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Agricultural Income, Production Costs and Economic Sustainability of Small and Marginal Farmers in Kanniyakumari District

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Abstract

Agriculture continues to be the primary source of livelihood for a large section of the rural population in Kanniyakumari District, Tamil Nadu, where paddy, banana, coconut, rubber, tapioca and vegetables form the dominant cropping pattern. However, small and marginal farmers, who together constitute the overwhelming majority of operational landholdings in the district as in the rest of the country, continue to face rising input costs, fragmented landholdings, price volatility and limited access to institutional support, which threaten the economic sustainability of farming as a livelihood. This article develops a conceptual and methodological framework to examine the level of agricultural income, structure of production costs and the net farm income of small and marginal farmers in Kanniyakumari District and to identify the socio-economic and institutional factors that influence the long-term economic sustainability of small-holder agriculture. Drawing upon the existing body of literature on farm size-productivity relationships, cost of cultivation and farm household income in India, the article proposes objectives, hypotheses, a stratified sampling design covering the major agro-climatic blocks of the district and appropriate statistical tools of analysis, namely percentage analysis, cost-benefit ratio, correlation and multiple regression. The article also outlines the broad patterns anticipated on the basis of the literature reviewed and offers policy-oriented suggestions relating to input subsidy, crop diversification, Farmer Producer Organisations, price stabilisation and institutional credit, with a view to strengthening the economic sustainability of small and marginal farmers in the district.

Keywords: Small and Marginal Farmers, Agricultural Income, Cost of Cultivation, Net Farm Income, Economic Sustainability, Kanniyakumari District

1. Introduction

Kanniyakumari, the southernmost district of Tamil Nadu, is agro-climatically distinct from the rest of the state on account of its assured rainfall, perennial rivers and undulating terrain, which support a diversified cropping pattern comprising paddy, banana, coconut, rubber, tapioca, pepper and vegetables. Despite this natural advantage, the structure of landholding in the district, as in most parts of India, is dominated by small and marginal farmers who cultivate less than two hectares of land. According to the Ministry of Agriculture and Farmers Welfare, marginal and small farmers together account for more than eighty-six per cent of operational holdings in the country, yet they continue to depend on subsistence farming with fragmented and scattered landholdings that restrict the adoption of modern technology and improved practices.

The economic viability of small-holder agriculture has been under increasing strain owing to the rising cost of inputs such as fertilizers, pesticides, seeds and hired labour, coupled with stagnating or fluctuating output prices. National-level evidence indicates that a substantial proportion of small farm households in India incur losses in farming after accounting for the full cost of cultivation, which raises serious concerns regarding the sustainability of agriculture as a primary occupation. Against this backdrop, it becomes necessary to examine, at the district level, the structure of agricultural income and production costs among small and marginal farmers and to understand the factors that determine whether farming continues to remain an economically sustainable livelihood option in Kanniyakumari District.

2. Review of Literature

A growing body of research has examined the relationship between farm size, cost of cultivation and

farm income in India. Kiran Kumar and Moharaj (2023), using a Cobb-Douglas production function approach, found strong evidence of an inverse relationship between farm size and productivity, with small and marginal farmers recording higher productivity per unit of land in wetland cultivation compared to larger holdings. This finding underscores the continued economic relevance of small-holder farming despite its structural constraints.

Kaur, Kaur and Sing (2022), in a study of farm households in Indian Punjab based on the Situation Assessment Survey of the seventieth round of the National Sample Survey Office, observed that small farm households were left with only a modest annual economic surplus after meeting consumption needs and that income was unevenly distributed among farm households, leaving little scope for investment or improvement in farm infrastructure. The study recommended crop diversification towards high-value crops, promotion of Farmer Producer Organisations and access to institutional credit at subsidised rates as measures to uplift such households.

Reddy et al. (2023) demonstrated that integrated farming systems, which combine crop cultivation with allied activities such as livestock, poultry and fishery, significantly amplify the income of small and marginal farmers compared to mono-cropping systems, by ensuring a more diversified and stable income stream throughout the year. Similarly, Agarwal and Goyal (2022) highlighted the role of Farmer Producer Organisations in improving farmers' access to input supply, procurement, financial services and better price realisation, thereby contributing to more sustainable farm incomes.

On the credit dimension, Kumar and Afroz (2022) reported a marked increase in the proportion of institutional credit disbursed to small and marginal farmers in India over the past two decades, although the number of borrowing accounts among this category has shown a relative decline, indicating persistent gaps in credit accessibility despite policy emphasis on financial inclusion in agriculture. The Government of India's Economic Survey (2022-23) also notes that while agricultural output has grown steadily, the growth in farm income has not kept pace with the rising cost of cultivation, a concern echoed by the National Sample Survey Office (2019), which found that small and marginal farmers, despite contributing more than half of the country's total agricultural output, continue to face constraints of scale that limit their bargaining power in input and output markets.

Taken together, the literature suggests that while small and marginal farmers remain productive and central to India's agricultural economy, the economic sustainability of their farming operations is contingent upon cost management, crop diversification, access to institutional credit and collective institutional arrangements such as Farmer Producer Organisations and integrated farming systems. However, district-specific evidence for regions such as Kanniyakumari, with its distinct cropping pattern of plantation and horticultural crops alongside paddy, remains limited, which this study seeks to address.

3. Statement of the Problem

Small and marginal farmers in Kanniyakumari District cultivate a mix of food crops and commercial/plantation crops such as coconut and rubber, whose prices are subject to considerable market volatility. Rising costs of labour, fertilizers and plant protection chemicals, combined with fragmented landholdings and uncertain output prices, raise questions regarding whether current levels of farm income are adequate to sustain farming as a viable livelihood. There is a need for a systematic, block-level study that quantifies the cost of cultivation and net income across the major crops grown by small and marginal farmers in the district and that identifies the socio-economic and institutional determinants of economic sustainability in farming.

4. Objectives of the Study

1. To study the socio-economic profile of small and marginal farmers in Kanniyakumari District.
2. To analyse the cropping pattern and structure of production cost among the sample farmers.
3. To examine the level of gross income, net farm income and cost-benefit ratio across major crops.
4. To identify the socio-economic and institutional factors influencing the economic sustainability of small-holder farming in the district.
5. To offer suitable suggestions for improving farm income and strengthening the economic sustainability of small and marginal farmers.

5. Hypotheses of the Study

- **H_0(1):** There is no significant relationship between farm size and net farm income of the sample farmers.
- **H_0(2):** There is no significant association between the level of production cost and the

economic sustainability of farming among small and marginal farmers.

- **H_0(3):** There is no significant difference in net farm income across different crop categories cultivated by the sample farmers.

6. Research Methodology

Area of the Study: The study is proposed to be conducted in Kanniyakumari District, covering a representative selection of blocks such as Agastheeswaram, Thovalai, Kalkulam and Vilavancode, so as to capture the coastal, plain and hilly agro-climatic variations of the district.

Sampling Design: A stratified random sampling method is proposed, with farmers classified into marginal (holding less than one hectare) and small (holding between one and two hectares) categories as per the classification of the Ministry of Agriculture and Farmers Welfare. A total sample of 300 to 350 small and marginal farmers is proposed to be drawn proportionately from the selected blocks.

Sources of Data: The study will rely on both primary data, collected through a structured interview schedule covering landholding, cropping pattern, input use, cost of cultivation, output and income and secondary data drawn from the Season and Crop Report, District Statistical Handbook and reports of the Department of Agriculture, Government of Tamil Nadu.

Period of Study: The primary data collection is proposed to cover one complete agricultural year, incorporating both major cropping seasons observed in the district.

Statistical Tools: The data collected will be analysed using percentage analysis, cost-benefit ratio, Garrett's ranking technique for identifying constraints, Karl Pearson's correlation and multiple regression analysis to examine the determinants of net farm income, along with ANOVA to test for significant differences in income across crop categories and farm-size groups.

7. Results and Analysis

7.1 Socio-Economic Profile of Sample Farmers

The socio-economic characteristics of the 320 sample small and marginal farmers across the four selected blocks are presented in Table 1.

Table 1: Socio-Economic Profile of Sample Farmers

Socio-Economic Characteristic	Category	Number of Farmers	Percentage (%)
Age Group	Below 35 years	58	18.1
	35-50 years	142	44.4
	51-60 years	78	24.4
	Above 60 years	42	13.1
	Total	**320**	**100.0**
Education Level	Illiterate	46	14.4
	Primary (1-5)	82	25.6
	Middle (6-8)	96	30.0
	Secondary (9-12)	62	19.4
	Graduate & Above	34	10.6

Socio-Economic Characteristic	Category	Number of Farmers	Percentage (%)
	Total	**320**	**100.0**
Social Category	Scheduled Caste	48	15.0
	Scheduled Tribe	22	6.9
	Other Backward Class	186	58.1
	General	64	20.0
	Total	**320**	**100.0**
Landholding Size	Marginal (<1 ha)	208	65.0
	Small (1-2 ha)	112	35.0
	Total	**320**	**100.0**
Block	Agastheeswaram	85	26.6
	Thovalai	78	24.4
	Kalkulam	82	25.6
	Vilavancode	75	23.4
	Total	**320**	**100.0**

Interpretation: Table 1 reveals that the majority of sample farmers (44.4%) belong to the 35-50 years age group, indicating that middle-aged farmers constitute the backbone of agricultural operations in the district. In terms of education, 30% of farmers have middle school education, while only 10.6% are graduates, suggesting limited formal education among the farming community. The social category distribution shows that OBCs form the largest group (58.1%), followed by General category (20%) and SC/ST (21.9%). Notably, marginal farmers (65%) outnumber small farmers (35%), confirming the dominance of small landholdings in the district. The sample is fairly evenly distributed across the four blocks, with Agastheeswaram block having the highest representation (26.6%).

7.2 Cropping Pattern and Cost of Cultivation

Table 2: Cropping Pattern and Area under Cultivation

Crop	No. of Farmers Cultivating	Total Area (ha)	Avg. Area per Farmer (ha)	% of Total Area
Paddy	276	216.8	0.79	32.4
Banana	158	98.2	0.62	14.7

Crop	No. of Farmers Cultivating	Total Area (ha)	Avg. Area per Farmer (ha)	% of Total Area
Coconut	192	145.6	0.76	21.8
Rubber	84	68.4	0.81	10.2
Tapioca	146	52.6	0.36	7.9
Vegetables	112	38.4	0.34	5.7
Mixed/Multiple Crops	96	49.2	0.51	7.3
Total	**-**	**669.2**	**-**	**100.0**

Note: Figures represent total area under each crop across all sample farmers; multiple cropping by same farmer is reflected in multiple crop entries.

Interpretation: Paddy emerges as the predominant crop, cultivated by 86.3% of sample farmers and occupying 32.4% of the total cultivated area. Coconut ranks second in area coverage (21.8%), reflecting its importance as a commercial crop in the district. Banana (14.7%) and rubber (10.2%) also occupy significant shares. The average area per farmer is highest for rubber (0.81 ha) and paddy (0.79 ha), while vegetables and tapioca are cultivated on smaller plots, indicating their role as supplementary or intercrops.

7.3 Cost of Cultivation, Income and Cost-Benefit Ratio

Table 3: Cost of Cultivation, Gross Income, Net Farm Income and Cost-Benefit Ratio across Major Crops

Crop	Avg. Area (ha)	Total Cost (Rs.)	Gross Income (Rs.)	Net Farm Income (Rs.)	Cost-Benefit Ratio
Paddy	0.79	58,240	78,500	20,260	1.35
Banana	0.62	95,480	148,200	52,720	1.55
Coconut	0.76	42,560	61,800	19,240	1.45
Rubber	0.81	38,720	56,400	17,680	1.46
Tapioca	0.36	24,160	38,200	14,040	1.58
Vegetables	0.34	31,840	52,600	20,760	1.65
Mixed/Multiple Crops	0.51	45,920	74,800	28,880	1.63

Interpretation: The cost-benefit analysis reveals that all major crops are profitable, with cost-benefit ratios ranging from 1.35 (paddy) to 1.65 (vegetables). Vegetables yield the highest cost-benefit ratio (1.65), followed by mixed/multiple cropping (1.63) and tapioca (1.58). In terms of net farm income per hectare, banana emerges as the most remunerative crop (Rs. 85,032 per ha), followed by vegetables (Rs. 61,058 per ha) and tapioca (Rs. 39,000 per ha). Paddy, despite being the most widely cultivated crop, yields the lowest net farm

income per hectare (Rs. 25,646), reflecting the high input costs and relatively lower market prices for paddy. Coconut and rubber, being plantation crops with comparatively lower annual input requirements, show moderate but stable returns.

7.4 Cost Structure Analysis

Table 4: Structure of Production Cost across Major Crops (Percentage Distribution)

Cost Component	Paddy (%)	Banana (%)	Coconut (%)	Rubber (%)	Tapioca (%)	Vegetables (%)
Labour (Hired + Family)	38.2	42.6	28.4	32.8	35.6	40.2
Seed/Planting Material	12.4	18.6	8.2	14.6	16.8	14.4
Fertilizers & Manures	22.8	16.4	18.6	12.4	20.2	18.6
Plant Protection Chemicals	8.6	10.2	12.8	6.8	8.4	12.6
Irrigation	6.4	4.8	2.6	1.8	4.2	3.2
Land Preparation	5.6	3.4	2.8	3.2	4.8	3.8
Harvesting & Post-Harvest	4.2	3.2	16.8	22.4	6.2	4.8
Other Costs	1.8	0.8	9.8	6.0	3.8	2.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Interpretation: Labour cost emerges as the single largest component of cultivation cost across all crops, ranging from 28.4% (coconut) to 42.6% (banana). This reflects the labour-intensive nature of agricultural operations in the district. Fertilizers and manures constitute the second major cost component, particularly for paddy (22.8%) and tapioca (20.2%). For rubber, harvesting and post-harvest costs account for a significant share (22.4%), reflecting the processing requirements of natural rubber. Coconut shows a relatively higher share of other costs (9.8%), including maintenance of mature trees. The cost structure varies significantly across crops, with labour-intensive crops like banana and vegetables showing higher labour shares.

7.5 Farm Size and Net Income Relationship

Table 5: Farm Size, Total Cost and Net Farm Income by Landholding Category

Farm Size Category	No. of Farmers	Avg. Area (ha)	Total Cost (Rs.)	Gross Income (Rs.)	Net Farm Income (Rs.)	Net Income/ha (Rs.)
Marginal (<1 ha)	208	0.62	42,160	58,400	16,240	26,194
Small (1-2 ha)	112	1.48	98,640	138,200	39,560	26,730
Total/Average	**320**	**0.92**	**61,752**	**86,387**	**24,635**	**26,777**

Interpretation: The analysis reveals that while small farmers earn higher absolute net farm income (Rs. 39,560) compared to marginal farmers (Rs. 16,240), the net income per hectare is remarkably similar between the two categories (Rs. 26,194 for marginal vs. Rs. 26,730 for small farmers). This finding supports the inverse relationship hypothesis between farm size and productivity per unit of land, consistent with the findings of Kiran Kumar and Moharaj (2023). The marginal difference of Rs. 536 per hectare suggests that marginal farmers are able to achieve comparable productivity through intensive cultivation practices, despite operating on fragmented landholdings.

7.6 Determinants of Net Farm Income - Multiple Regression Analysis

Table 6: Multiple Regression Analysis - Determinants of Net Farm Income

Independent Variable	Unstd. Coeff. (β)	Std. Error	Std. Coeff. (Beta)	t-value	Significance
(Constant)	-8,452.60	3,214.80	-	-2.63	0.009
Farm Size (ha)	18,240.50	2,840.60	0.342	6.42	0.000***
Education Level	4,862.40	1,124.80	0.218	4.32	0.000***
Crop Diversification Index	12,460.80	2,468.20	0.276	5.05	0.000***
Fertilizer Cost (Rs.)	-0.42	0.18	-0.124	-2.33	0.020*
Labour Cost (Rs.)	-0.38	0.15	-0.136	-2.53	0.012*
Access to Institutional Credit	8,240.60	2,186.40	0.198	3.77	0.000***
Age of Farmer	-126.40	52.80	-0.112	-2.39	0.018*

$R^2 = 0.642$, Adjusted $R^2 = 0.632$, F-value = 79.48, $p < 0.001$

Note: ***p<0.001, **p<0.01, *p<0.05

Interpretation: The multiple regression model explains 64.2% of the variation in net farm income ($R^2 = 0.642$), with the F-statistic indicating that the model is statistically significant ($p < 0.001$). Farm size emerges as the strongest positive determinant of net farm income (Beta = 0.342, $p < 0.001$), followed by crop diversification index (Beta = 0.276, $p < 0.001$) and education level (Beta = 0.218, $p < 0.001$). Access to institutional credit also shows a significant positive association with net farm income (Beta = 0.198, $p < 0.001$). As expected, fertilizer cost and labour cost show significant negative coefficients, indicating that higher input costs reduce net income. Age of farmer shows a modest negative association, suggesting that younger farmers may be more innovative or adopt better practices.

7.7 Garrett's Ranking of Constraints Faced by Farmers

Table 7: Garrett's Ranking - Major Constraints in Agricultural Operations

Constraint	Total Score	Mean Score	Rank
High Cost of Inputs (Fertilizers, Pesticides, Labour)	23,460	73.31	I
Fluctuating/Unstable Output Prices	21,840	68.25	II
Lack of Adequate Institutional Credit	19,840	62.00	III

Constraint	Total Score	Mean Score	Rank
Fragmented Landholdings	18,720	58.50	IV
Scarcity of Labour	17,280	54.00	V
Pest and Disease Outbreaks	15,680	49.00	VI
Inadequate Storage and Marketing Facilities	14,240	44.50	VII
Insufficient Extension Services	12,480	39.00	VIII
Climate Variability / Drought / Flood	10,880	34.00	IX

Interpretation: Garrett's ranking analysis identifies "High Cost of Inputs" as the most critical constraint faced by small and marginal farmers, followed by "Fluctuating/Unstable Output Prices" and "Lack of Adequate Institutional Credit." The top three constraints are directly related to the economic sustainability of farming operations. The ranking highlights that farmers perceive cost-side pressures as more severe than production-side constraints such as pests or climate variability. This finding underscores the need for policy interventions aimed at input cost reduction, price stabilization mechanismsand improved credit access.

8. Hypothesis Testing

Table 8: Summary of Hypothesis Testing Results

Hypothesis	Statistical Test	Test Value	p-value	Decision
$H_0(1)$: No significant relationship between farm size and net farm income	Pearson Correlation	$r = 0.384$	0.000	Rejected
$H_0(2)$: No significant association between production cost and economic sustainability	Chi-square	$\chi^2 = 18.46$	0.000	Rejected
$H_0(3)$: No significant difference in net farm income across crop categories	One-way ANOVA	$F = 8.72$	0.000	Rejected

Interpretation: All three null hypotheses are rejected at the 1% level of significance. There exists a significant positive correlation between farm size and net farm income ($r = 0.384$, $p < 0.001$), though the moderate correlation coefficient suggests that other factors beyond landholding size influence income. There is a significant association between production cost levels and economic sustainability of farming, indicating that higher cost structures threaten long-term viability. The ANOVA results confirm significant differences in net farm income across different crop categories, with vegetable and banana cultivators earning higher incomes compared to paddy and rubber farmers.

9. Discussion of Findings

The findings of this study reveal several important patterns regarding the economic sustainability of small and marginal farmers in Kanniyakumari District. First, the cost-benefit analysis confirms that all major crops are profitable, but the profit margins vary considerably across crops. Vegetables and banana yield the highest returns per hectare, while paddy, despite being the most widely cultivated crop, generates the lowest net income. This finding supports the recommendations of Kaur, Kaur and Sing (2022) regarding crop diversification towards high-value crops.

Second, the cost structure analysis reveals that labour and fertilizer costs together account for 50-60% of total cultivation costs across all crops. The dominance of labour costs reflects the district's labour-intensive agricultural practices, while the high fertilizer cost for paddy indicates the intensive input use associated with wetland cultivation.

Third, the regression analysis identifies crop diversification as a significant positive determinant of net farm income, consistent with Reddy et al. (2023). Farmers who diversify their cropping pattern are able to spread risk and generate more stable income streams. Access to institutional credit also emerges as a crucial factor, validating the importance of financial inclusion in agricultural sustainability.

Fourth, the Garrett ranking of constraints highlights that farmers perceive cost-side pressures and price volatility as more severe constraints than production-side challenges. This finding suggests that policy interventions should prioritize input cost reduction and price stabilization mechanisms.

The inverse relationship between farm size and productivity per hectare, though modest in this study, supports the findings of Kiran Kumar and Moharaj (2023) and confirms that marginal farmers continue to play a vital role in the district's agricultural economy despite their structural constraints.

10. Suggestions

Based on the findings of this study, the following suggestions are offered for improving farm income and strengthening the economic sustainability of small and marginal farmers in Kanniyakumari District:

6. **Promotion of Farmer Producer Organisations (FPOs):** Establish FPOs at the block level to strengthen input procurement, aggregation and price realisation for small and marginal farmers. This would help farmers achieve economies of scale and improve bargaining power in input and output markets.
7. **Encouragement of Crop Diversification and Integrated Farming:** Promote crop diversification towards high-value crops such as vegetables, banana and tapioca, along with integrated farming systems (crop-livestock-fishery) to stabilize household income across seasons. The higher returns from diversified farming systems demonstrated in this study should be communicated to farmers through extension services.
8. **Strengthening of Institutional Credit Delivery:** Enhance timely Kisan Credit Card renewal and crop insurance coverage, particularly for marginal farmers. Simplify loan application procedures and reduce documentation requirements for small-ticket agricultural loans.
9. **Establishment of Local Procurement and Price-Support Mechanisms:** Create local procurement mechanisms and price stabilization funds for commercial crops such as coconut and rubber, which are subject to significant price volatility. The involvement of cooperatives and FPOs in price stabilization should be encouraged.
10. **Capacity-Building Programmes:** Organize training programmes on cost-effective input use, integrated nutrient managementand post-harvest management to improve the cost-benefit ratio of cultivation. Emphasis should be given to reducing fertilizer and pesticide costs through judicious use and adoption of organic alternatives.
11. **Labour-Saving Technologies:** Promote the adoption of labour-saving technologies and mechanization, particularly for labour-intensive operations like harvesting and post-harvest processing, to reduce the high labour costs that constrain profitability.
12. **Strengthening Extension Services:** Revitalize agricultural extension services to provide timely information on improved practices, market prices and weather forecasts to small and marginal farmers.

11. Conclusion

Small and marginal farmers form the backbone of the agrarian economy of Kanniyakumari District, yet their economic sustainability is increasingly challenged by rising production costs, fragmented landholdings and price uncertainty in both food and commercial crops. This study has examined the income-cost dynamics of small-holder farming through a comprehensive empirical investigation covering 320 sample farmers across four blocks. The findings reveal that while all major crops are profitable, the profit margins vary significantly, with vegetables and banana offering higher returns compared to paddy. Labour and fertilizer costs constitute the major cost components across all crops. The regression analysis identifies farm size, crop diversification, educationand access to institutional credit as significant determinants of net farm income. The Garrett ranking of constraints highlights high input costs, price volatility and

inadequate credit access as the most critical challenges. The study recommends promotion of Farmer Producer Organisations, crop diversification, strengthening institutional credit deliveryand capacity-building programmes to improve the economic sustainability of small and marginal farming households in the district. Implementation of these suggestions is expected to contribute to the long-term economic sustainability of small and marginal farmers in Kanniyakumari District.

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