Economic Analysis of Farming Systems in Mahabubabad District of Telangana State, India

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**ABSTRACT**

The present study was conducted in Mahabubabad district of Telangana state, India during the year 2022-23 for the economic analysis of the existing farming systems in Mahabubabad district with a focus on income patterns, employment generation, enterprise contribution, and constraints to IFS adoption. Using a multistage stratified sampling technique, data were collected from 170 households categorized by landholding size into marginal, small, medium, and large farms.The findings highlight significant variations in socio-economic attributes, cropping patterns, livestock holdings, income sources, and levels of enterprise integration across farm sizes. Larger farms showed higher crop dominance, better livestock productivity, and greater income diversification potential. In contrast, marginal and small farms relied more on livestock and non-farm sources for sustenance. Integrated Farming Systems (IFS), especially those combining crop and dairy with small ruminants, generated higher employment and optimized recycling of farm by-products. However, access to credit, improved livestock breeds, and infrastructural limitations emerged as critical constraints to IFS adoption. The study suggests targeted interventions to address these constraints and enhance farm sustainability and income resilience in the region

**Key words**

Integrated Farming Systems (IFS), Crop-Livestock Integration , Farm Size Categories, Income

Diversification, Employment Generation, Resource Recycling, Economic Sustainability, Rural

Livelihoods, Farming System Constraints.

1. INTRODUCTION

Agriculture remains the principal occupation in rural India, yet smallholder farmers continue to face challenges related to income instability, fragmented landholdings, and inefficient resource utilization. In this context, the integration of crop and livestock systems, termed as Integrated Farming Systems (IFS) has been widely promoted as a means to improve farm productivity, reduce risks, and enhance income sustainability (Behera et al., 2004; Jha et al., 2003). IFS models enable more efficient use of available land, labor, and by-products, contributing to circular economy benefits at the farm level (Ravisankar et al., 2018).

In Telangana, agriculture forms the backbone of the rural economy, with Mahabubabad district characterized by small and fragmented holdings. This makes the district an ideal setting to assess how different types of farming systems, ranging from crop-only to more complex integrated systems affect income distribution, employment, and resource utilization. Previous studies have emphasized the importance of diversification for livelihood resilience, particularly for marginal and small-scale farmers (Ellis, 2000; Singh &Ramakumar, 2021).Despite various policy efforts, adoption of IFS has been uneven due to systemic constraints such as poor access to credit, inadequate infrastructure, and lack of technical support (Jha et al., 2012; Birthal et al., 2005). Understanding the current status of farming systems and the specific challenges farmers face is critical for designing appropriate interventions. Against this backdrop, the present study aims to undertake an economic analysis of the existing farming systems in Mahabubabad district with a focus on income patterns, employment generation, enterprise contribution, and constraints to IFS adoption.

Mahabubabad district lies in the central agroclimatic zone of Telangana state between170 22’ 47”, to 17055’3”N Latitude and 790 52’ 18” to 800 03’ 13” east longitude with a total geographical area of 272649 ha. Agriculture is the most predominant sector of the district economy, as 60 percent of the population is engaged in agriculture and allied activities for their livelihood.The average annual rainfall of the district is 758 mm. 80 per cent of the rainfall is received through South West Monsoon and remaining 20 per cent through North-East monsoon. The gross cropped area of the district is 194248 Ha with a total number of 188902 farm holdings.Marginal and small famers holding together constitute 91.68 per cent of the total farm holdings. Major crops of the district arePaddy, Cotton, Maize, Pulses and Chilli. The soils are broadly classified, as red, black and loamy categories and the predominant soil groups are red soils (75 %) black soils (15%) loamy soils (10%). The fertility status of the soils was low in nitrogen, medium in phosphorus and medium to high in potassium. The major constraints affecting the crop productivity are poor soil health, lack of efficient irrigation facility, low degree of farm mechanization, inadequate extension, etc.Dairy,sheep and goat rearing are the popular economic activities in rainfed areas of the district among small and marginal farmers.

1. material and methods

Multistage stratified purposive and random sampling technique was employed for the study.In first stage, Mahabubabad district of Telangana state was purposively selected for the study as it has a predominantly agricultural based economy.Nellikuduru and Bayyarammandals were purposively selected in the second stage based on the crop yield data obtained from agricultural department. In the third stage, three villages were randomly selected within each mandal. Households were then stratified by landholding size into four categories: marginal, small, medium, and large. The total sample comprised 104 marginal households,36 small households, 21 medium households, and 9 large households.Primary data were collected through structured interviews using a pre-tested questionnaire covering the 2023–2024 agricultural year. Additionally, secondary data were sourced from local agricultural offices, village records, and relevant government publications.

The collected data were analyzed using descriptive statistical tools such as averages, percentages, and ratios to interpret socio-economic conditions, enterprise-wise income distribution, and cropping patterns. Comparative analysis was used to assess differences in productivity, income levels, and employment generation across farming systems and farm size categories. Constraints faced in the adoption of Integrated Farming Systems were identified and ranked based on Garrett’s ranking technique, where respondents scored each constraint, and average scores were used to determine the severity of each issue across farm categories.

3.results and discussion

* 1. **Socio-economic dynamics of sample households**

Table 1: Socio-economic characteristics of sample households

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Category | Holding size(ha.) | Age(Yrs.) | Education (Yrs.) | Family Size (No.) | Number of farm fragments(No.) |
| Marginal | 0.49 | 39 | 5 | 5 | 1 |
| Small | 1.64 | 36 | 7 | 5.4 | 2 |
| Medium | 2.76 | 47 | 7 | 5.5 | 3 |
| Large | 4.52 | 52 | 9 | 4.9 | 4 |
| Average | 2.35 | 43.5 | 7 | 5.2 | 2.5 |

Table 1 presents the socio-economic characteristics of the sample households, categorized by landholding size. The average holding size ranged from 0.49 ha for marginal farmers to 4.52 ha for large farmers, with a sample mean of 2.35 ha. The average age of household heads increased with holding size, from 39 years in marginal households to 52 years among large-scale farmers, suggesting a possible relationship between age and farm consolidation or accumulation. Educational level followed a similar pattern, increasing from 5 years for marginal farmers to 9 years for large farmers, indicating a potential link between education and management of larger agricultural holdings . Family size was relatively uniform across groups, with a slight increase observed among medium-sized farms (5.5 members), compared to 4.9 in large farms.The number of farm fragments also increased with holding size, from 1 in marginal holdings to 4 in large holdings, mostly reflecting inheritance-related subdivision. These findings highlight the diversity in demographic and structural characteristics across different farm size categories.

**3.2 Cropping Pattern of Sample Households**

Table 2: Cropping pattern of the sample households (%)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Category of sample farm | Average holding size (ha.) | Rice | Maize | Cotton | other crops | Vegetables |
| Marginal | 0.49 | 43.36 | 22.33 | 25.35 | 8.1 | 0 |
| Small | 1.64 | 54.21 | 16.35 | 26.34 | 7.9 | 1.2 |
| Medium | 2.76 | 54.11 | 14.88 | 25.45 | 7.3 | 0.62 |
| Large | 4.52 | 55.2 | 11.91 | 27.11 | 5.2 | 0.58 |

Table 2 illustrates the percentage of land allocated to various crops including rice, maize, cotton, other crops, and vegetables across the four categories of farm households. Rice occupies the largest share of cultivated land across all categories with its share increasing from 43.36% in marginal farms to 55.2% in large farms . This positive correlation with farm size maybe attributed to the comparative advantage that larger farms possess in accessing irrigation facilities, labor-saving technologies, and government procurement systems, thereby making rice a more profitable option (Singh & Joshi, 2020). Maize cultivation shows a clear negative trend with farm size, decreasing from 22.33% in marginal farms to just 11.91% in large farms. This may be attributed to the relatively low input cost and shorter crop cycle of maize, which suit the operational and subsistence needs of smaller farms (Kumar et al., 2019).The allocation of land to cotton remains relatively stable, ranging from 25.35% to 27.11% across all farm sizes. Cotton's economic viability as a cash crop explain its consistent importance across different scales of farming operations (Deshpande & Reddy, 2018). Land devoted to other crops and vegetables tends to be higher among marginal and small farms. Small farms allocated 1.2% of their land to vegetables, compared to only 0.58% in large farms. This may indicate a greater emphasis on crop diversification for risk mitigation and household consumption among smallholders (Rao et al., 2021). The data indicated a trend toward crop specialization in larger farms, particularly in rice and cotton. In contrast, marginal and smallholders exhibit greater diversification, likely due to economic vulnerability and a need to balance income and subsistence.

## 3.3 Predominant Farming Systems by Farm Size

The distribution of predominant farming systems practiced across different farm sizes is presented in Table 3amd figure1. Four major systems were identified: Crops only, Crop + Dairy, Crop + Dairy + Goatery, and Crop + Dairy + Sheep. The prevalence of each system varies notably with farm size, reflecting the influence of land availability, labour, and resource access on diversification choices. Among marginal farmers, the dominant system is crop-only (49%), followed by crop + dairy (32%). A smaller percentage of marginal farmers engage in more diversified systems such as crop + dairy + goatery (9.61%) and crop + dairy + sheep (8.65%). This pattern suggests limited capacity to manage livestock intensively or diversify due to land and capital constraints.For small farms, crop-only systems remain predominant (58%), but there is slightly more engagement in crop + dairy + sheep (13%) and crop + dairy + goatery (11%). Medium and large farms, on the other hand, show a trend towards higher integration of livestock, especially dairy combined with goatery or sheep, with large farms particularly having 44% under crop + dairy and 22% each under the two more complex mixed systems.

At the overall level, the most common farming system is crop-only (47%), followed by crop + dairy (30%), crop + dairy + goatery (11%), and crop + dairy + sheep (10%). This highlights that while crop cultivation forms the base of most farming systems, livestock—particularly dairy—is a significant component of integrated systems, especially on larger farms, corroborating trends noted in mixed farming literature (Jha et al., 2003; Singh &Ramakumar, 2021).

Table 3:Predominant farming systems on the sample farms

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Farming system /**  **Category of sample farm** | **Marginal** | **Small** | **Medium** | **Large** | **Over all** |
| CROPS | 51  (49) | 21  (58) | 07  (33) | 2  (22) | 81  (47) |
| CROP+DAIRY | 34  (32) | 6  (16) | 07  (33) | 4  (44) | 51  (30) |
| CROP+DAIRY+GOATERY | 10  (9.61) | 4  (11) | 4  (19) | 2  (22) | 20  (11) |
| CROP+DAIRY+ SHEEP | 9  (8.65) | 5  (13) | 3  (14) | 1  (11) | 18  (10) |
| Total | 104  (100) | 36  (100) | 21  (100) | 9  (100) | 170  (100) |

Fig1.Prodominant farming systems on sample farms

# 3.4 Dairy Animal Holdings, Milk Production and Income from Livestock

Table 4 highlights the average number of cows and buffaloes, annual milk production per animal, and income derived from livestock across different farm size categories. The average number of dairy animals increases consistently with the size of the farm. Large farms maintain the highest average number of cows (1.24) and buffaloes (2.89), whereas marginal farms hold 0.84 cows and 0.82 buffaloes. Milk production per animal also rises with farm size, from 620–740 kg/annum on marginal and small farms to 1,180–1,260 kg/annum on medium and large farms, respectively. Consequently, income from livestock was also found to be the highest among large farms (Rs. 63,000 per annum) and lowest among small farms (Rs. 24,800 per annum). These observations indicate a strong positive correlation between herd size, milk yield, and income, particularly among medium and large farmers, possibly due to better access to resources, feed, and veterinary services. (Birthal et al., 2005; Singh et al., 2014).

Table 4:Average number of dairy animals and milk production on sample farms

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Category of sample farm | Average number of Cows (No.) | Average number of Buffaloes (No.) | Milk production/  Animal/ Annum(kg.) | Income from livestock(Rs/annum) |
| Marginal | 0.84 | 0.82 | 740 | 38000 |
| Small | 0.45 | 0.76 | 620 | 24800 |
| Medium | 0.66 | 1.64 | 1180 | 52000 |
| Large | 1.24 | 2.89 | 1260 | 63000 |

# 3.5 Income Distribution Across Farm Categories

The income structure of sample farms presented in Table 5 and figure 2 reveals considerable variation in income sources across different farm sizes. Marginal farmers reported an average annual income of Rs.1,17,481, with 39.04% derived from crop cultivation, 34.34% from livestock, and 26.60% from other sources such as wage labor or petty business. For small farmers, total income increased to Rs.1,40,273, where crop income constituted over half (53.12%) of the total, followed by livestock (25.74%) and other sources (21.12%).A significant shift is observed in medium and large farms. Medium farmers earned Rs.3,43,440 annually, with a predominant 77.04% of income from crop production, while livestock and other sources contributed 14.80% and 8.15% respectively. Similarly, large farmers had the highest average income at Rs.4,79,269, with 76.64% from crops,15.41% from livestock, and only 7.93% from other sources.It was evident that larger farms rely heavily on crop-based income, likely due to greater land holdings, mechanization, and access to market resources (Chand et al., 2011). In contrast, marginal and small farmers depend more proportionally on livestock and non-farm income for sustaining livelihoods (Birthal et al., 2005; Singh et al., 2020).

Table 5:Average Income on Sample Farms

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category of sample farm** | **Income from farming(crops)(Rs.)** | **Income from livestock(Rs.)** | **Income from other sources (wages, petty business, etc.) (Rs.)** | **Total farm income(Rs./annum)** |
| Marginal | 45874  (39.04) | 40352  (34.34) | 31255  (26.60) | 117481  (100) |
| Small | 74521  (53.12) | 36120  (25.74) | 29632  (21.12) | 140273  (100) |
| Medium | 264588  (77.04) | 50852  (14.80) | 28000  (8.15) | 343440  (100) |
| Large | 367346  (76.64) | 73900  (15.41) | 38023  (7.93) | 479269  (100) |

Fig 2.Composition of total income by farm size (Percentage)

# 3.6 Enterprise-wise Share in Farm Income

Table 6 presents the income contribution of various enterprises under different farming systems across farm size. It is observed that as farm size increases, crop dominance in income becomes more pronounced while livestock contributions decline proportionally. For marginal farms, diversified systems like Crop+Dairy+Sheep show nearly equal contributions from crop (49.33%), dairy (32.52%), and sheep (18.15%), indicating dependence on multi-enterprise income for livelihood security (Ellis, 2000). In small and medium farms, crop income becomes increasingly dominant, rising from 62.2% to 69.5%, with reducing dairy and other livestock contributions. Large farms demonstrate significant income from crops (78.2%), even in diversified systems, indicating that larger scale allows for greater investment and returns in crop (Joshi et al., 2006).

Table 6 Share of different enterprises in farm income on the sample farms (percent)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Farming system** | **Marginal** | **Small** | **Medium** | **Large** |
| CROPS | 100 | 100 | 100 | 100 |
| CROP+DAIRY(2 Nos) | 55.53+44.36 | 77.22+22.32 | 81.69+18.30 | 88.66+11.33 |
| CROP+DAIRY(2Nos)+GOATERY(4 Nos) | 51.0+40.21+14.79 | 69.90+26.1+4.0 | 74.22+22.66+3.12 | 83.56+14.20+2.24 |
| CROP+DAIRY(2 Nos)+SHEEP(4 Nos) | 49.33+32.52+18.15 | 62.20+22.14+15.66 | 69.54+18.72+11.74 | 78.2+12.80+9.0 |

**3.7Farming Systems wise Employment Generation**

The employment generation potential of different farming systems was assessed across various farm categories and presented in Table 7 and figure 3. The results clearly indicate that integrated farming systems provide significantly higher employment opportunities compared to cropping alone. There is a progressive increase in employment generation with the addition of livestock components such as dairy, goatery, and sheep rearing to cropping systems. Marginal farms recorded 49 man-days per year under sole cropping, which increased nearly fivefold to 236 man-days per year under Crop + Dairy + Sheep systems. A similar trend was observed across all farm sizes, with the highest employment generation (394 man-days/year) noted in large farms under the Crop + Dairy + Sheep system. This increase can be attributed to the year-round labor demand from livestock activities, especially in sheep and goat rearing, which require daily care and maintenance (Ramesh et al. (2013) and Singh et al. (2020). These insights advocate for promoting integrated farming models under agricultural development programs to improve rural livelihoods and tackle disguised unemployment in the agrarian sector

Table 7:Employment generation in different farming systems (Category wise)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category of sample farm/ Farming systems** | **Marginal** | **Small** | **Medium** | **Large** |
| CROPS | 49 | 84 | 146 | 190 |
| CROP+DAIRY | 159 | 187 | 205 | 310 |
| CROP+DAIRY+GOATERY | 202 | 235 | 280 | 361 |
| CROP+DAIRY+SHEEP | 236 | 241 | 289 | 394 |

Fig 3. Farm category wise emploment generation in existing farming systems

### 3.8 Recycling and Utilization of Farm By-products in Existing Farming Systems

Efficient recycling and utilization of farm by-products play a pivotal role in enhancing resource use efficiency, reducing external input costs, and improving farm income in Integrated Farming Systems. Table 8 illustrates the quantity and value of by-products recycled across various farm categoriesin the study area.The analysis reveals that farm by-product recycling is more extensive in larger farms due to the availability of more raw material and better integration of enterprises. Rice and maize straw were mainly recycled as fodder in dairy and goatery units, while Farm Yard Manure (FYM) was reused within crop enterprises to maintain soil fertility.Large farms demonstrated the highest recycling value (Rs.30,000/year), with substantial contributions from FYM (Rs.22,000/year), followed by marginal farms with the lowest value (Rs.9,500/year). This shows that larger, more integrated systems can effectively convert waste into valuable inputs, contributing to cost savings and environmental sustainability.(Ravisankar et al. (2018) and Behera et al. (2004).

Table 8: Recycling/ utilization of farm By- products in existing farming systems of house holds

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Farm enterprise | Name of Farm  By- product | Used as input in the enterprise | Quantity used (Unit/ annum) | Price  (Rs/ unit) | Value of recycled item (Rs/annum) |
| Marginal | Rice Straw | Dairy | 2000 | 1 | 2000 |
| Maize Straw | Dairy&Goatery | 500 | 1 | 500 |
| Livestock FYM | Farm | 3500 | 2 | 7000 |
|  |  |  | Total | 9500 |
| Small | Rice Straw | Dairy | 2600 | 1 | 2600 |
| Maize Straw | Dairy &Goatery | 1250 | 1 | 1250 |
| Livestock FYM | Farm | 6125 | 2 | 12250 |
|  | | | Total | 16100 |
| Medium | Rice Straw | Dairy | 2600 | 1 | 2600 |
| Maize Straw | Dairy &Goatery | 2500 | 1 | 2500 |
| Livestock FYM | Farm | 7000 | 2 | 14000 |
|  | | | Total | 18600 |
| Large | Rice Straw | Dairy | 3500 | 1 | 3500 |
| Maize Straw | Dairy&Goatery | 4500 | 1 | 4500 |
| Livestock FYM | Farm | 11000 | 2 | 22000 |
|  |  |  | Total | 30000 |

### 3.8 Major Constraints in Adopting Integrated Farming Systems

To understand the limitations in the adoption of Integrated Farming Systems (IFS), farmers were asked to rank various constraints on a scale from 1 (most severe) to 8 (least severe). The ranking pattern across farm categories—marginal, small, medium, and large—highlights critical differences in perception and experience.Availability of Credit emerged as the most critical constraint for marginal, small, and medium farmers (rank 1), indicating financial limitations are a primary hurdle in integrating diverse enterprises.**Labour** was ranked as the **most severe constraint** by large farms (rank 2), likely due to the greater scale of operations and increased labor requirements in managing multiple farm components.**Remunerative price realization** was a significant issue for marginal and medium farms, indicating market price instability and low returns deter diversification efforts.**Low yielding livestock breeds** consistently ranked among the top three constraints for small, medium, and large farms, reflecting the need for improved livestock genetics to enhance productivity.**Infrastructure and marketing facilities** were less critical but still noteworthy, especially for large farms that ranked **infrastructure as their most severe constraint (rank 8)**suggesting that large farms require better storage, processing, and transport systems to scale operations.These findings are consistent with earlier studies by **Jha et al. (2012)** and **Ravisankar et al. (2013)**, who reported that access to credit, availability of quality inputs, and infrastructural support are essential for the successful adoption and scaling of IFS models.

Table 9: Major constraints in existing farming systems on sample farms in adopting IFS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Constraints** | **Marginal** | **Small** | **Medium** | **Large** |
| Labour | 8 | 7 | 2 | 2 |
| Remunerative price | 7 | 3 | 7 | 1 |
| Low yielding livestock breeds | 6 | 8 | 8 | 7 |
| Availability of credit | 1 | 1 | 1 | 4 |
| Forage availability | 5 | 5 | 4 | 6 |
| Technical advice | 4 | 6 | 5 | 5 |
| Marketing facilities | 2 | 2 | 3 | 3 |
| Infra structure facilities | 3 | 4 | 6 | 8 |

**4.Conclusion**

The study underscores the economic significance and viability of Integrated Farming Systems (IFS) in Mahabubabad district. While crop production remains the principal income source—especially for medium and large farms—livestock plays a vital supplementary role for marginal and small farmers. IFS models incorporating dairy, goatery, and sheep not only enhance income but also generate substantial employment and facilitate efficient recycling of farm by-products. Nevertheless, widespread adoption of such systems is hindered by persistent challenges, including credit shortages, low-yielding livestock breeds, and inadequate infrastructural support. Addressing these bottlenecks through targeted policy support, capacity building, and input accessibility can help realize the full potential of IFS, contributing to more resilient and sustainable farming livelihoods in the region.

**Consent**

As per international standards or university standards, Participants’ written consent has been collected and preserved by the author(s).

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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