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Cooperative models and smallholder livelihoods: A socio-economic case study of sugarcane farmers in western Maharashtra

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Abstract

Sugarcane cultivation plays a central role in shaping rural livelihoods in Maharashtra, particularly in regions where cooperative institutions have historically influenced agricultural production and marketing systems. This study examines the socio-economic dimensions of sugarcane cultivation in Ajara Taluka of Kolhapur District, with specific reference to the functioning of the Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. The research is motivated by the limited availability of micro-level empirical evidence on how cooperative structures affect income stability among smallholder farmers. A case study approach supported by a mixed-method research design was adopted, combining field-based surveys, structured interviews, and institutional data analysis. The study focuses on small and medium farmers, who constitute the majority of the farming population and whose livelihoods are predominantly dependent on sugarcane as a single cash crop. The findings indicate that the cooperative sugar factory plays a crucial role in stabilizing farmer incomes through assured procurement, remunerative pricing, and timely payments. In addition, institutional support in the form of technical guidance, input facilitation, and harvesting arrangements contributes to improved productivity and reduced market risk. The study also highlights that in the absence of such cooperative mechanisms, farmers are more likely to depend on private intermediaries, which may adversely affect their income realization. Beyond farm-level impacts, the cooperative model contributes to rural employment generation, strengthens local economic linkages, and enhances social participation among member farmers. However, challenges such as rising input costs, labour constraints, and dependence on a single crop continue to affect long-term sustainability. The study demonstrates that cooperative institutions remain critical for sustaining smallholder livelihoods in sugarcane-dominated regions and offers important insights for policy interventions aimed at strengthening farmer-centric agricultural systems and promoting inclusive rural development.

Keywords: Sugarcane cultivation, cooperative sugar factories, smallholder farmers, rural livelihoods, income stability, agricultural institutions, Western Maharashtra

Introduction

Sugarcane (*Saccharum officinarum*) is one of the most important commercial crops in India and plays a significant role in the rural economy of several states, particularly Maharashtra. The state has consistently remained among the leading producers of sugarcane due to favourable climatic conditions, irrigation facilities, and an established network of sugar factories (Government of India, 2022; Sugar Commissionerate, 2025) ^[3, 26]. Beyond its contribution to sugar production, sugarcane cultivation supports rural employment, sustains farm incomes, and strengthens linkages between agriculture and agro-based industries (Patil, 2017; Kamat, 2019) ^[24, 16].

In Maharashtra, the growth of the cooperative sugar sector has significantly shaped the structure of sugarcane farming.

Since the establishment of Asia's first cooperative sugar factory, Pravara Sahakari Sakhar Karkhana Ltd., the cooperative model has expanded widely across Western Maharashtra (Kumbhar, 2013; Kulkarni & Desai, 2018) ^[19, 17]. Under this model, farmers are not merely suppliers of raw material but also shareholders in the processing units. This structure has enabled greater farmer participation in decision-making, improved access to markets, and more stable price realization compared to purely private procurement systems (Singh, 2015; Dahatonde et al., 2025) ^[25, 5].

Kolhapur District occupies an important position in the sugar economy of the state. The district is characterized by fertile soils, relatively high rainfall, and an irrigation network that supports year-round sugarcane cultivation

(Government of Maharashtra, 2022) ^[14]. Sugar recovery rates in the district are generally high, and the presence of cooperative and private sugar factories has encouraged large-scale cultivation of cane. In many parts of Kolhapur, sugarcane is not simply a crop but the foundation of the rural production system.

Within Kolhapur, Ajara Taluka represents a distinctive agricultural region located along the western boundary of the district. The taluka receives substantial rainfall and has suitable agro-climatic conditions for sugarcane. Field observations indicate that while farmers cultivate paddy and ragi during the Kharif season primarily for household consumption, sugarcane serves as the principal cash crop for a majority of small and medium landholders. For many households, annual financial planning such as repayment of loans, educational expenses, and reinvestment in agriculture is closely tied to cane payment cycles.

The presence of the Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. has further shaped cropping decisions in the taluka. The cooperative provides assured procurement, facilitates harvesting and transport arrangements, and often pays prices aligned with or above the Fair and Remunerative Price (FRP) (Government of India, 2022) ^[3]. In addition to marketing support, the factory extends technical guidance and input-related assistance, which influence both productivity and income stability.

However, dependence on a single long-duration crop also introduces certain risks. Rising input costs, labour shortages during peak harvesting periods, and fluctuations in sugar prices affect farm profitability. Small and medium farmers, in particular, remain vulnerable to these pressures because alternative income sources are limited (Kumbhar & Gadhave, 2025) ^[18]. Understanding how cooperative institutions mediate these risks is therefore essential for assessing the broader implications of sugarcane-based rural development.

Despite a substantial body of literature examining sugarcane cultivation and the role of cooperative sugar factories in Maharashtra, most existing studies have largely focused on macro-level trends, regional production patterns, or institutional performance (Kulkarni & Desai, 2018; Kamat, 2019) ^[17, 16]. There remains a relative lack of micro-level empirical evidence that captures the livelihood dynamics of farmers within specific cooperative command areas. In particular, the relationship between cooperative institutional mechanisms such as procurement systems, pricing policies, and farmer participation and household-level income stability is not examined in sufficient detail. Moreover, recent studies have emphasized the need for localized analyses to better understand how cooperative structures influence economic resilience among smallholder farmers under changing cost and market conditions (Dahatonde *et al.*, 2025; Kumbhar & Gadhave, 2025) ^[5, 18].

In this context, the present study attempts to address this gap by examining sugarcane cultivation patterns and their livelihood implications in Ajara Taluka, with special reference to the functioning of the Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. By combining field-based evidence with institutional data, the study seeks to understand how the cooperative model influences income stability, farmer participation, and rural economic outcomes in a sugarcane-dominated region of western Maharashtra.

Objectives

1. To examine the cropping pattern in Ajara Taluka, with particular emphasis on the extent of sugarcane cultivation in comparison to food crops such as paddy and ragi, along with the agronomic practices followed by farmers.
2. To analyse the functioning of the Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. with respect to procurement practices, pricing policies, harvesting arrangements, and farmer support mechanisms.
3. To assess the degree of income dependence on sugarcane among small, medium, and large farmers, and to evaluate how cane payments influence household financial stability.
4. To identify and analyse the key operational and economic challenges faced by sugarcane growers, including issues related to input costs, labour availability, irrigation, harvesting, and transportation.
5. To evaluate the broader livelihood implications of cooperative sugarcane production, particularly in terms of employment generation, income security, and its contribution to the rural economy of Ajara Taluka.

Methodology

Study Area

The study was conducted in Ajara Taluka, located in Kolhapur District of Maharashtra, India. The region is situated in the Western Ghats and is characterized by hilly terrain, fertile river valleys, and dense vegetation. Ajara Taluka lies along the banks of the Hiranyakeshi and Chitri Rivers and is surrounded by numerous hills, which contribute to its unique microclimatic conditions. The area receives substantial rainfall, with average annual precipitation ranging between 2,500–3,000 mm, and experiences moderate temperatures ranging from 20°C to 35 °C, making it highly suitable for sugarcane cultivation. The soils in the region are predominantly alluvial and lateritic, supporting a variety of crops, including sugarcane and the locally important Ghansal paddy variety. Adequate irrigation infrastructure, including river-based channels and local water storage systems, further enhances the suitability of the region for commercial sugarcane farming.

Research Design

The study adopts a case study approach combined with field-based empirical investigation. A mixed-method framework was used to capture both quantitative and qualitative aspects of sugarcane cultivation and farmer livelihoods.

The case study design was selected to examine the relationship between agricultural production and cooperative institutional support within a specific regional setting. This approach allowed detailed understanding of local realities rather than broad generalizations.

Data Sources

Primary Data

Primary data were collected through field surveys conducted across selected villages in Ajara Taluka. The data collection process included structured interviews with sugarcane farmers belonging to small, medium, and large landholding

categories, village-level observations regarding cropping patterns, irrigation sources, and harvesting practices, and informal discussions with farmers to understand income cycles, dependence on sugarcane, and experiences related to procurement and payment. In addition, interactions were held with officials and staff of the cooperative sugar factory to obtain information regarding procurement systems, pricing policies, and farmer services. Field visits were carried out during the agricultural season and crushing period to ensure that responses reflected current production and marketing conditions.

Secondary data were obtained from

Secondary data were obtained from annual reports and official records of the cooperative sugar factory, government publications relating to Fair and Remunerative Price (FRP), district agricultural statistics, and cooperative sector reports, as well as research articles and institutional publications related to sugarcane cultivation and rural development in Maharashtra. These sources were used to cross-verify the primary findings and to situate the study within the broader regional context.

Sampling Procedure

The sampling was purposive in nature, focusing on farmers who actively cultivate sugarcane and supply cane to the cooperative factory. Efforts were made to include respondents from different villages to capture variations in landholding size, irrigation access, and production practices. The selected farmers were broadly categorized into small, medium, and large farmers in Ajara Taluka. This classification facilitated comparison of cultivation patterns, income dependence on sugarcane, and participation in cooperative activities across different farm size categories.

Data Collection Tools

Data for the study were collected using multiple tools. A structured interview schedule was used for collecting quantitative information such as area under cultivation, yield levels, input costs, and income dependence. An observation checklist was used to document field conditions, irrigation methods, and crop management practices. A discussion guide was used to record qualitative insights regarding pricing mechanisms, harvesting arrangements, and institutional support. The questions were framed in simple and clear language to ensure the reliability of responses.

Data Analysis

Quantitative data were analysed using descriptive statistical methods such as percentage distribution, tabular presentation, and category-wise comparison. These techniques were used to examine cropping structure, farmer participation, and income dependence on sugarcane cultivation.

Qualitative responses were analysed thematically to identify recurring issues related to labour availability, cost of cultivation, irrigation constraints, and payment mechanisms. The combined use of descriptive statistics and thematic interpretation provided a comprehensive understanding of the socio-economic dimensions of sugarcane farming in Ajara Taluka.

Cropping Pattern and Farmer Classification

Based on extensive field surveys across all villages of Ajara Taluka, farmers can be broadly categorized into three groups: large-scale, medium-scale, and small-scale farmers. Large-scale farmers typically possess substantial landholdings and practice crop diversification to mitigate income risks. In addition to sugarcane, they cultivate a variety of crops, including seasonal staples and horticultural crops such as cashew, as intercrops or border crops, ensuring a more stable and year-round income.

Medium and small-scale farmers, who constitute approximately 60–80% of the local farming population, generally have limited landholdings and rely heavily on sugarcane as their primary source of income. During the Kharif season, these farmers primarily cultivate paddy and ragi for household consumption, producing minimal surplus for the market.

Sugarcane, being a long-duration cash crop cultivated throughout the year, emerges as the main determinant of household income for small and medium farmers. Its cultivation not only supports family livelihoods but also represents the most significant source of financial stability in the villages of Ajara Taluka. The dependence on sugarcane is reinforced by its assured market access through cooperative sugar factories, which provide fair pricing and timely payments.

These observations underscore that, while large-scale farmers benefit from diversified cropping strategies, sugarcane remains the cornerstone of income generation for the majority of farmers, particularly small and medium landholders, highlighting the crop's central role in the rural economy of Ajara Taluka.

Impact of Sugarcane Cultivation on Farmer Livelihoods

Sugarcane cultivation plays a significant role in shaping the rural economy of Ajara Taluka. Unlike seasonal food crops, sugarcane is a long-duration commercial crop that provides comparatively stable monetary returns. In many villages of the taluka, farm households depend heavily on sugarcane income to meet expenses related to education, healthcare, housing, and agricultural reinvestment.

The crop generates both direct and indirect employment. Family labour is often engaged throughout the cultivation cycle, while additional labour is required during planting and harvesting periods. This creates seasonal wage opportunities within the village itself, reducing migration in certain cases. Farmers with irrigation facilities prefer sugarcane because of its assured market linkage through cooperative factories.

However, sugarcane cultivation also involves high input costs, including fertilizers, irrigation, labour, and transportation. Small and medium farmers, in particular, depend on timely payments from sugar factories to maintain financial stability. Thus, while sugarcane improves income potential, it also increases financial dependence on institutional support systems.

Overall, sugarcane cultivation has contributed to improved living standards in the study area, but the degree of impact varies according to landholding size, irrigation access, and institutional backing.

Role of Cooperative Sugar Factories

Cooperative sugar factories have played a significant role in

organizing sugarcane production and marketing in Maharashtra. These institutions provide a structured system for cane procurement, processing, and payment distribution. By ensuring assured purchase of sugarcane within designated command areas, cooperatives reduce farmers' dependence on private traders and market intermediaries.

The cooperative model connects agricultural production with industrial processing. Member farmers supply sugarcane to the factory and receive payments based on government-declared Fair and Remunerative Price (FRP). In several cases, factories pay amounts above the FRP depending on recovery rates and financial performance. This system improves income predictability and reduces exposure to market fluctuations.

In addition to procurement, cooperative sugar factories provide various support services. These include distribution of quality seed material, technical guidance on cultivation practices, assistance in harvesting operations, and transportation arrangements. Some factories also extend advance payments or facilitate credit through cooperative banks during the cultivation period. Such support reduces production risk and strengthens the production–processing relationship.

Employment generation is another important contribution. Cooperative sugar factories create direct employment during the crushing season and indirect employment in harvesting, loading, transport, and allied activities. This seasonal and permanent employment supports rural households beyond landholding farmers.

However, the benefits derived from cooperative sugar factories depend largely on operational efficiency, management practices, and financial discipline. Delayed payments, high operational costs, and financial mismanagement can weaken farmer confidence. Therefore, effective administration and transparency are essential for sustaining the cooperative model.

Cooperative Movement and Rural Development

The cooperative movement in Maharashtra has been closely associated with rural economic development since the mid-twentieth century. In agricultural regions, cooperatives have enabled farmers to collectively participate in production, processing, marketing, and credit systems. This collective structure has strengthened bargaining power and improved access to institutional finance.

Through democratic governance, cooperative institutions encourage farmer participation in decision-making processes. Membership-based management creates a sense of ownership among producers and promotes accountability. In many regions, cooperative sugar factories have contributed to rural infrastructure development, including roads, educational facilities, and community welfare activities through reinvestment of surplus funds.

Beyond economic gains, the cooperative movement has helped strengthen social cohesion. Collective participation has enabled farmers to negotiate with government agencies and financial institutions more effectively. The integration of agriculture with cooperative industrial units has supported localized models of rural development, particularly in sugarcane-dominated regions.

At the same time, the performance of cooperatives varies across regions. Political interference, financial constraints,

and managerial inefficiencies have affected some factories. Thus, while cooperative sugar factories have significantly contributed to rural development, their long-term success depends on sound governance, financial stability, and continued farmer participation.

Cooperative sugar factories play an important role in supporting farmers by arranging financial assistance through institutional lenders such as state cooperative banks and the National Cooperative Development Corporation. These financial institutions provide working capital and investment loans that help factories continue their procurement activities and improve infrastructure when required. Such loans are generally available at comparatively lower interest rates and may include repayment flexibility, which helps factories manage seasonal cash requirements. This financial support also enables factories to make timely payments to farmers, which is essential for maintaining trust and smooth functioning of the cooperative system. However, in recent years, there has been an increasing dependence on borrowed funds for routine operational expenses, which indicates certain financial challenges within the cooperative sugar sector.

Case Study: Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd.

Background and Establishment

The Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. was established in 1997 with the objective of integrating sugarcane growers into an organized processing and marketing system. The cooperative model emphasizes farmer participation, democratic governance, and equitable distribution of economic benefits. The factory has played a pivotal role in promoting agro-based industrialization and strengthening rural livelihoods in Ajara Taluka of Kolhapur District, Maharashtra. By linking agricultural production with industrial processing, the cooperative has emerged as a key institutional mechanism for rural development in the region.

Crushing Operations and Production Performance

During the 25th crushing season (2023–24), the factory operated for 111 days, from 14 November 2023 to 3 March 2024. A total of 264,413.158 metric tonnes (MT) of sugarcane were crushed, resulting in the production of 328,650 quintals of sugar with an average recovery rate of 12.42 percent. Of the total sugarcane procured, 158,520 MT was sourced from member and non-member farmers within Ajara Taluka, while 105,893 MT was procured from outside the taluka. The factory adopted efficient harvesting schedules and transportation management practices to ensure timely cane lifting and to minimize post-harvest losses.

Farmer Membership Structure and Participation

As per the factory records dated 31 March 2024, the cooperative had a total membership of 33,045 farmer members. These members are classified into three categories based on their level of participation in sugarcane cultivation and cane supply.

A Class Producer Members (25,328) represent active sugarcane-growing farmers who regularly cultivate and supply sugarcane to the factory during the crushing season.

These members possess full cooperative rights, including voting rights and eligibility for patronage-based benefits such as dividends, incentives, and bonuses. A Class producer members form the core income-generating group and constitute the backbone of the cooperative system. In the context of Ajara Taluka, this group plays a crucial role in sustaining rural household incomes through continuous engagement in sugarcane cultivation.

B Class Productive Members (7,551) are registered farmer members who own agricultural land suitable for sugarcane cultivation but did not supply sugarcane to the factory during the reference year. Factors such as crop failure, water scarcity, labor shortages, financial constraints, or temporary shifts to alternative crops contributed to their non-supply. Although these members retain limited cooperative rights, they do not receive full producer-linked benefits for that year. This category reflects the dynamic nature of agricultural decision-making and vulnerability to agro-climatic and economic constraints.

B Class Non-Productive Members (166) consist of members who are currently inactive in sugarcane cultivation or no longer possess productive agricultural land. This group includes retired farmers, landless members, and those who have permanently exited sugarcane cultivation. Their participation in the cooperative remains largely nominal, with restricted economic engagement.

Overall, the membership structure indicates a high proportion of active producer members, demonstrating strong farmer participation and the central role of the cooperative in sustaining sugarcane-based livelihoods in Ajara Taluka.

Farmer Participation, Area Coverage, and Extension Support

The cooperative engages farmers across a wide geographical area of Ajara Taluka under sugarcane cultivation. Field-level interactions indicate that the factory actively motivates farmers to expand and sustain sugarcane cultivation through continuous technical and institutional support. Guidance is provided through farmer meetings, expert visits, and advisory services. Former experts from the Vasantdada Sugar Institute (VSI) ^[27], Pune, along with the factory's agricultural department, advise farmers on improved agronomic practices, including variety selection, fertilizer management, irrigation scheduling, and pest control measures such as the use of light traps to manage human pest infestation.

The factory also supplies by-products such as press mud and boiler ash at subsidized rates, contributing to soil fertility improvement and enhanced sugarcane productivity. These initiatives strengthen the production–processing linkage and promote sustainable farming practices.

Labour Management and Employment Generation

The factory provides direct employment to 571 permanent and temporary workers during the crushing season and indirect employment through harvesting, transportation, loading, and allied services. Employee welfare measures include accident insurance, safety equipment, periodic medical check-ups, and skill development programs. The cooperative's commitment to labor welfare contributes to social security and income stability for rural households,

particularly landless laborers.

Sugarcane Remuneration and Price Policy

The factory follows the Fair and Remunerative Price (FRP) declared by the Central and State Governments. For the study period, the FRP was Rs. 2,866.04 per MT. Recognizing the rising costs of cultivation and transportation, the factory paid farmers Rs. 3,100 per MT, which was higher than payments offered by neighboring sugar factories. This pricing policy strengthens farmer confidence, enhances income security, and reinforces the cooperative's role in protecting farmers from market volatility. The management has also advocated for an increase in the Minimum Support Price (MSP) of sugar to Rs. 4,000–4,200 per quintal to ensure long-term viability of the sugar industry.

Farmer Development Initiatives

The cooperative undertakes several initiatives aimed at farmer capacity building, including regular field visits, training programs, and dissemination of informational materials on improved cultivation practices. The factory also addresses operational challenges related to harvesting schedules and cane supply coordination, ensuring maximum participation of member farmers in sugarcane delivery.

Ethanol Project and Diversification Strategy

To enhance economic sustainability, the factory has proposed a 105 K.L.P.D. ethanol production unit. Given rising production costs and fluctuating sugar prices, diversification beyond sugar production has become essential. Although central government approvals have been obtained, environmental and statutory clearances are pending. Once operational, the ethanol project is expected to generate additional revenue, create employment, and strengthen the factory's contribution to rural economic development.

Impact on Rural Livelihoods and Development of Ajara Taluka

The Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. plays a central role in influencing rural livelihoods in Ajara Taluka. The high proportion of A Class producer members reflects strong farmer engagement and dependence on the cooperative for income generation. Assured market access, remunerative pricing, technical support, and employment opportunities collectively enhance income stability for farming and labor households. The cooperative also strengthens social capital through participatory governance and collective action.

Discussion

The findings of this study underscore the pivotal role of sugarcane cultivation in sustaining the livelihoods of small and medium farmers in Ajara Taluka. Consistent with previous research on the socio-economic impact of sugarcane in Maharashtra, the crop serves as the primary source of income for a majority of farmers, especially those with limited landholdings (Bhatt, Kumar, & Anuradha, 2021; Kumbhar & Gadhave, 2025) ^[1, 18]. Seasonal crops such as paddy and ragi are primarily grown for household consumption, generating minimal marketable surplus, which

highlights the dependence of these farmers on sugarcane as a long-duration cash crop.

The Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. plays a central role in mitigating market risks and enhancing income security. By ensuring assured procurement, fair pricing above government FRP, and timely payments, the cooperative reduces the vulnerability of small and medium farmers to price volatility. Additionally, the factory's initiatives in technical guidance, pest management, provision of by-products (press mud and boiler ash), and labour welfare contribute to improved agricultural productivity and social well-being. These practices demonstrate the effectiveness of cooperative institutions in promoting inclusive rural development, consistent with observations in other cooperative-based sugar regions of Maharashtra (Dahatonde *et al.*, 2025) ^[5].

The study also highlights the importance of value addition and diversification, as exemplified by the proposed ethanol project. Incorporating ethanol production can not only improve the economic sustainability of the factory but also create additional employment opportunities and promote agro-based industrialization, contributing further to rural economic growth. Strengthening irrigation infrastructure and promoting efficient harvesting techniques are equally essential to maximize yield and ensure sustainable sugarcane production in the taluka.

The importance of the present case study lies in its focus on the micro-level realities of a smallholder-dominated agrarian system, where large-scale farmers constitute only a marginal proportion of the farming population. In Ajara Taluka, rural livelihoods are predominantly shaped by small and medium farmers with limited landholdings, making their economic stability central to overall rural development. While many existing studies emphasize broader district- or state-level trends, such approaches often overlook the ground-level challenges and institutional dependencies experienced by these farmer groups. By concentrating on farmers whose livelihoods depend largely on a single commercial crop, this study provides a more nuanced understanding of income vulnerability and livelihood dynamics.

Furthermore, the case highlights the critical role of cooperative institutions in sustaining these livelihoods. The functioning of the cooperative sugar factory illustrates how assured procurement, pricing support, and institutional linkages can directly influence income stability. The findings also demonstrate that in the absence of such institutional support, farmers are likely to depend on private intermediaries, which may reduce their income and increase economic uncertainty. Therefore, this case study offers important insights into how cooperative models can shape rural development outcomes in regions where smallholder agriculture dominates, making it relevant for both policy formulation and future research.

Limitations of the Study

This study is limited to Ajara Taluka in Kolhapur District and is based mainly on field-level data and cooperative records. The findings therefore reflect the specific conditions of this region. Variations in climate, irrigation availability, institutional management, and market linkages in other sugarcane-growing areas may produce different

outcomes.

The analysis primarily uses descriptive methods and farmer responses. It does not include detailed econometric modelling or long-term time-series data. While the findings provide useful insights into local socio-economic conditions, further research using broader datasets could strengthen the conclusions.

Policy Implications

The study highlights the importance of cooperative sugar factories in stabilizing agricultural income in sugarcane-based regions. Ensuring timely implementation of Fair and Remunerative Price (FRP) policies and maintaining efficient payment systems are essential for protecting small and medium farmers from financial stress. Improving financial management within cooperative institutions can enhance their long-term sustainability. Support for value addition activities such as ethanol production and better utilization of by-products can strengthen revenue streams and reduce dependence solely on sugar sales.

In addition, strengthening irrigation infrastructure, promoting water-use efficiency, and providing technical guidance on improved cultivation practices can increase productivity while maintaining resource sustainability. Institutional arrangements for harvesting and transportation should also be streamlined to reduce delays and losses. Policy measures that integrate production, processing, and rural employment generation can contribute to balanced agricultural development in the region.

Conclusion

This study highlights the central role of sugarcane cultivation in sustaining rural livelihoods in Ajara Taluka, where the agrarian structure is predominantly composed of small and medium farmers with limited landholdings. The findings demonstrate that, in such contexts, livelihood stability is closely linked to the performance of a single commercial crop and the institutional mechanisms that support its production and marketing. The case of the Vasant Rao Desai Ajara Farmers' Cooperative Sugar Factory Ltd. illustrates how cooperative models can effectively bridge the gap between agricultural production and market access. Assured procurement, relatively remunerative pricing, and timely payments emerge as critical factors in reducing income uncertainty and strengthening the economic position of farmers.

In addition, the provision of technical guidance, input support, and organized harvesting and transportation systems enhances production efficiency and lowers operational risks. At a broader level, the cooperative system contributes to rural development by generating employment, promoting local economic linkages, and fostering participatory decision-making among farmers. The high level of farmer membership and engagement reflects the continued relevance of cooperative institutions in regions where smallholder agriculture dominates.

However, the study also underscores emerging challenges, including rising input costs, labour shortages, and increasing dependence on a single crop, which may affect long-term sustainability. Addressing these issues requires strengthening institutional efficiency, promoting diversification through value addition initiatives such as

ethanol production, and improving resource management practices, particularly in irrigation and input use. Overall, the study concludes that cooperative sugar factories remain a vital institutional framework for supporting smallholder livelihoods and advancing rural economic development in sugarcane-growing regions. Strengthening such models through sound governance, financial stability, and policy support can play a crucial role in ensuring sustainable and inclusive agricultural growth.

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Conflict of Interest

The authors declare that there are no financial, personal, or institutional conflicts of interest that could have influenced the outcomes of this study.

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