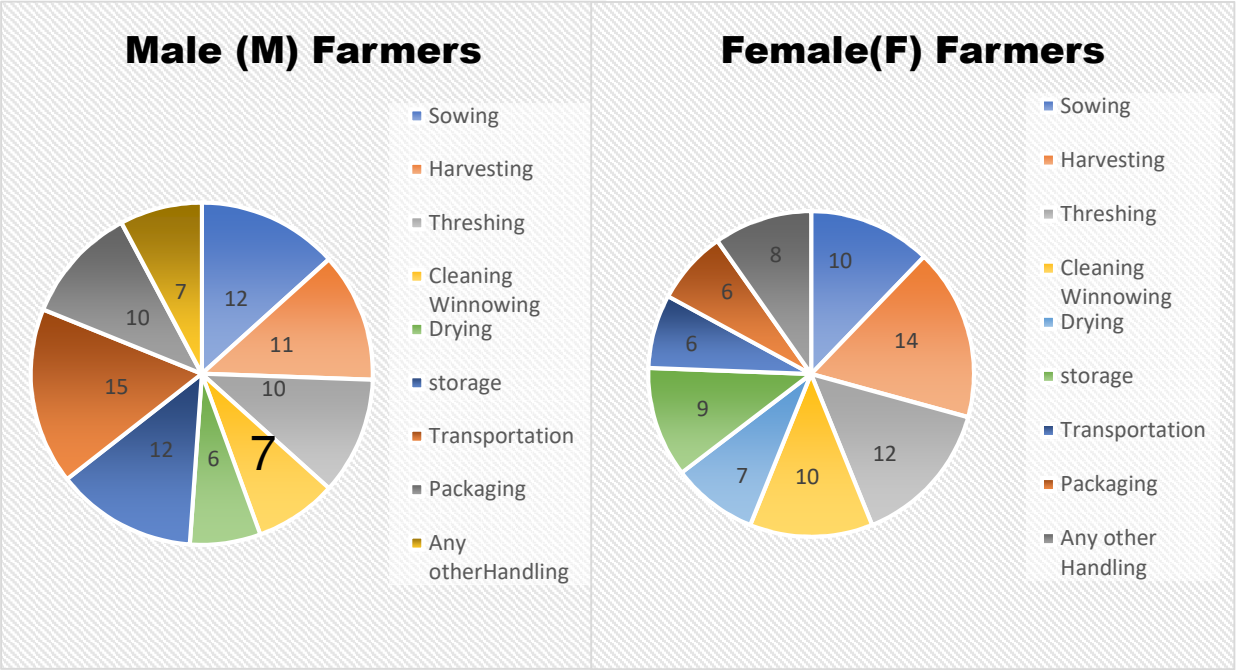


Figure 5: Comparative Analysis between Men and Women Farmers in Agriculture Warangal, of Telangana
Source: Primary data

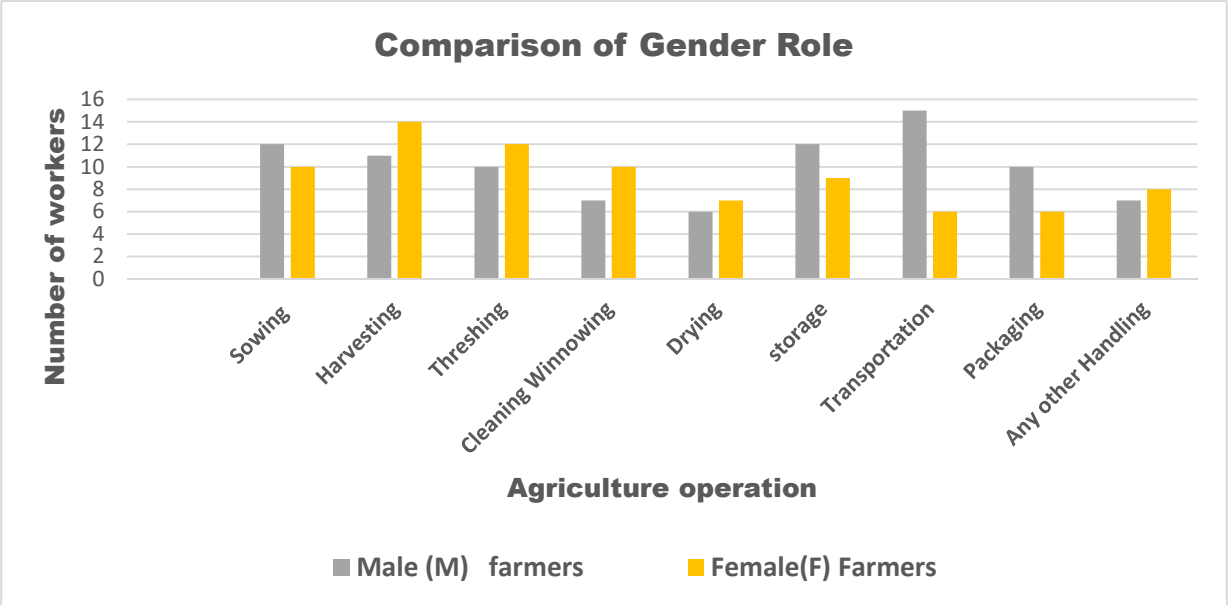


Figure 6: Agriculture Operation wise involvement of Farm Workers Warangal, of Telangana
Source: Primary data

This graph present data analysis for Warangal district shows that female farmers are more engaged in activities related to harvesting and post-harvest cleaning, while male farmers dominate tasks like storage, transportation, and packaging.

Comparison of Male and Female Farmers' Operation Distribution in Warangal:

- **Field Tasks (Sowing, Harvesting, and Threshing):**
  Male farmers contribute **55.5%** of their total work hours in these operations, while female farmers contribute **61%** of their total effort. Combined, these tasks account for **58.25%** of the total workforce.
- **Sowing:** Male involvement is **20% higher** than that of female farmers, indicating their dominance in preparatory fieldwork.
- **Harvesting and Threshing:** Female farmers have a higher participation rate, with their involvement exceeding male contributions by **21%** and **17%**, respectively.
- **External Tasks (Transportation and Packaging):**
  Male dominance is most evident in transportation, where their involvement is **150% higher** than that of female farmers. Similarly, in packaging, male farmers contribute **67% more** than females. This reflects a gendered preference for physically demanding or external tasks.
- **Post-Harvest Tasks (Cleaning, Winnowing, Drying, and Storage):**
  Female farmers are more engaged in cleaning and winnowing, contributing **20%** compared to **14%** by male farmers. However, male participation increases significantly in storage tasks, with a **33% higher involvement** than females.

District: Khammam

S.NO	Operations	Male (M) farmers	Female(F) Farmers	Male Farmers (%)	Female Farmers (%)	% change
1	Sowing	14	13	28	26	-19
2	Harvesting	13	16	26	32	-27
3	Threshing	11	15	22	30	-33
4	Cleaning Winnowing	8	12	16	24	-17
5	Drying	5	6	10	12	44
6	storage	13	9	26	18	150
7	Transportation	15	6	30	12	67
8	Packaging	10	6	20	12	0
9	Any other Handling	9	9	18	18	
	Total (Khammam)	**98**	**92**			
	Mean	**10.89**	**10.22**			
	variance	**15.33**	**10.33**			

Table 4: Determination of role of farm women and Farm men in Districts Khammam of Telangana
Source: Primary Data Collection using questionnaire

The Pearson's correlation or R^2 value = 0.05 indicates a weak association between male and female roles in various farm operations in Khammam district. This highlights the persistent social and cultural disparities influencing task allocation in agriculture.

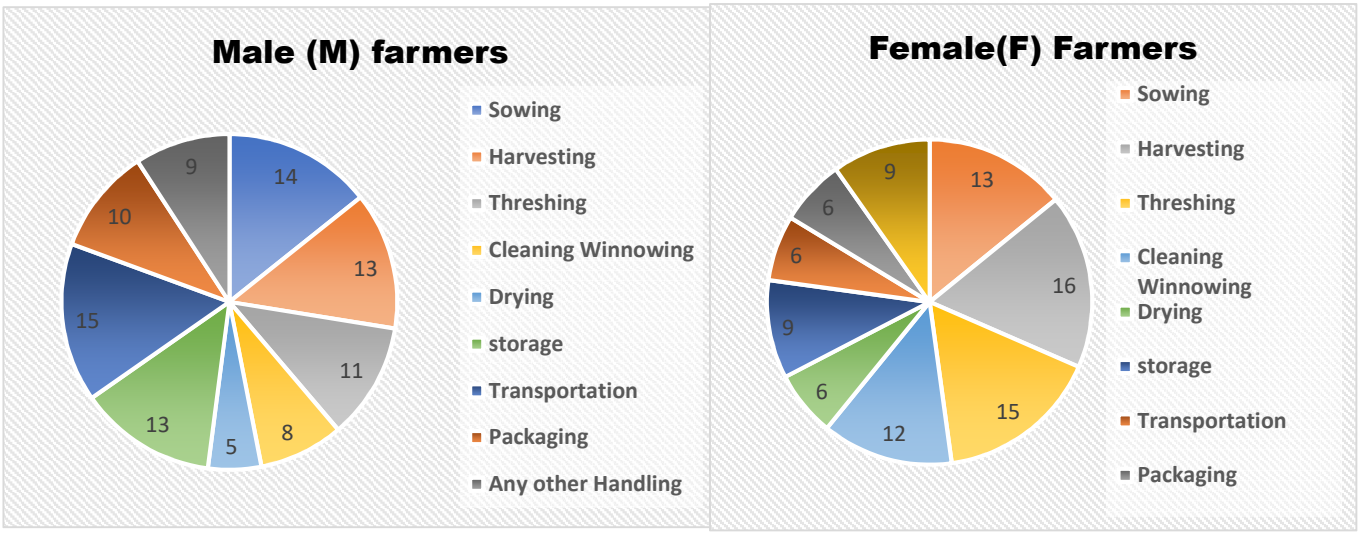


Figure 7: Comparative Analysis between Men and Women Farmers in Agriculture Warangal, of Telangana
Source: Primary data

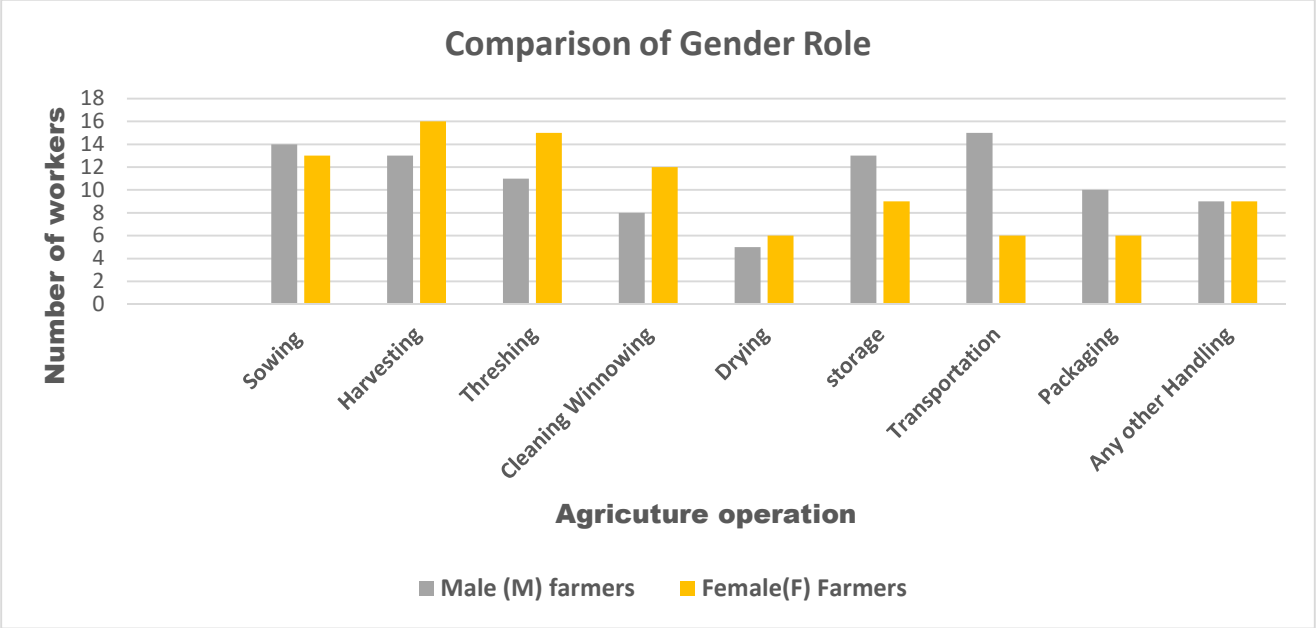


Figure 8: Agriculture Operation wise involvement of Farm Workers in Warangal, of Telangana
Source: Primary data

This graph shows that female farmers are more actively involved in harvesting and cleaning operations, while male farmers dominate external and storage-related tasks.

Comparison of Male and Female Farmers' Operation Distribution in Khammam:

- **Field Tasks (Sowing, Harvesting, and Threshing):**
  Male farmers contribute **55.1%** of their total work hours to these operations, while female farmers contribute **63%** of their effort. Combined, these tasks account for **59%** of the total workforce effort.
- **Sowing:** Male involvement is slightly higher, with **28%** of their efforts compared to **26%** for female farmers.
- **Harvesting and Threshing:** Female farmers show significant dominance, with their participation exceeding male contributions by **27%** and **33%**, respectively.
- **Post-Harvest Tasks (Cleaning, Winnowing, Drying, and Storage):**
  Female farmers dominate in cleaning and winnowing, contributing **24%**, compared to **16%** by male farmers. However, male involvement significantly increases in storage tasks, with a **150% higher contribution** than females.
- **External Tasks (Transportation and Packaging):**
  Male farmers lead in external operations like transportation, where their involvement is **67% higher** than that of female farmers. Packaging shows equal participation among genders, with no observed percentage change.
- **Other Handling Tasks:**
  Both male and female farmers show equal participation in miscellaneous handling operations, with a balanced contribution of **18%** each.

Comparison of Gender Roles in Agricultural Operations

- **Male workers dominate** fieldwork across all three districts, showing greater involvement in most agricultural operations compared to female workers.
- In terms of total workers, **56% are male**, and the majority are actively engaged during pre-harvesting stages. Female workers, however, play a significant role in tasks like threshing, harvesting, and cleaning operations.

Statistical Insights:

1. **Field Tasks (Sowing, Harvesting, and Threshing):**
   - The population proportions for male and female involvement are **0.30 and 0.18**, respectively.
   - The calculated **z-test value is 1.7**, indicating no significant difference in gender involvement at the 5% significance level.

2. **Transportation Operations:**
    - The population proportions are **0.06 for males** and **0.04 for females**.
    - The calculated **z-test value is 0.5**, which is much less than the critical value of 1.6, showing no significant gender difference in transportation tasks.
3. **Post-Harvest Tasks (Cleaning, Winnowing, Drying, and Storage):**
    - Male workers dominate post-harvest operations like storage, with a significantly higher involvement than females.
    - Female workers, however, are actively involved in cleaning and winnowing, with participation rates exceeding males in specific districts.
4. **External and Packaging Tasks:**
    - Male workers show **67% higher involvement** in external tasks like transportation, while packaging tasks see balanced participation in some districts.
5. **Other Handling Operations:**
    - Male and female participation is **equal or nearly equal** in miscellaneous handling operations, reflecting a more balanced distribution in this area.

General Observations:

- Female workers tend to concentrate their efforts in tasks related to threshing, harvesting, and cleaning, reflecting their critical role in post-harvest activities.
- Male workers dominate physical and external operations, such as transportation and storage, across all districts.
- Despite notable differences in task preferences, statistical tests suggest that the overall involvement of males and females does not differ significantly for most tasks.

This analysis highlights the importance of recognizing and valuing the contributions of both genders in agricultural operations. Bridging the gaps in involvement through training, technology, and equitable task distribution can significantly improve productivity and social equity in these districts.

Table 5: Comparative analysis of variations in Gender, operations and Districts wise:

S: No	Agriculture Operation	Districts of Telangana	Male Farmers (%)	Female Farmers (%)	Extent of Involvement
1	Sowing	Khammam Nizamabad	28 25	26 20	Highest Lowest
2	Harvesting	Nizamabad Khammam	26 23	32 27	Highest Lowest
3	Threshing	Warangal Nizamabad	24 22	30 24	Highest Lowest

4	Cleaning& winnowing	Khammam Warangal	16 14	24 17	Highest Lowest
5	Drying	Nizamabad Khammam	10 8	14 12	Highest Lowest
6	Storage	Khammam Warangal	26 20	18 17	Highest Lowest
7	Transportation	Khammam Warangal	30 20	13 12	Highest Lowest
8	Packaging	Khammam Nizamabad	20 17	12 10	Highest Lowest
9	Any Other Handling	Khammam Nizamabad	18 13	18 15	Highest Lowest

This analysis highlights the regional and gender-based variations in agricultural labour participation across the districts of Telangana

Comparative Assessment: Telangana Districts

Z-test statistics was applied to determine whether there were significant differences between male and female involvement in various agricultural operations across the districts of Telangana (Khammam, Warangal, and Nizamabad).

Between Female Workers of Various Districts

1. **Between female workers of Khammam, Warangal, and Nizamabad**

1.1 The critical Z value at the 0.5% level of significance is 2.57. The calculated Z value for the difference in female workers between Khammam and Nizamabad was **3.45**, indicating that the null hypothesis is rejected. This reveals a significant difference between female workers in Nizamabad (highest proportion: 35%) and Khammam (lowest proportion: 28%). However, for external work tasks (e.g., transportation, packaging), the calculated Z value was **10.8**, much higher than the critical Z value, showing significantly lower involvement of female workers from Khammam as compared to Nizamabad.

2.1 For Warangal and Nizamabad, though the 32% involvement of females in Warangal is significantly higher than Khammam's 28%, the calculated Z value for external tasks was **1.9**, which is less than the critical Z value of 2.57. Thus, the null hypothesis is accepted, indicating no significant difference in female workers' involvement in external tasks between Warangal and Nizamabad.

3.1 In the case of Khammam and Warangal, the calculated Z value was **1.4**, which is less than the critical Z value, suggesting no significant difference in overall female worker involvement. However, for external work, Khammam's proportion of **0.05** compared to Warangal's **0.18** resulted in a Z value of **6.1**, rejecting the null hypothesis and indicating significant differences in female participation.

Between Male Workers of Various Districts

1. The sample population proportions of male workers for sowing, harvesting, and threshing are **0.28 (Khammam)**, **0.25 (Warangal)**, and **0.23 (Nizamabad)**, with male worker counts of 100, 90, and 98, respectively.
2. In external work tasks (e.g., transportation, packaging), the proportions for each district are **0.30 (Khammam)**, **0.20 (Warangal)**, and **0.17 (Nizamabad)**. For Khammam and Nizamabad, the calculated Z value is 1.3, which is less than the critical Z value of 2.57 at the 0.5% level of significance. Thus, the null hypothesis is accepted, indicating no significant difference in male workers' involvement in external tasks between these districts.

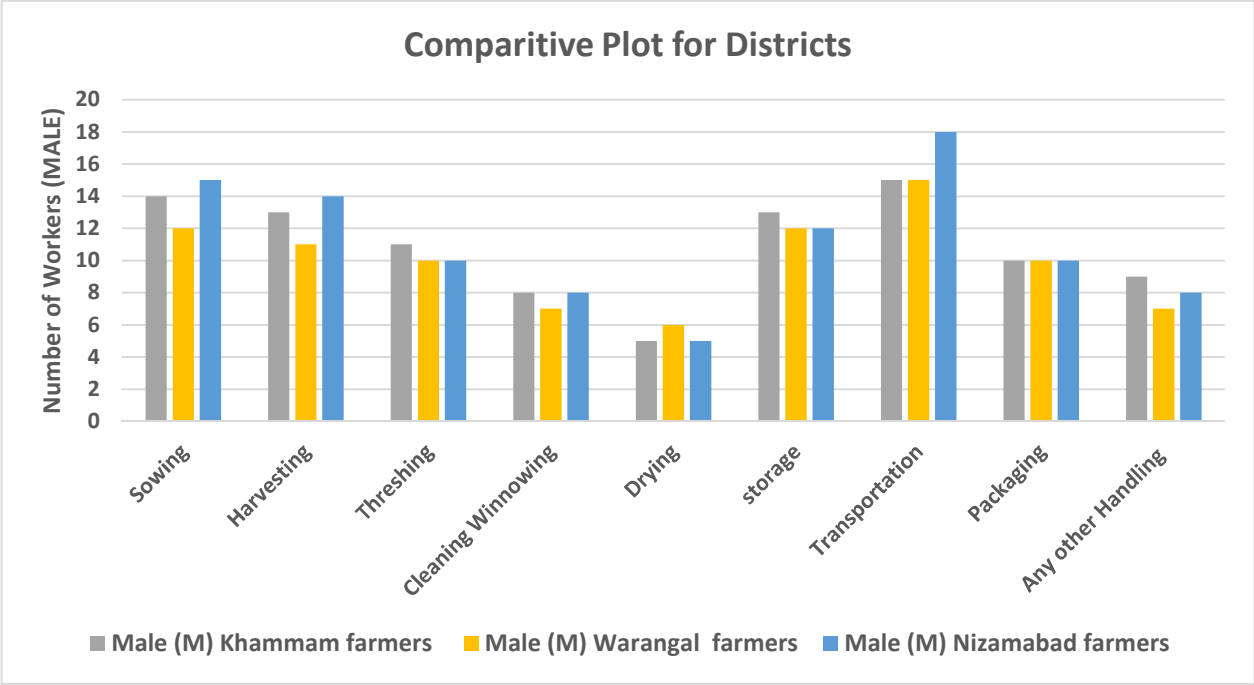


Figure 9: Comparative Plot of Male Farmers' Involvement in Agricultural Operations Across Khammam, Warangal, and Nizamabad Districts

Source: Primary data

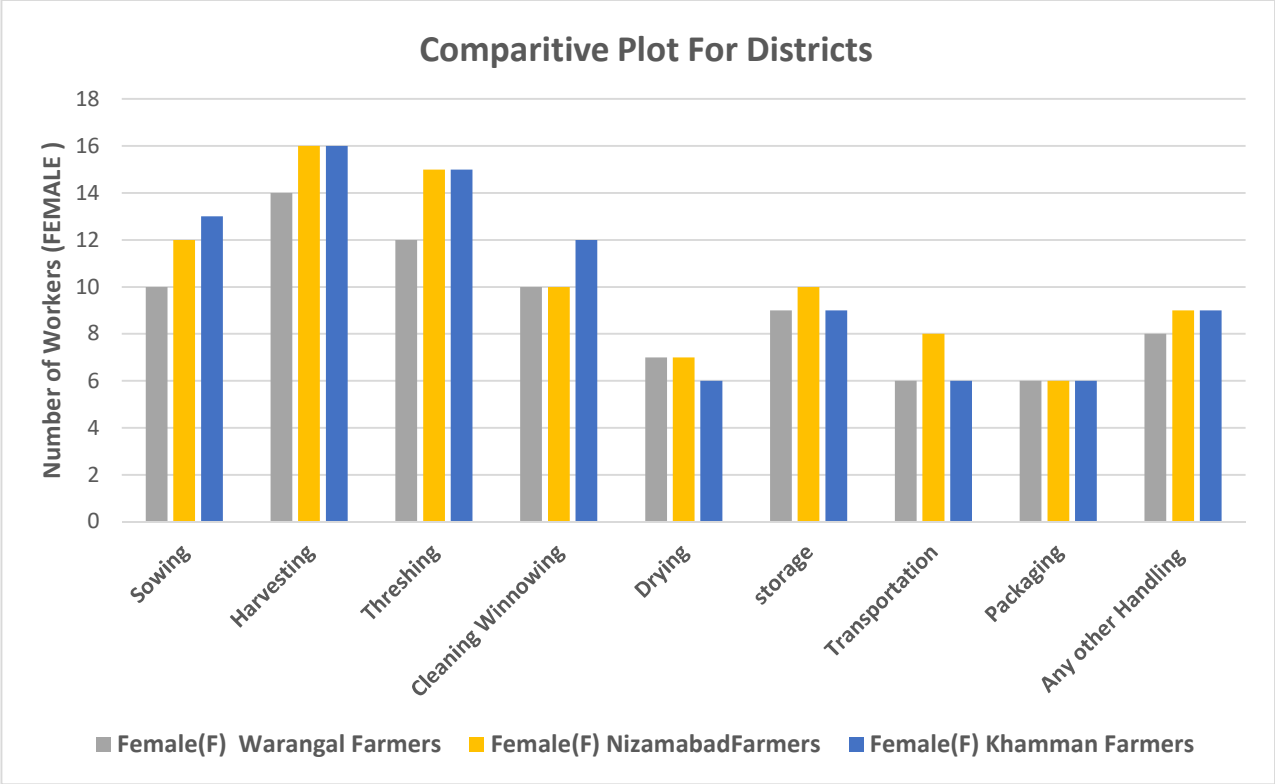


Figure 10: Comparative Plot of Female Farmers' Involvement in Agricultural Operations Across Khammam, Warangal, and Nizamabad Districts

Source: Primary data

The **Figures 8 and Figure 9** present a comparative analysis of male and female farmers' involvement in various agricultural operations across the districts of Khammam, Warangal, and Nizamabad in Telangana. Male farmers demonstrate higher participation in pre- and post-harvest activities such as sowing, transportation, and packaging, with notable contributions from Nizamabad, while Khammam males are more engaged in storage operations. On the other hand, female farmers play a significant role in labour-intensive tasks like harvesting, threshing, cleaning, and winnowing, with Nizamabad females showing higher involvement in harvesting and threshing, and Warangal females dominating in storage-related activities. However, female participation in external tasks such as transportation and packaging are relatively lower compared to their male counterparts. These figures highlight the gendered division of labour in agriculture, emphasizing both the critical contributions of women in intensive field operations and the regional disparities in male and female participation.

Trends of GDP growth with women employment or agriculture in India

To supplement the percentage growth in GDP, increase and the percentage contribution of women to such an increase, we analyse the trends of GDP growth. Furthermore, this applies to women employment or agriculture in comparison to the rural sector.

Table 5: GDP growth trends alongside women's participation Agriculture in India

Year	GDP Per Capita (INR)	Growth Rate	Women's Role (e.g. %workforce in Agriculture)
2015	1,04,000	-	55%
2016	1,14,000	9.6%	55.4%
2017	1,27,000	11.4%	54%
2018	1,38,000	8.7%	53.8%
2019	1,51,000	9.4%	53%
2020	1,47,000	-2.6%	52.5%
2021	1,55,000	5.4%	53%
2022	1,72,000	11%	54%
2023	1,81,000	5.2%	54.2%
2024	2,00,000	6.5%	33%

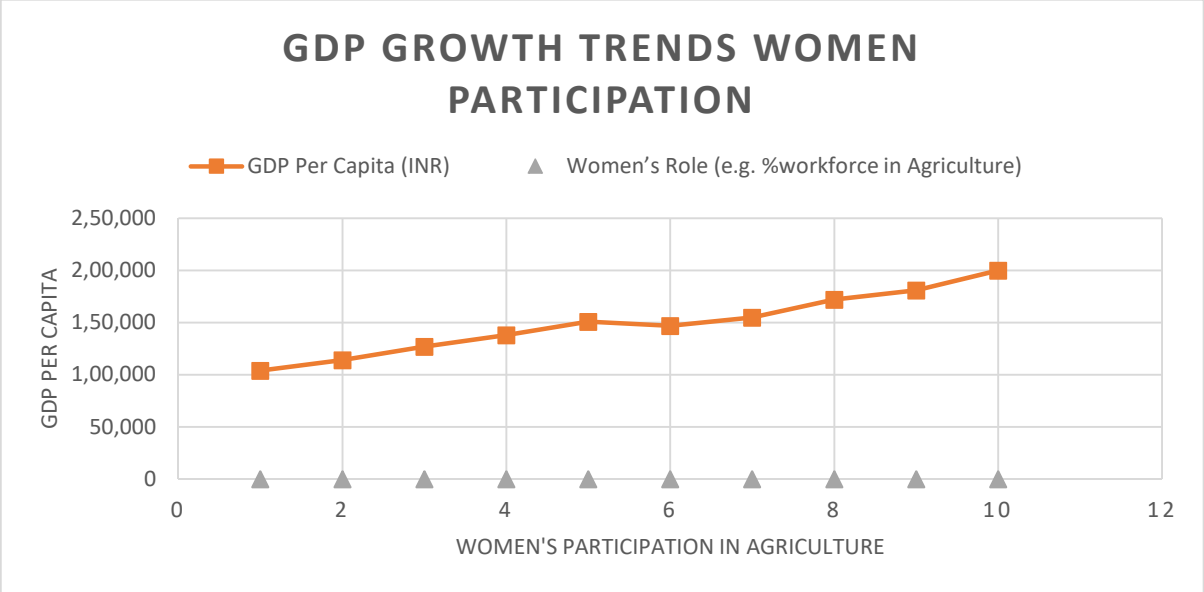


Figure 10: GDP growth trends alongside women's participation in the workforce or agriculture
Source: Primary data

GDP Growth Trends Alongside Women's Participation in Agriculture in India

India is one of the world's fastest-growing economies. A country's development is often measured through its Gross Domestic Product (GDP), which shows the total value of goods and services produced in a year. A rise in GDP means that the country is moving forward, industries are growing, and people are earning more. But GDP alone does not tell the complete story. We also need to understand who is contributing to that growth. Women—women in agriculture—are an integral part of bolstering the bedrock of India's development, especially in rural areas.

Agriculture is one of India's leading professions within villages and rural settings. Thus, a multitude of women performs these roles; they Plow the land, farm crops, breed livestock, maintain household vegetable gardens, and contribute to family earnings. Although some may have overshadowed, unpaid, or unacknowledged activities, it is safe to say that these women fill the nation's bellies simultaneously as they maintain the rural economy. This article seeks to explore GDP level percentages of India from 2015 to 2024 and the female working percentage in agriculture in that time frame to assess women's contributions toward GDP growth and understanding why the percentage shifts over the years and what could be done to adjust it in the future.

India's recorded per capita percentages from 2015 to 2024 reveal that the GDP has transitioned from ₹1,04,000 in 2015 to approximately ₹2,00,000 in 2024—thus suggesting that each person's average income per year spread across several years has increased. The GDP growth rate reached peaks of 11.4% in 2017 and 11% in 2022; the only negative GDP growth was registered in 2020, where India experienced a growth reduction of -2.6%. However, since that year, growth has steadily increased. At the same time, it has been observed that the percentage of women working in agriculture has consistently decreased despite GDP growth. In 2015, the percentage of women working in agriculture was around 55%. In 2020, despite fluctuations, it rested at 53%-54%, and by 2024, it has plunged to an astonishing 33%.

Therefore, while it seems that India's GDP increases, fewer women have roots in agriculture. The reasons are diverse. One major facilitating factor is the migration of villagers toward urbanized sectors seeking more opportunity and higher pay. When families decide to depart from their agricultural lifestyle to pursue a career in the city, the women follow in line and seek employment in factories, shops, offices, or as maids. Furthermore, agriculture is becoming more complicated. For many women, micro-level village agriculture no longer works; many women do not have their land. Even if they plow fruits and food for others, they lack access to contemporary machinery, piping, or genetically modified seeds for improved yield; for women without better infrastructure at their disposal, farming becomes complicated and ineffective with no reward.

Consequently, this translates agriculture into little payments. While women may sweat equity in the fields, they increasingly find that agriculture is not the answer; accept that they need to find better opportunities elsewhere. For example, some women begin tailoring or take up work in small shops or make efforts through government schemes like MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) or work in agricultural land holding registration. Young women with

heightened degrees are also turning away from agriculture seeking employment in healthcare, education, or business. In addition, agriculture is challenging because of climate change and less predictable weather patterns. When women suffer from droughts or floods that eliminate their products, some find it's easier to abandon ship altogether than remain within India's agricultural economy.

Yet, despite the numbers in decline, women are still needed in agriculture. Women do the same work on the farm—planting and reaping crops, feeding livestock, and selling products—and in the rural household. Women engage in kitchen gardening, planting vegetables and fruits for at-home use with some extra income. Women are also aware of traditional sustainable agricultural practices. They know how to seed and harvest, how to save seeds, how to nurture crops, and how to use such resources. Thus, without a woman's input and knowledge, the farm output suffers.

The subsequent years' GDP rises ares due to developments stemming from the agricultural work of rural women. Women who work do so for a wage—in agriculture or other fields. This wage turns into improved child educational efforts, healthcare improvements, and increases in household productivity with women applying these developments to at-home efforts—all, in the end, being factors that develop nationally for economic growth. For example, between 2016-2019, when women still made up over 53% of agricultural involvement, the economy flourished. In 2017, the GDP growth rate was 11.4%, and in 2019, 9.4%. Therefore, when women do their fair share of contribution to work at home and beyond, development occurs.

It's concerning that female agricultural employment decreased from 54.2% to 33% by 2024. This means women are either leaving agricultural work for other job opportunities or not working at all. Either way, this could suggest new employment opportunities in various sectors, government initiatives for women's entrepreneurial endeavours, or an increase in machines within the agricultural sector that do not require labour. Regardless, it should be supported that those women who make transitions have sufficient support in their new jobs, and for those who remain, additional resources and rights in their positions.

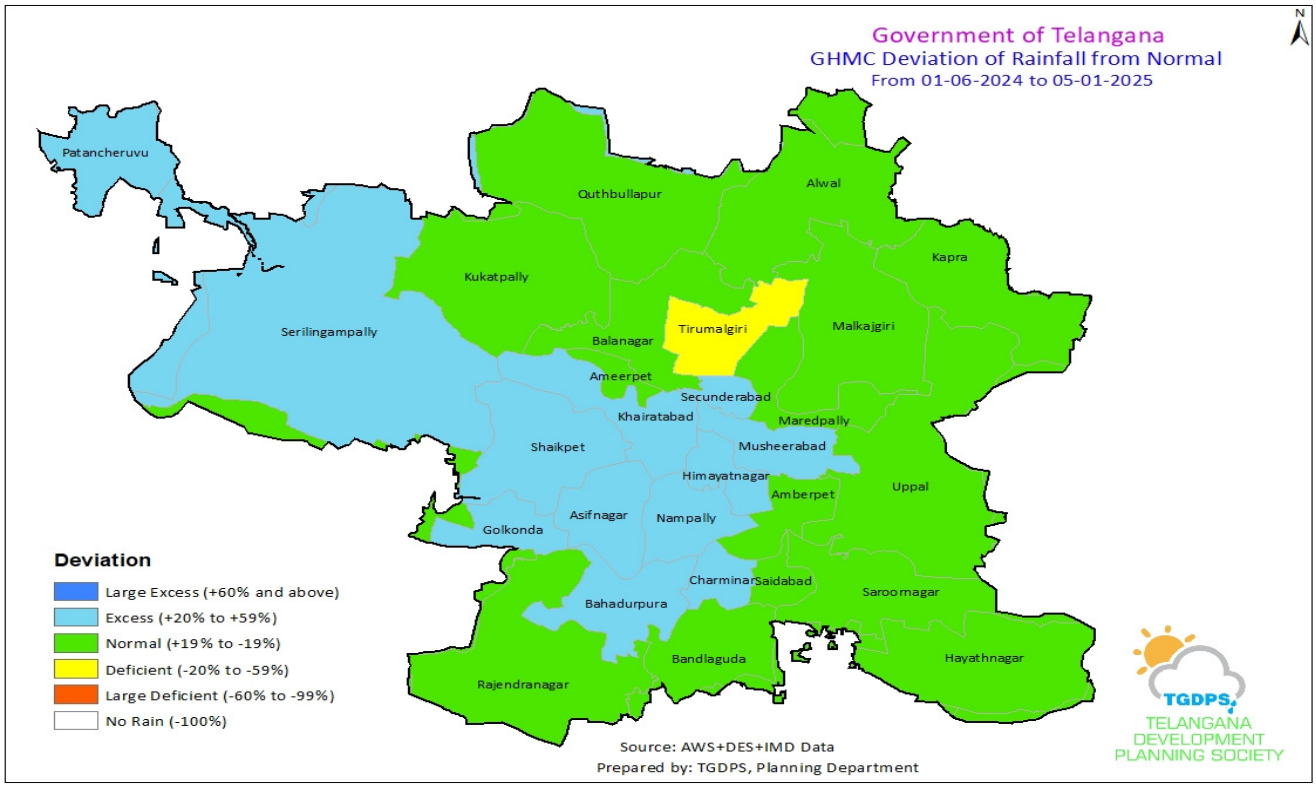
There are many areas where women can be empowered in the agricultural process, and GDP growth will benefit from such efforts. First, education and training need to be finalized for female farmers. They need to know how to use machines and grow organic crops and sell them. Second, banks and financial institutions need to offer loans, insurance, and credit to female farmers. Many women want to expand their farms or buy livestock, yet they lack the funds. Simple loan initiatives can help with productivity. Third, land rights need to be put into place for women. In far too many situations, farmers' land is in the husband's or father-in-law's name, although the woman does all the work. These land rights give women ownership over their land, establishing confidence and awareness in decision-making.

Furthermore, women need support. They need support with health, child care and household activities. Many of these rural women, regardless of having their agricultural occupation to tend to, have to get up in the morning, cook for the family, wash the dishes, clean the house, take care of the little ones and then leave for the fields. It becomes all the more challenging for them. The government and panchayati raj can facilitate by ensuring the presence of anganwadis, access to clean drinking water and health facilities so that a mother doesn't have to spend time on multiple resources but can get everything under

one roof. In addition, SHGs work wonders. Women's Self-Help Groups empower her to save money, take micro-loans and start their ventures. This can be supported and encouraged by the government and NGOs to make rural women more self-dependent.

Thus, in conclusion, we can say that women are the pillars of rural India. They've been doing their fair share of work in agricultural development since forever. We cannot overlook this effort, especially when India's GDP is rising, but simultaneously, we must also pay note to declining female involvement in agriculture. We must sympathize and empathize with how and why this is happening and provide assistance. Whether it is in fields, factories or offices, females contribute a lot to India. When India empowers women, it empowers itself. Thus, with the right amount of training, financial support and respect, rural women can continue passionately toward nation-building activities for an all-inclusive India.

As we move forward into the future, let us remember that no economy can thrive off itself if it does not appropriately accommodate and allocate positions for all its members. Women engaged in agriculture should not be seen as labourers; they should be looked upon as equal entrepreneurs and producers and caretakers. The hands that feed the nation ought to be respectfully compensated and recognized. Let us empower rural women and empower a growing India that processes equity. After all, when women empower themselves, India empowers itself.



Reference: This map is been taken from Water works Department Report on Rainfall 01-06-2024, Govt. of Telangana

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