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From Policy to Jobs: The Role of Government Schemes in Powering Employment in India

Karan Veerbhan

Department of Geography, Meerut College, Meerut (U.P.) 250001- India
Email: karanveerbhan2009@gmail.com

ABSTRACT

This study presents a comparative analysis of employment generation under key Indian government schemes in the agro and forest-based processing sectors up to 31st October 2024: PM Formalisation of Micro Food Processing Enterprises (PMFME), Creation/Expansion of Food Processing and Preservation Capacities (CEFPPC) and Agro-Processing Cluster (APC). These schemes are part of India's broader strategy for rural development, income enhancement, and job creation under the Atmanirbhar Bharat Abhiyan. Utilizing official scheme-level data, this study quantifies and visualizes the employment outcomes driven by each scheme. The analysis highlights differences in the scale and type of employment generated, showing that integrated models like APC and CEFPPC generally create more jobs due to their infrastructure-intensive and value chain-oriented approach.

In contrast, schemes like PMFME focus more on micro-level entrepreneurship and self-employment. Findings suggest that effective convergence of schemes, better access to infrastructure, and localized implementation strategies are essential for maximizing employment impact. The study further underscores the need for policy adjustments to strengthen underperforming areas and enhance overall outcomes. Based on the post-hoc Tukey HSD test results, significant differences in total employment are found under the PMFME scheme between OBC vs SC and OBC vs ST groups at both 5% and 1% significance levels. For the APC scheme (after log transformation), a significant difference is observed only between North and South zones. By offering insights into the performance of these schemes up to October 2024, this research supports evidence-based policymaking aimed at sustainable rural employment and inclusive economic growth.

Keywords: Employment Generation; Tukey HSD test; PMFME; Rural Development; Inclusive Growth

1. Introduction

India, one of the world's fastest-growing major economies, is characterized by its vast demographic diversity, vibrant agricultural base, and expanding industrial and service sectors. However, despite impressive GDP growth over the past decades, the Indian economy continues to grapple with significant structural challenges chief among them being unemployment, underemployment, and socio-economic disparities, especially in rural and marginalized communities. The country's economic development remains uneven, with large sections of the population, particularly Scheduled Castes (SCs), Scheduled Tribes (STs), and rural dwellers, still excluded from the full benefits of economic progress. In this context, government-led employment-generation schemes in food processing and forest-based industries serve as targeted tools to bridge these gaps, promote inclusive development, and empower vulnerable sections of society.

1.1. Indian Economy and Structural Challenges

India's GDP stands at approximately $3.7 trillion as of 2024, making it the fifth-largest economy globally. It is projected to become the third-largest by 2030. While the services sector contributes the largest share to the GDP, agriculture still employs more than 45% of the workforce, often informally and at low productivity levels. This dichotomy points to a fundamental structural issue India has not transitioned labor from agriculture to manufacturing and high-productivity sectors at the same pace as its East Asian counterparts. Moreover, regional disparities persist. Rural India, where over 65% of the population resides, suffers from inadequate infrastructure, limited access to markets, and seasonal employment, especially among small and marginal farmers. Despite ambitious schemes like Make in India and Skill India, the manufacturing sector's share in employment has not seen substantial increases, creating a bottleneck in the path toward full employment and income stability.

1.2. The Need for Employment-Oriented Schemes

In light of the structural imbalances and socio-economic fragmentation, the Government of India has implemented targeted schemes to stimulate local economies, create jobs, and encourage entrepreneurship. These schemes are not only about economic development but are deeply embedded in the broader

objectives of social justice, regional equity, and sustainable livelihoods. One critical area identified is agro and food processing, a sector with immense potential to add value to primary produce, reduce wastage and generate large-scale employment across rural areas. Schemes such as:

- PM Formalisation of Micro Food Processing Enterprises (PMFME)
- Creation/Expansion of Food Processing and Preservation Capacities (CEFPPC)
- Agro-Processing Cluster (APC)

Scheme have been launched to harness this potential. These schemes are designed not only to boost value addition and improve food security but also to generate employment through infrastructure creation, self-employment, micro-enterprise support, and supply chain development. They prioritize decentralized processing models, making it easier for rural entrepreneurs and tribal communities to participate in the economy. The employment aspect of these schemes is particularly important given the current labor market situation in India.

1.3. India's Employment Rate and the Informality Challenge

India's labor force participation rate (LFPR) and employment-to-population ratio remain lower than global averages. As per the periodic labour force survey (PLFS) 2023-24, the overall unemployment rate in India stood at around 6.6%, with urban unemployment notably higher than in rural areas. Youth unemployment remains a pressing concern, with educated youth (especially in the 20-29 age group) facing structural barriers in accessing stable employment. Additionally, more than 90% of India's workforce is employed in the informal sector, with limited access to job security, social protection, or formal skills training. In such a context, the government's approach has shifted towards self-employment promotion, particularly through MSME support and micro-enterprise development, which are central goals of the schemes under study. Employment-generation schemes that integrate credit support, market linkage, skilling, and infrastructure play a dual role: they formalize informal work and create new employment opportunities, especially in agro-based industries which can absorb both unskilled and semi-skilled labor in large numbers.

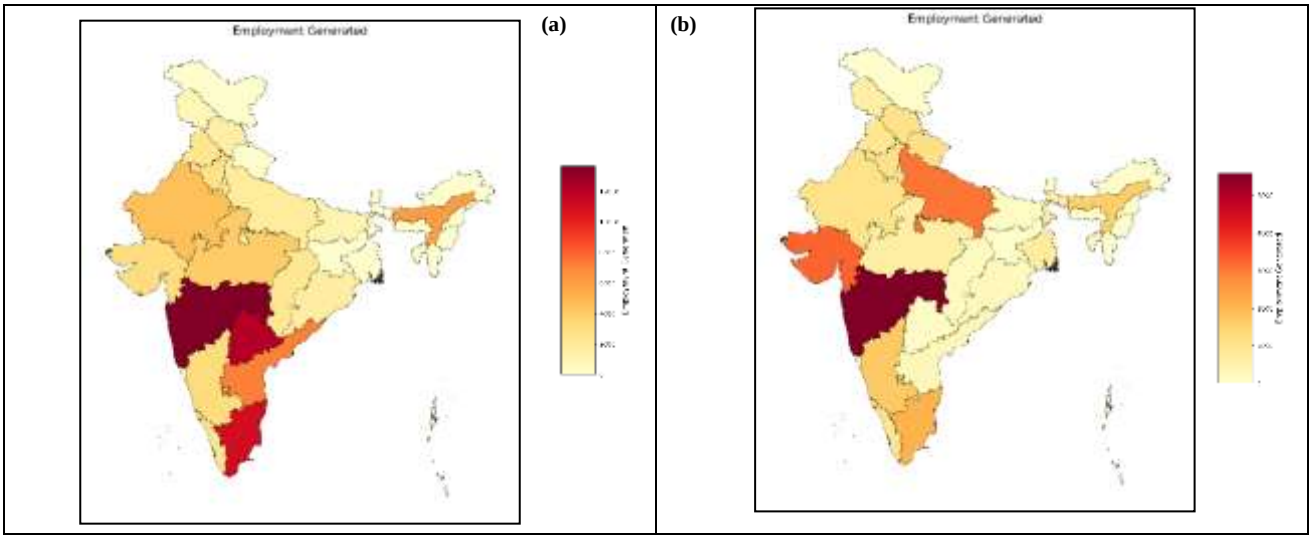
1.4. Role in Empowering Scheduled Castes (SCs) and Scheduled Tribes (STs)

One of the most significant achievements of these schemes lies in their targeted approach toward empowering SCs and STs, two historically disadvantaged groups in India. These communities face multiple deprivations not just economic, but also social and geographical exclusion from mainstream markets and institutions. According to Census 2011, SCs make up about 16.6% and STs about 8.6% of India's population, yet their representation in formal employment and enterprise ownership remains disproportionately low. Reserved targets for SC/ST beneficiaries in credit-linked subsidy programs.

- Support for Self Help Groups (SHGs) and Farmer Producer Organizations (FPOs) primarily composed of SC/ST members.

The PMFME scheme adopts the "One District One Product" (ODOP) framework, which often overlaps with SC/ST-concentrated rural regions. It focuses on traditional products like jaggery, tamarind, mahua, and millet-based items, supporting SC/ST entrepreneurs in scaling and formalizing their traditional businesses.

1.5. PAN India Employment Generation



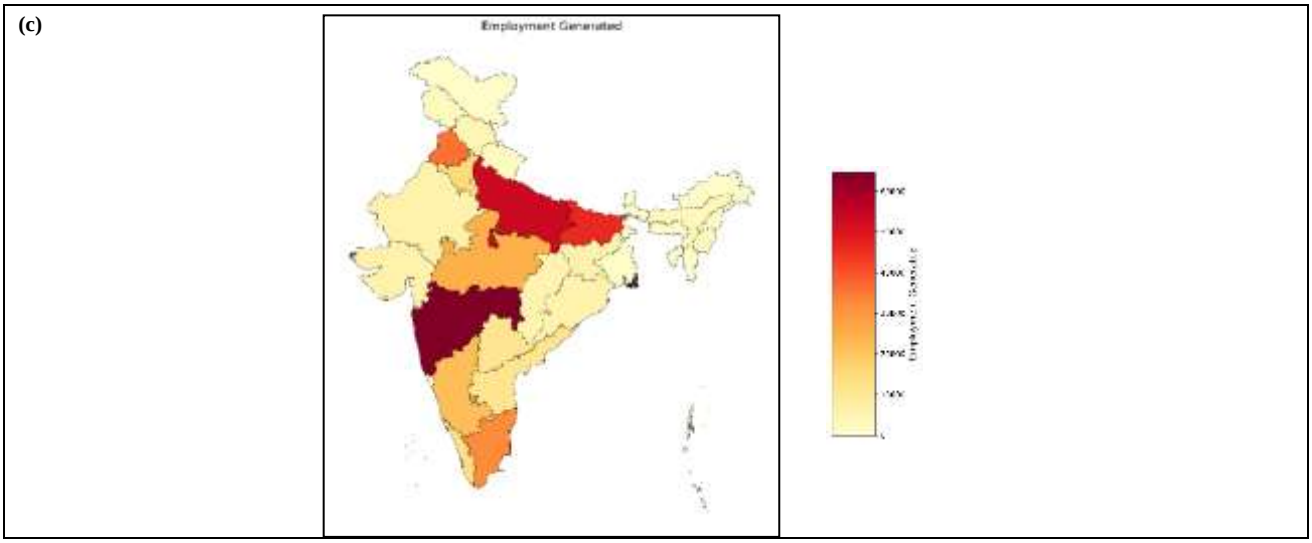


Fig. 1: State wise Plot for Total Employment Generation under: (a) APC Scheme, (b) CEFPPC Scheme, (c) PMFME Scheme

2. Methodology

- The study utilizes a multi-stage quantitative methodology to assess the employment impact across three government schemes: PMFME, APC and CEFPPC. Initially, descriptive statistics are computed for each scheme, and data normality is examined using Q-Q plots and skewness values. Quantile-Quantile (Q-Q) plots (Wilk and Gnanadesikan 1968) are a common statistical tool used for judging whether a sample comes from a specified distribution, and, perhaps most usefully, for visualizing the particular ways in which the sample might seem to deviate from that distribution. In cases where the employment data exhibited significant skewness (e.g., CEFPPC with skewness ≈ 2.09), a logarithmic transformation is applied: Y = log (Ei) where Ei is the total employment generated in zone or demographic group i.
- Subsequently, a one-way Analysis of Variance (ANOVA) is conducted for each scheme (Altman, 1990; McDonald, 2014). For PMFME, the ANOVA tested for significant differences in employment generation among Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC):

H_0: μSC = μST= μOBC

H_1: At least one μi ≠ μ j

- For APC and CEFPPC, India is categorized into distinct geographical zones (e.g., North, East, South, etc.), and ANOVA is applied on the log-transformed employment data to examine inter-zonal variation. Agbangba et al. (2024) Post-hoc pairwise comparisons are performed using Tukey's Honest Significant Difference (HSD) test at both 5% (α = 0.05) and 1% (α = 0.01) significance levels to identify statistically significant differences between group means. By using the following formula:

$$HSD = q.\sqrt{\frac{MS_{within}}{n}}$$

Where: q = studentized range statistic, n = number of observations per group, MS_{within} = mean square within groups.

- Artificial Intelligence tools are employed for data cleaning and sorting, while Python and allied libraries are used for graphical representation wherever necessary. All statistical interpretations and inferences are manually conducted by the authors.

2.2. Data Extraction and Compilation

Quantitative data regarding employment generation (both direct and indirect) are extracted from the Rajya Sabha reply and cross-validated with MoFPI's online scheme dashboards. Key metrics compiled include:

- Number of jobs created under each scheme
- Scheme-wise and state-wise distribution of employment
- Category-wise beneficiary details (where available, particularly for SCs/STs)

3. Results and Discussion

3.1. Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme

The PM Formalisation of Micro Food Processing Enterprises (PMFME) Scheme is a centrally sponsored initiative launched on 29 June 2020 under the Aatmanirbhar Bharat Abhiyan. With a total outlay of ₹10,000 crore and a five-year implementation period from 2020-21 to 2025-26, the scheme aims to formalize and enhance the competitiveness of 2,00,000 micro food processing units. It supports credit-linked subsidies, infrastructure development, branding, marketing, and capacity building. Adopting a One District One Product (ODOP) approach, PMFME focuses on promoting local value chains by leveraging region-specific agricultural strengths.

PMFME aims to:

- **Enhance competitiveness** of existing individual micro-enterprises in India's unorganized food processing sector.
- **Promote formalization** by transitioning 200,000 micro food processing units into the organized framework.
- **Support collective entities** such as Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), and producer cooperatives along their entire value chains.

Objectives

To accomplish its aim, PMFME seeks to:

1. Increase access to credit for entrepreneurs, FPOs, SHGs, and cooperatives.
2. Facilitate integration with organized supply chains via strengthened branding and marketing.
3. Provide common services processing facilities, laboratories, storage, packaging, marketing, and incubation.
4. Strengthen institutions, research, and training in food processing.
5. Deliver professional and technical handholding support.

The PMFME Scheme has a total financial outlay of ₹10,000 crore over five years (2020-21 to 2024-25). The cost is shared between the Central and State Governments in a 60:40 ratio, with special provisions: 90:10 for North Eastern and Himalayan states, 60:40 for UTs with legislatures, and 100% Central funding for other UTs.

Key Components and Benefits

PMFME's benefits are delivered through following components:

1. **Support to Individual/Group Micro-Enterprises**
    - Credit-linked capital subsidy at 35% of eligible project cost (up to ₹10 lakh per unit).
    - Beneficiary minimum contribution: 10% of project cost; balance via bank loan.
2. **Seed Capital for SHGs**
    - Seed capital of ₹40,000 per SHG member (up to ₹4 lakh per federation) for working capital and tools.
3. **Common Infrastructure Support**
    - Credit-linked subsidy at 35% (up to ₹3 crore) to FPOs, SHGs, cooperatives, or government agencies for setting up facilities such as sorting, grading, warehouses, processing units, and labs; available to others on hire basis.
4. **Branding and Marketing Assistance**
    - Grant up to 50% of expenditure for branding and marketing for groups of FPOs, SHGs, cooperatives, or Special Purpose Vehicles (SPVs).
5. **Capacity Building**
    - Entrepreneurship Development and Product-specific skilling through NIFTEM-Kundli, NIFTEM-Thanjavur, state technical institutes, and private partners.

Operational Highlights to Date

- Over 50,000 applicants registered on the PMFME portal; more than 25,000 applications submitted.
- Digital GIS ODOP map developed for all States/UTs, highlighting aspirational districts, tribal regions, and incubation centers.

- MoUs signed with MoRD, MoTA, MoHUA, ICAR, NCDC, TRIFED, NAFED, NSFDC, NSTFDC, FSSAI, DAHD, and 15 banks for seamless implementation.
- 75 incubation centers approved; seed capital of ₹203 crore disbursed to over 100,000 SHG members.
- Launch of state-level and ODOP brands ("AASNAA" in Punjab; "BHIMTHADI" in Maharashtra) and ongoing marketing support via NAFED and TRIFED.

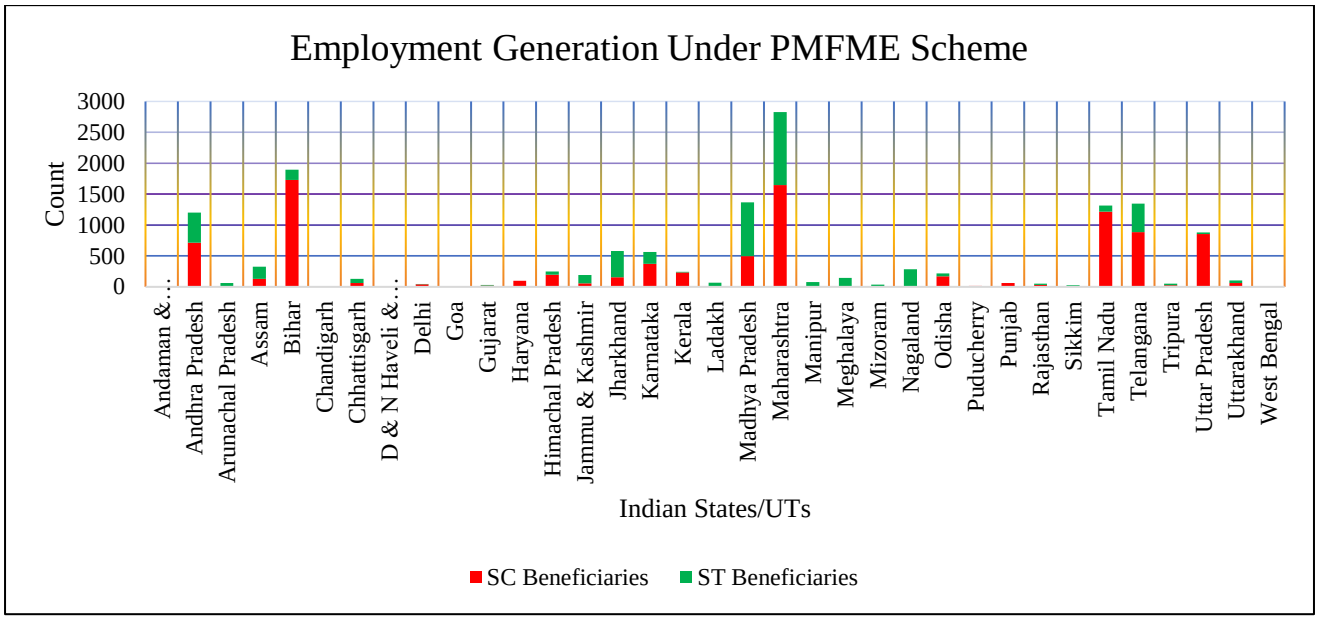


Fig. 2: State wise Employment Generation under Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme for Scheduled Caste and Scheduled Tribes (till 31st October 2024)

3.1.1. One-way ANOVA Analysis for (SCs, ST, and OBCs)

The ANOVA test is employed to examine whether statistically significant differences exist in the mean number of beneficiaries across SC, ST, and OBC categories under the PMFME scheme. The null hypothesis (H_0) assumed no significant difference in means among the three groups, while the alternative hypothesis (H_1) posited that at least one group differs significantly. The results indicated statistical significance at both 5% and 1% levels, confirming the rejection of the null hypothesis (Mishra et al., 2019).

The results of the one-way ANOVA test performed on the number of SC, ST, and OBC beneficiaries across various Indian states and Union Territories (UTs) reveal a statistically significant difference among these three social groups. The F-statistic value of 7.2864 and a corresponding p-value of 0.0011 clearly indicate that the mean number of beneficiaries differs significantly between at least two of these groups. Since the p-value is well below the conventional significance threshold of 0.05 (and even below 0.01), we confidently reject the null hypothesis that assumes equal means for all three categories. This outcome suggests that the number of beneficiaries reported under the Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC) categories is not uniformly distributed, and there are substantial disparities in their distributions across the states. These differences could arise from variations in state-wise population demographics, outreach policies, socio-economic development, or implementation effectiveness of welfare schemes aimed at these groups. For instance, states like Bihar and Tamil Nadu show very high OBC beneficiary counts, while states like Nagaland and Mizoram report only ST beneficiaries, highlighting stark regional patterns. The dataset itself contains zero entries in many rows, which typically reflect either the absence of data or lack of recorded beneficiaries in that category. Despite these zero values, the ANOVA test remains robust enough to detect significant inter-group differences, suggesting that the observed differences are meaningful. It's also worth noting that some states show a relatively balanced distribution (like Telangana and Maharashtra), while others are heavily skewed toward one group (such as Bihar for OBCs or Nagaland for STs).

Given the presence of statistically significant differences among the zones, a post-hoc Tukey HSD analysis is conducted at both 5% and 1% significance levels. The findings are summarized as follows.

3.1.2. Post-hoc Tukey HSD Analysis at 5% and 1% Significance Levels

Table 1: Statistical Values for Post-hoc Tukey HSD Analysis at 5% Significance Level

Group 1	Group 2	Mean Difference	p-adj	Lower Bound	Upper Bound
OBC	SC	-1349.77	0.0058	-2365.55	-333.99
OBC	ST	-1466.83	0.0025	-2482.61	-451.05
SC	ST	-117.06	0.9595	-1132.84	898.73

At the 5% level, the results show that the OBC group has significantly higher mean values compared to both the SC and ST groups. The mean difference between OBC and SC is approximately -1349.77, with a p-value of 0.0058, indicating strong evidence against the null hypothesis of no difference. Similarly, the mean difference between OBC and ST is about -1466.83, with a p-value of 0.0025, which is also statistically significant. The confidence intervals for both comparisons (OBC vs SC and OBC vs ST) do not include zero, further confirming statistical significance. However, the comparison between SC and ST yields a small mean difference of -117.06, with a very high p-value (0.9595), and the confidence interval includes zero. Thus, there is no significant difference between SC and ST at the 5% level.

Table 2: Statistical Values for Post-hoc Tukey HSD Analysis at 1% Significance Level

Group 1	Group 2	Mean Difference	p-adj	Lower Bound	Upper Bound
OBC	SC	-1349.77	0.0058	-2622.46	-77.08
OBC	ST	-1466.83	0.0025	-2739.52	-194.14
SC	ST	-117.06	0.9595	-1389.74	1155.63

At the 1% significance level, the findings remain consistent. The differences between OBC and SC, and OBC and ST, are still statistically significant, with even wider confidence intervals that do not cross zero. The results strengthen the earlier conclusion: OBCs are statistically distinct from both SCs and STs in terms of the measured outcome (likely related to entrepreneurship, employment, or enrolment based on earlier context). Meanwhile, the difference between SC and ST remains non-significant even at this more stringent threshold, indicating that these two groups are quite similar with respect to the observed metric.

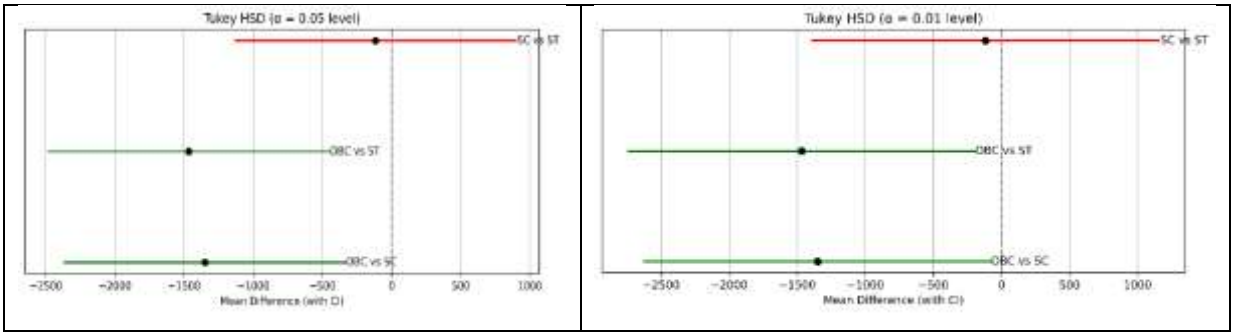


Fig. 3: The Tukey analysis revealed that the SC-OBC and ST-OBC pairs had significant differences in mean beneficiaries, highlighted in green to denote statistically significant rejection of the null hypothesis for these pairs. In contrast, the SC-ST pair did not show a significant difference, marked in red to reflect retention of the null hypothesis.

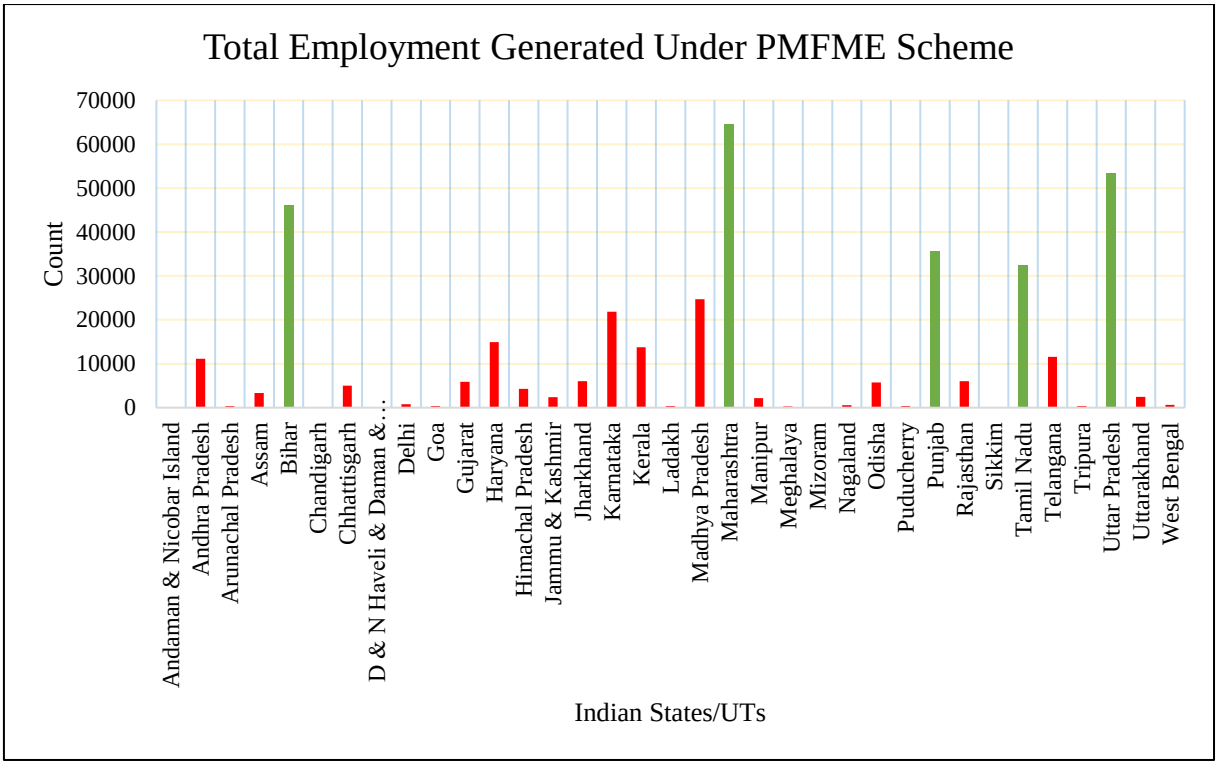


Fig. 4: State wise Total Employment Generation under Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme (till 31st October 2024)

The implementation of the PMFME (PM Formalisation of Micro Food Processing Enterprises) scheme across Indian states shows significant progress in generating employment and supporting SC/ST entrepreneurs. Notably, Maharashtra leads in employment generation with 64,668 jobs, followed by Bihar (46,066), Uttar Pradesh (53,465), and Punjab (35,703), reflecting the extensive reach and positive economic impact of the scheme in populous states. Tamil Nadu and Madhya Pradesh also performed well, generating 32,447 and 24,690 jobs respectively, showcasing effective execution and uptake of the scheme at the state level.

In terms of inclusion, SC beneficiaries are most prominent in Bihar (1,731), Maharashtra (1,647), and Tamil Nadu (1,218), indicating targeted support for marginalized communities in these states. Meanwhile, ST participation is high in Maharashtra (1,181), Madhya Pradesh (873), and Telangana (460), which aligns with the scheme's aim of uplifting tribal populations. States in the North-East, including Nagaland, Arunachal Pradesh, and Manipur, also recorded decent ST participation despite lower absolute numbers, reflecting a focus on tribal empowerment in remote regions. However, some Union Territories like Andaman & Nicobar, and Chandigarh, recorded no SC/ST beneficiaries, highlighting potential gaps in outreach or implementation that may need addressing.

Overall, the data reflects the PMFME scheme's dual impact: it has significantly contributed to employment generation across diverse geographies and has also helped promote social inclusion by supporting entrepreneurs from SC/ST communities, particularly in rural and underserved regions.

3.2. Scheme for Creation of Infrastructure for Agro-Processing Clusters (APC)

Launched in May 2017 under the Pradhan Mantri Kisan SAMPADA Yojana (PMKSY), the Agro-Processing Cluster (APC) Scheme is designed to promote modern, demand-driven agro-processing infrastructure near production zones. Implemented by the Ministry of Food Processing Industries (MoFPI), the scheme provides grant-in-aid ranging from 35% to 50% (up to ₹10 crore per cluster) to support the development of integrated facilities such as processing units, cold chains, and packaging centers. By clustering at least five food-processing units, the scheme seeks to reduce post-harvest losses and minimize farm-gate wastage.

The APC Scheme aims to enhance value addition, improve price realization for farmers, and create sustainable rural employment by linking producers directly to processors and markets. Through this cluster-based approach, the scheme encourages private investment in food processing while strengthening local value chains and increasing the competitiveness of India's agro-based economy.

Objectives

- Develop Basic Enabling Infrastructure Roads, power, water supply, and drainage to support cluster operations.
- Establish Core/Common Facilities Warehouses, cold storages, sorting/grading lines, tetra-pack/retort units, and effluent treatment plants.
- Aggregate Processing Capacity Encourage at least five independent yet co-located units with a minimum combined investment of ₹25 crore.

- Promote Inclusive Growth Provide higher subsidy rates for clusters in North-East, Himalayan, tribal, and island regions, and for SC/ST-promoted projects.
- Reduce Post-Harvest Losses Leverage modern preservation and packaging to cut wastage by an estimated 15-20 percent.
- Boost Farmers' Incomes Through organized procurement linkages, enabling fair prices and timely off-take.

Pattern of Assistance

Grant-in-Aid (Capital Subsidy): 35 percent of eligible project cost (General Areas) up to ₹10 crore.

50 percent in Difficult Areas (North-East, Himalayan, ITDP-notified), island UTs, and for SC/ST entrepreneurs up to ₹10 crore.

- **Eligible Expenditure:** Plant and machinery, core civil works, utilities (capped at 25 percent of project cost).
- **Land Requirement:** Minimum 10 acres (General Areas), 5 acres (urban/municipal locations), on 50-year lease or ownership basis.
- **Cluster Composition:** Minimum five food-processing units with individual ownership and a combined minimum investment of ₹25 crore.

Benefits

- Capital De-Risking: Up-to ₹10 crore grant reduces upfront investment barrier.
- Modern Technology Adoption: Access to IQF tunnels, cold chains, tertiary packaging, ETPs, and automation.
- Economies of Scale: Shared infrastructure lowers unit processing cost by 15-25 percent.
- Employment Generation: Each APC is expected to generate 200-300 direct and 500-700 indirect jobs.
- Market Linkages: Integration with Mega Food Parks, retail chains, and exporters ensures reliable off-take.
- Regional Development: Priority funding for backward, tribal, and hill regions spurs equitable growth

Implementation Highlights

- The Independent Management Advisory Committee (IMAC) has approved over 40 APC proposals worth ₹1,200 crore, leveraging private investment of ₹2,800 crore and creating employment for 12,000 persons across five States.
- Special-purpose vehicles (SPVs) comprising local entrepreneurs, FPOs, cooperatives, banks, and state agencies manage cluster operations.
- An online Sampada portal streamlines applications, approvals, and fund disbursement enabling 80 percent of grants to be released within 60 days of project commissioning.

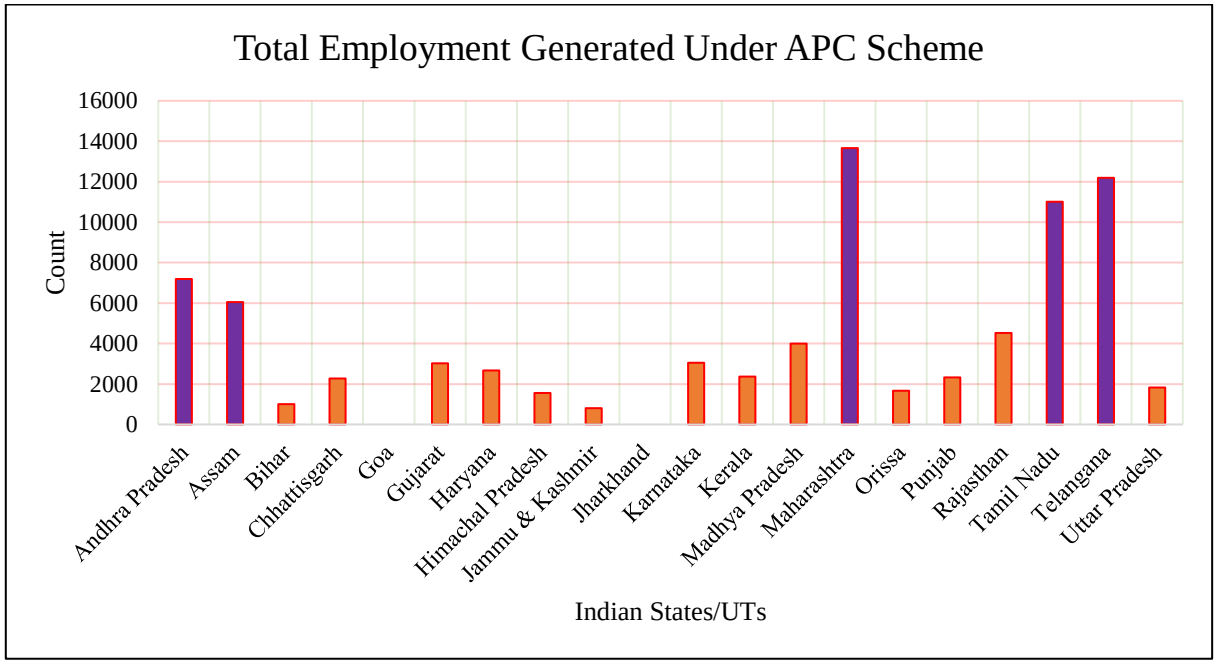


Fig. 5: State wise Total Employment Generation under Agro-Processing Clusters (APC) Scheme (till 31st October 2024)

Under the Agro Processing Cluster (APC) Scheme, the Ministry of Food Processing Industries (MoFPI), Government of India, has facilitated the development of agro-based industrial clusters aimed at improving infrastructure, value addition, and employment generation in rural areas. The scheme has played a vital role in boosting agri-processing capacity and strengthening farm-to-market linkages across multiple states.

A total of 20 states have reported employment generation under the APC scheme, with a combined impact across the country. Maharashtra led in employment generation with 13,662 jobs, followed by Telangana (12,192) and Tamil Nadu (11,010), reflecting strong cluster-based development in these states. Other notable contributors include Andhra Pradesh (7,190), Assam (6,050), and Rajasthan (4,523).

Conversely, states like Goa and Jharkhand reported zero employment, suggesting pending implementation or lack of cluster development under the scheme in these regions. This asymmetry points to the need for strategic interventions and state-level facilitation to promote inclusive benefits from the APC scheme nationwide. Overall, the APC Scheme has demonstrated considerable potential in fostering agro-industrial growth and rural employment, but uneven performance across states highlights the importance of improved outreach, capacity building, and monitoring for achieving its full impact.

3.2.1. ANOVA performed for APC Scheme by Setting Districts into Different Zones

Initially, an ANOVA test is conducted on the Agro-Processing Clusters (APC) scheme to evaluate differences in total employment across districts; however, the results indicated no statistically significant variation. Upon further examination of the distribution, a Q-Q plot revealed noticeable skewness in the data Weine et al. (2023). To address this, a logarithmic transformation is applied to the total employment figures, which successfully corrected the skewness and brought the distribution closer to normality. Following this transformation, a second ANOVA is performed, which revealed significant differences in the log-transformed employment data across districts. Subsequently, a Tukey HSD post-hoc test is conducted, treating each district as a separate zone, to identify specific inter-district differences at both 5% and 1% significance levels.

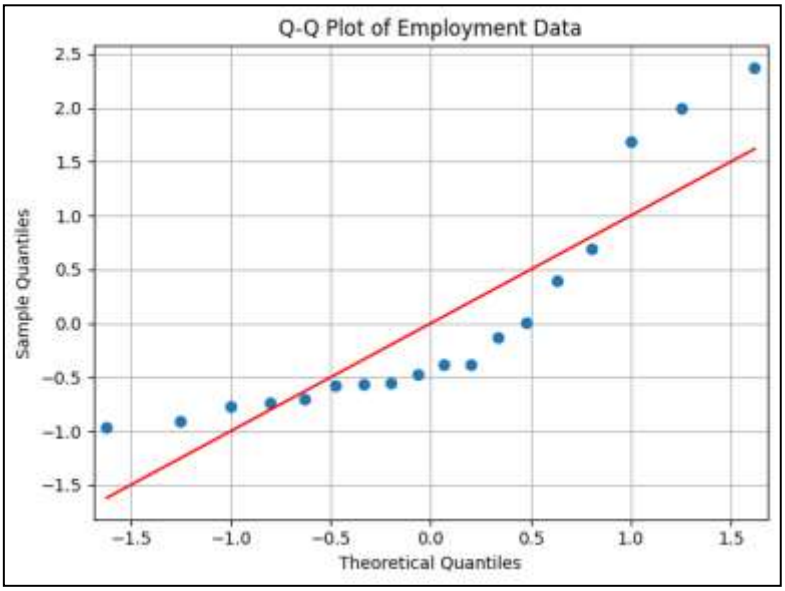


Fig. 6: Q-Q Plot to Identify Skewness for Total Employment Generated Under APC Scheme till (31st October 2024)

The calculated skewness of 1.27 indicates that the distribution of total employment is positively skewed, meaning it has a long right tail. This suggests that while most districts have relatively low employment figures, a few districts exhibit exceptionally high employment, pulling the distribution to the right. Such skewness can violate ANOVA assumptions, highlighting the need for data transformation before further analysis.

3.2.2. ANOVA Performed Using Log Transformed on Total Employment Generated under APC Scheme

After applying the logarithmic transformation to the total employment data, the skewness value reduced from 1.27 to 0.27, indicating a substantial improvement in the distribution's symmetry. This transformation effectively minimized the right-tailed skewness previously observed, thereby making the data more suitable for parametric statistical testing. The near-normal distribution achieved post-transformation is also visually supported by a Q-Q plot, reinforcing the appropriateness of the transformation for ANOVA. Following this correction, a one-way ANOVA is conducted on the log-transformed employment data across different zones (each representing a district). The results reveal a statistically significant difference in employment among the zones at the 5% significance level ($F = 4.09$, $p = 0.028$). This indicates that after addressing the skewness, the variability in employment between zones is no longer due to random chance, suggesting genuine disparities in employment distribution across the Agro-Processing Clusters.

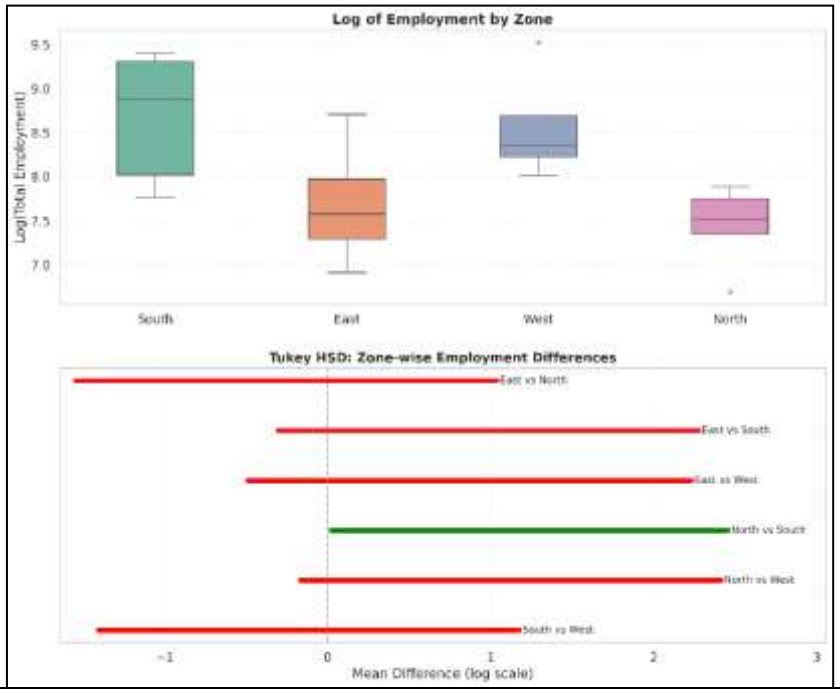
Table 3: Tukey HSD Statistical Values Per Zone at 5% Significance Level for APC Scheme

Group 1	Group 2	Mean Difference	p-value (Adj.)	Lower Bound	Upper Bound
East	North	-0.2531	0.9393	-1.543	1.0367
East	South	0.9854	0.1654	-0.3044	2.2753
East	West	0.8696	0.2886	-0.49	2.2292
North	South	1.2386	0.0453	0.0225	2.4546
North	West	1.1227	0.0982	-0.1671	2.4126
South	West	-0.1158	0.9935	-1.4057	1.174

The Tukey HSD test is used to determine which specific groups' means are significantly different after obtaining a significant result from ANOVA. It performs pairwise comparisons while controlling for the family-wise error rate. In this case, four regions East, North, South, and West are compared to assess whether their mean values differ significantly from each other. From the results, we observe that out of six possible pairwise comparisons, only one comparison (North vs. South) shows a statistically significant difference, indicated by the reject = True and a p-value of 0.0453, which is just below the conventional significance level of 0.05. The mean difference between North and South is 1.2386, with a confidence interval ranging from 0.0225 to 2.4546 importantly, this interval does not include zero, supporting the conclusion of a significant difference.

This suggests that the mean value for South is significantly higher (or lower, depending on direction) than that of North, pointing to possible regional variation in the underlying variable being measured (e.g., income, entrepreneurship, etc.). For the remaining comparisons (e.g., East vs. North, East vs. South, East vs. West, etc.), the null hypothesis is not rejected, meaning no statistically significant difference in mean values found between those regional pairs. For instance, the East vs. South comparison yielded a mean difference of 0.9854 with a p-value of 0.1654, and a confidence interval including zero (-0.3044 to 2.2753), indicating that while there appears to be a moderate difference in means, the evidence is not strong enough to be deemed statistically significant. Similarly, South vs. West had the smallest mean difference (-0.1158) and the highest p-value (0.9935), clearly indicating a lack of evidence for any difference.

(a)



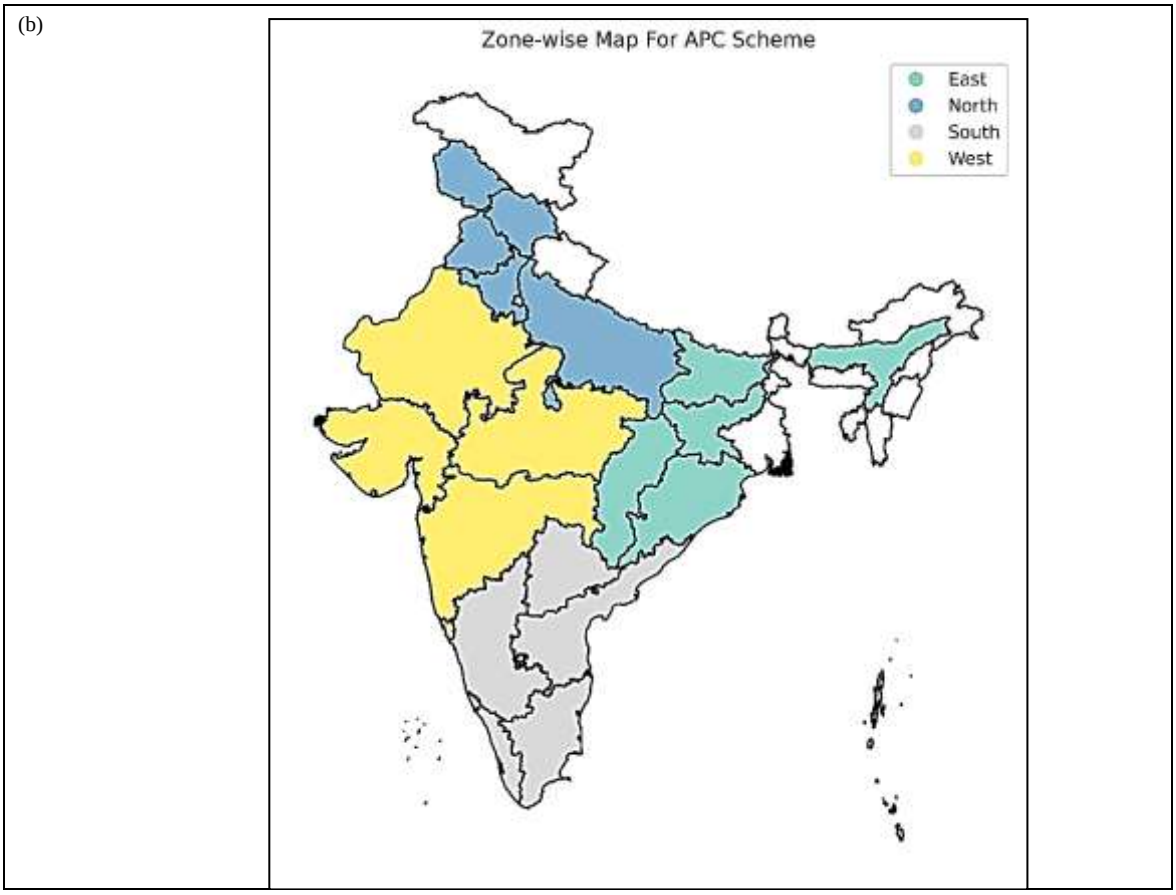


Fig. 7: (a): Box plot showing Outliers per Zone and Tukey HSD showing Significant and Non-Significant per Group, (b): PAN India Zoning for APC Scheme.

3.3. Creation/Expansion of Food Processing and Preservation Capacities (CEFPPC) Scheme

The Creation/Expansion of Food Processing and Preservation Capacities (CEFPPC) Scheme is launched in 2017 as a central sector sub-scheme under the Pradhan Mantri Kisan SAMPADA Yojana (PMKSY). Notified by the Ministry of Food Processing Industries (MoFPI) on 28 November 2017, the scheme supports the development, modernization, and expansion of food processing and preservation units across the country, with a particular focus on North-Eastern, Himalayan, tribal, and island regions.

Under this scheme, eligible projects can receive grant-in-aid of 35% to 50% of the project cost, up to a maximum of ₹5 crore per unit. By promoting infrastructure for processing and preservation, the CEFPPC scheme aims to reduce post-harvest losses, improve value addition, and enhance income opportunities for farmers and entrepreneurs in both rural and remote areas.

Aim

CEFPPC seeks to:

- **Increase processing levels** of agricultural and horticultural produce.
- **Reduce wastage** by extending shelf life through modern preservation.
- **Enhance value addition** and integrate farmers into organized supply chains.
- **Raise farm incomes** via improved market linkages and quality enhancements.

Objectives

1. Facilitate **modernization** and **capacity expansion** of individual food-processing units.
2. Promote **value chain integration** by supporting end-to-end post-harvest activities (sorting, grading, packaging, cold storage).
3. Encourage **inclusive growth** by offering higher subsidies (50% of eligible cost) for units in difficult and tribal areas, and for SC/ST entrepreneurs.
4. Strengthen **food safety** and **quality standards** through technology upgrades and Good Manufacturing Practices.

Pattern of Assistance and Eligibility (CEFPPC Scheme)

Grant-in-Aid:

1. **Up to 35% of the eligible project cost (maximum ₹5 crore) in General Areas.**

Up to 50% of the eligible project cost (maximum ₹5 crore) in North-Eastern, Himalayan, Island regions, ITDP areas, and for projects promoted by SC/ST entrepreneurs.

2. **Eligible Expenditures:**

Includes costs for plant and machinery, technical civil works, and essential utilities (utilities capped at 25% of total project cost).

3. **Eligible Beneficiaries:**

Central and State PSUs, Farmer Producer Organizations (FPOs), Cooperatives, NGOs, Self-Help Groups (SHGs), private companies, LLPs, partnerships, and sole proprietorships.

4. **Minimum Project Cost Requirement:**

₹3 crore in general areas such as clusters and mega food parks. ₹1 crore for projects in difficult regions (e.g., NE, tribal, and hilly areas) and for SC/ST-promoted units.

Key Benefits

- **Capital Subsidy:** Significant reduction in upfront investment through grants covering one-third to one-half of capex.
- **Technology Adoption:** Access to modern equipment IQF, aseptic packaging, ETPs, cold chains enhance product quality and shelf life.
- **Market Linkages:** Integration with Mega Food Parks and Agro-processing Clusters ensures economies of scale and ready markets.
- **Employment Generation:** New and expanded units create rural jobs across processing, packaging, and logistics.
- **Reduced Losses:** Specialized preservation cuts post-harvest losses by up to 20-25%.
- **Inclusive Growth:** Priority to SC/ST entrepreneurs and difficult geographies broadens participation and regional development.

Implementation and Impact

Since 2017, the scheme has:

- Approved projects worth over ₹2,700 crore under IMAC, catalyzing private investment and public-private partnerships.
- Enabled modernization of units in fruits and vegetables, dairy, meat and poultry, ready-to-eat foods, grains, spices, and specialty products.
- Spurred demand for skilled manpower in food technology, quality assurance, and cold-chain logistics.
- Laid groundwork for backward linkages with farmers, ensuring aggregated supplies and fair prices.

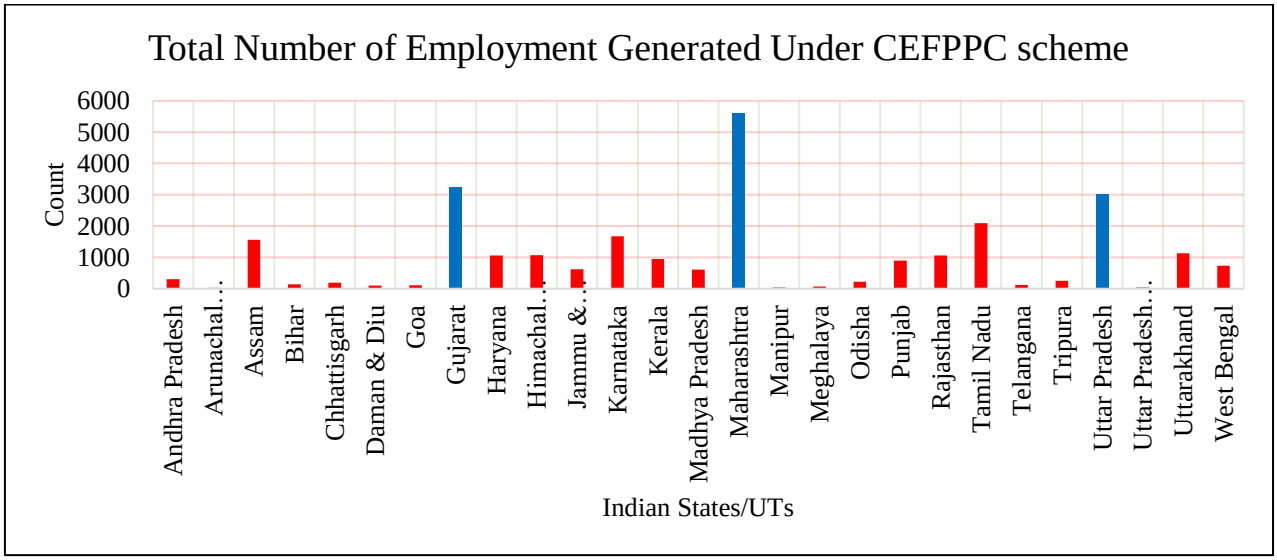


Fig. 8: State wise Total Employment Generation under Creation/Expansion of Food Processing and Preservation Capacities (CEFPPC) Scheme (till 31st October 2024)

The Comprehensive Entrepreneurship Facilitation through Pradhan Mantri Formalisation of Micro Food Processing Enterprises (CEFPPC) scheme, implemented under the Ministry of Food Processing Industries (MoFPI), aims to support individual entrepreneurs, micro enterprises, and farmer-producer organizations (FPOs) by enhancing capacity building, common infrastructure, and employment generation in the food processing sector. The employment data across Indian states and union territories under this scheme reflects varying degrees of implementation success and outreach.

Maharashtra emerged as the frontrunner under the CEFPPC scheme, generating 5,603 jobs, showcasing robust policy execution and industrial uptake. Other high-performing states include Gujarat (3,247), Uttar Pradesh (3,015), Tamil Nadu (2,093), and Karnataka (1,679) states that already possess strong agro-processing bases and industrial ecosystems conducive to CEFPPC implementation. These figures suggest that states with proactive industrial policies and infrastructure have been more successful in leveraging the scheme.

On the other hand, northeastern and smaller states like Arunachal Pradesh (25), Manipur (40), and Meghalaya (74) reported comparatively lower employment generation. This could be attributed to weaker industrial bases, limited awareness, or logistical challenges in implementation. Union Territories like Daman & Diu (100) and smaller states like Goa (110) also saw modest employment, indicating room for expansion in terms of outreach and resource allocation. Overall, while the CEFPPC scheme has shown significant potential in creating jobs and formalizing micro food enterprises across India, the wide variation in employment figures highlights the need for localized strategies. Emphasis on capacity building, financial facilitation, and infrastructure support in lagging regions can ensure balanced development and maximize the impact of this transformative initiative.

3.3.1. ANOVA performed for CEFPPC Scheme by Setting Districts into Different Zones

Similar to the analysis performed for the APC scheme, the CEFPPC scheme underwent ANOVA testing. The Q-Q plot for CEFPPC indicated a highly positively skewed distribution (Skewness: 2.09), prompting a log transformation to normalize the data before further statistical testing. Shown in Fig. 8(a). After applying a log transformation to the CEFPPC scheme data, the skewness reduced significantly from 2.09 to -0.31, indicating the distribution became approximately symmetric and suitable for parametric testing. The ANOVA results post-transformation reveal a statistically significant difference in the scheme's implementation across different zones at the 5% significance level (p-value = 0.043). The F-value of 3.20 suggests that the variation between zone means is greater than the variation within zones. This confirms that geographical location has a notable impact on the CEFPPC scheme's outcomes. Such findings emphasize the need for region-specific strategies to ensure more balanced implementation. Overall, data transformation improved normality and allowed for valid inference. The pairwise comparison results reveal that there is a statistically significant difference between the East and North regions (p = 0.0443), with East having a higher mean. However, no significant differences are found between any of the other regional pairs, as their p-values are well above conventional significance thresholds and their confidence intervals included zero. This suggests that, except for East vs North, regional differences are not strong enough to be considered statistically meaningful as shown in table 4.

Table 4: Tukey HSD Statistical Values Per Zone at 5% Significance Level for CEFPPC Scheme

Group 1	Group 2	Mean Difference	p-adj	Lower Bound	Upper Bound
East	North	1.8786	0.0443	0.0378	3.7194
East	South	1.3319	0.2575	-0.6162	3.28
East	West	1.4112	0.1752	-0.4296	3.252
North	South	-0.5467	0.8889	-2.6616	1.5682
North	West	-0.4674	0.9166	-2.4839	1.5491
South	West	0.0793	0.9996	-2.0356	2.1942

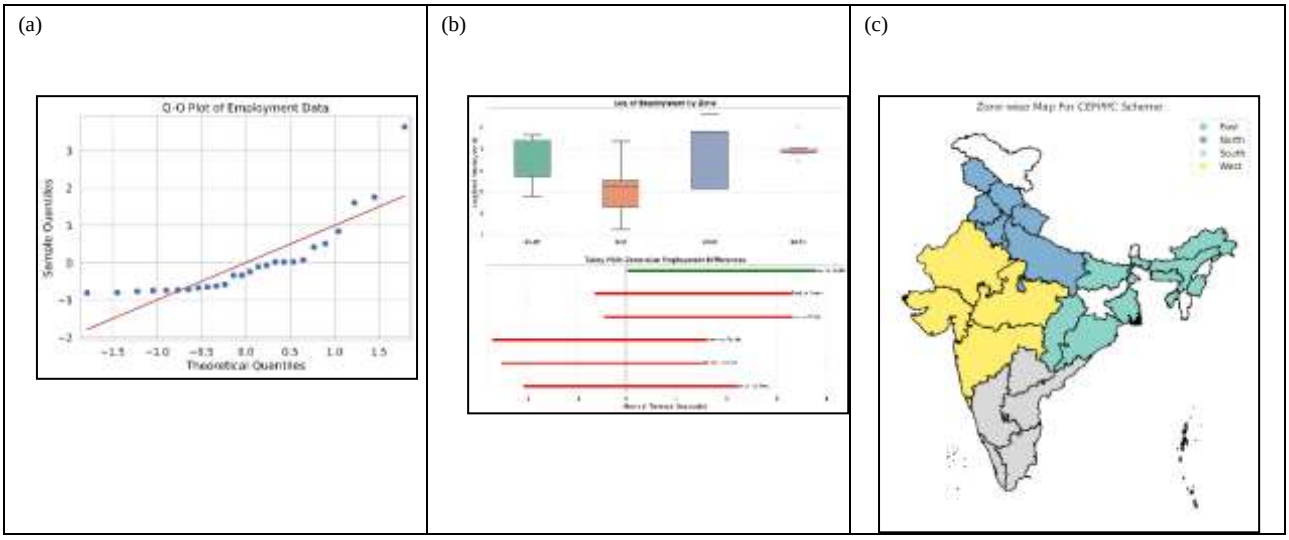


Fig. 9: (a): Q-Q Plot showing skewness in CEFPPC employment generation, (b): Box plot and Tukey HSD for CEFPPC showing outliers and Significant zones and (c): PAN India Zoning for CEFPPC Scheme.

Conclusion

The implementation of the PMFME (Pradhan Mantri Formalisation of Micro Food Processing Enterprises) scheme has significantly contributed to employment generation and the empowerment of marginalized communities across India. In the PMFME scheme, states like Maharashtra (64,668), Uttar Pradesh (53,465), and Bihar (46,066) recorded the highest employment figures, highlighting strong program outreach in densely populated and industrially active regions. Notably, the scheme also provided inclusive support to Scheduled Caste (SC) and Scheduled Tribe (ST) beneficiaries Maharashtra (1,647 SC and 1,181 ST), Madhya Pradesh (497 SC and 873 ST), and Telangana (888 SC and 460 ST) stood out for equitable beneficiary distribution. This indicates the scheme's success in targeting traditionally disadvantaged groups, especially in tribal-dominated regions like Jharkhand, Odisha, and Chhattisgarh. The data from APC (Agro Processing Clusters) and CEFPPC (Creation of Infrastructure for Agro Processing Clusters) schemes clearly reflects their growing impact on employment generation and agro-industrial development across states. In the APC scheme, major employment contributors include Maharashtra (13,662), Telangana (12,192), and Tamil Nadu (11,010), highlighting the industrial maturity and infrastructure-readiness of these states. Meanwhile, states like Jharkhand and Goa show zero reported employment, pointing toward a need for improved outreach or infrastructural facilitation. In the CEFPPC scheme, Maharashtra (5,603), Gujarat (3,247), and Uttar Pradesh (3,015) lead in employment generation, emphasizing their role as emerging agro-industrial hubs. States such as Haryana, Tamil Nadu, and Karnataka also report over 1,000 jobs each, indicating a widespread yet regionally concentrated impact. However, some Northeastern and smaller states report limited employment, indicating potential for targeted support. Together, both schemes reflect a gradual but strategic transformation in India's rural agro-economy through cluster-based industrial interventions. Also, in the CEFPPC scheme, East vs North zones exhibited a notable difference, while in APC, North vs South showed contrast. Most other comparisons are statistically insignificant. These outcomes reflect uneven impact distribution, highlighting the need for tailored policy strategies to promote inclusivity and balanced growth across zones and social categories.

Suggestions

1. Strengthen Implementation in Low-Performing States: Focused outreach, infrastructure investment, and capacity building are needed in states like Jharkhand, Goa, and certain Northeastern regions where employment generation is negligible.
2. Promote Inter-State Best Practices: States like Maharashtra, Telangana, and Tamil Nadu should be used as case studies to replicate successful models of agro-processing cluster development in other states.
3. Enhance Skill Development: Partner with skill development missions to train local populations in food processing and packaging, thereby aligning workforce readiness with cluster development.
4. Encourage MSME Participation: Simplify regulatory procedures and offer financial incentives to attract micro and small enterprises in agro-processing sectors, particularly in underperforming regions.
5. Leverage ODOP and MFP Synergies: Integrate One District One Product (ODOP) with existing CEFPPC/APC clusters to enhance product specialization and market linkage.
6. Improve Monitoring and Evaluation Mechanisms: Create a real-time dashboard to track project progress, fund utilization, and employment metrics for greater transparency and impact assessment.

7. Support Infrastructure in Backward Areas: Invest in rural logistics, cold chains, and processing facilities to make these schemes viable and attractive for investors in less-developed regions.

Compliance with ethical standards

This study adheres to ethical research standards, ensuring integrity, transparency, and accountability throughout the analysis. No human or animal subjects are involved, and all data used are secondary and publicly available.

Acknowledgement

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References

1. https://www.indialaw.in/blog/civil/food-processing-cefppc-scheme-pmksy/
2. Ministry of Food Processing Industries, PIB Press Release on Financial Assistance MoFPI, PIB Press Release on Two-Year Completion.
3. https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=97552
4. https://www.pib.gov.in/PressReleasePage.aspx?PRID=1627631
5. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2108385
6. https://archive.pib.gov.in/newsite/PrintRelease.aspx?relid=220825
7. https://rapidconsulting.in/agro-processing-cluster-apc/
8. IndiaLaw.in, CEFPPC scheme under PMKSY notified on January 22, 2025 (eligibility and operational guide)
9. Agbangba, C. E., Aide, E. S., Honfo, H., & Glèlè Kakai, R. (2024). On the use of post-hoc tests in environmental and biological sciences: A critical review. Heliyon, 10, e25131. https://doi.org/10.1016/j.heliyon.2024.e25131
10. Altman, D. G. (1990). Practical statistics for medical research. CRC Press.
11. McDonald, J. H. (2014). Handbook of biological statistics (3rd ed.). Sparky House Publishing.
12. Mishra, P., Singh, U., Pandey, C. M., Mishra, P., & Pandey, G. (2019). Application of Student's t-test, analysis of variance, and covariance. Annals of Cardiac Anaesthesia, 22(4), 407–411.
13. Wilk, M. B., & Gnanadesikan, R. (1968). Probability plotting methods for the analysis of data. Biometrika, 55(1), 1–17. https://doi.org/10.1093/biomet/55.1.1
14. Weine, E., McPeek, M. S., & Abney, M. (2023). Application of equal local levels to improve Q-Q plot testing bands with R package qqconf. Journal of Statistical Software, 106(10). https://doi.org/10.18637/jss.v106.i10