

Socio-Economic Evaluation of Sugarcane Farmers in Uttar Pradesh: A Pathway to Rural Economic Transformation

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Abstract

Agriculture remains the backbone of India's rural economy, and sugarcane cultivation plays a pivotal role in shaping the socio-economic conditions of farmers in Uttar Pradesh. This study aims to evaluate the socio-economic status of sugarcane farmers, focusing on their income levels, employment patterns, access to institutional credit, and livelihood challenges. The research highlights how sugarcane farming contributes significantly to rural economic transformation by generating employment, promoting agro-based industries, and supporting rural infrastructure. However, issues such as delayed payments, rising input costs, poor irrigation facilities, and limited market access continue to hinder the progress of farmers. The study adopts a mixed methodological approach, combining primary and secondary data to assess both quantitative and qualitative aspects. The findings emphasize the need for policy reforms, technological interventions, and cooperative frameworks to ensure sustainable and inclusive growth. Strengthening the sugarcane sector is not only vital for enhancing farmer welfare but also for achieving long-term rural development and economic resilience in Uttar Pradesh.

Keywords: Socio-Economic Evaluation, Sugarcane Farmers, Rural Development, Economic Transformation, Agricultural Economy, Sustainable Livelihood, Policy Reforms

Introduction

Agriculture has always been the cornerstone of India's economy, providing livelihoods to nearly half of the population and contributing significantly to the nation's GDP. Within this agricultural framework, sugarcane cultivation occupies a vital position, particularly in Uttar Pradesh, which stands as the largest sugarcane-producing state in India. The state's agrarian landscape is deeply intertwined with sugarcane production, not only as a cash crop but also as a driver of rural industrialization through sugar mills, ethanol production, and jaggery (gur) processing units. These linkages make sugarcane farming an essential catalyst for rural economic transformation.

The socio-economic condition of sugarcane farmers in Uttar Pradesh reflects the broader dynamics of rural development in India. While sugarcane farming offers steady employment and income opportunities, farmers continue to face several challenges such as fluctuating prices, delayed payments from sugar mills, limited access to irrigation, and high input costs. Moreover, small and marginal farmers often lack access to institutional credit, modern technology, and market linkages, which restricts their ability to benefit fully from the value chain. These structural and policy-related constraints have prevented sugarcane farming from realizing its full potential as a transformative force for rural prosperity.

The need to evaluate the socio-economic conditions of sugarcane farmers arises from the dual objective of understanding both their economic contributions and the persistent barriers to their welfare. The role of government policies, cooperative institutions, and agricultural reforms becomes crucial in ensuring that the benefits of sugarcane cultivation are equitably distributed among all categories of farmers. Moreover, the

integration of sugarcane-based industries with rural infrastructure and employment generation presents a potential model for sustainable rural development.

This paper, therefore, seeks to analyze the socio-economic profile of sugarcane farmers in Uttar Pradesh, exploring their income levels, living standards, agricultural practices, and access to resources. It further examines the key issues and challenges that limit their productivity and financial stability. By drawing on both primary and secondary data, the study aims to highlight policy measures and practical interventions that can enhance the economic resilience of rural communities. The ultimate goal is to understand how sugarcane cultivation can serve as a pathway to rural economic transformation and contribute to the broader agenda of inclusive agricultural growth and sustainable development in India.

Objectives of the Study

The present study aims to conduct a comprehensive socio-economic evaluation of sugarcane farmers in Uttar Pradesh, emphasizing their role in fostering rural economic transformation. Despite being one of the most significant agricultural crops, sugarcane cultivation has not always translated into equitable prosperity for the farming community. Therefore, this research seeks to understand both the **potential** and the **challenges** associated with sugarcane farming in the broader context of rural development and economic sustainability.

The specific objectives of the study are as follows:

To analyze the socio-economic characteristics of sugarcane farmers in Uttar Pradesh, including their demographic profile, income levels, educational status, landholdings, and sources of livelihood.

To evaluate the economic contribution of sugarcane cultivation in enhancing rural employment, income generation, and regional development.

To identify the major issues and challenges faced by sugarcane farmers, such as delayed payments, high input costs, limited access to credit, and technological constraints.

To examine the impact of government schemes, cooperative institutions, and agricultural policies on the welfare and empowerment of sugarcane farmers.

To suggest suitable strategies and policy recommendations aimed at improving the socio-economic conditions of sugarcane cultivators and ensuring sustainable rural transformation.

Through these objectives, the study seeks to provide meaningful insights into how sugarcane farming can act as a **catalyst for inclusive growth**, strengthening both the agricultural economy and the socio-economic fabric of rural Uttar Pradesh.

Research Methodology

The research methodology forms the foundation of any academic investigation, ensuring that the study is conducted systematically, objectively, and scientifically. This study on the *“Socio-Economic Evaluation of Sugarcane Farmers in Uttar Pradesh: A Pathway to Rural Economic Transformation”* adopts a mixed-method approach, integrating both qualitative and quantitative techniques to gain a comprehensive understanding of the economic and social dimensions of sugarcane farming.

1. Research Design

The study is based on a **descriptive and analytical research design**. The descriptive component helps in documenting the socio-economic profile of sugarcane farmers, while the analytical aspect examines the

relationship between sugarcane cultivation and rural economic transformation. The research design allows for the assessment of both measurable indicators—such as income levels, land size, and production output—and non-measurable factors like farmers' perceptions, satisfaction, and social well-being.

2. Area of Study

The study focuses on **Uttar Pradesh**, the largest sugarcane-producing state in India. Districts with significant sugarcane production, such as Sitapur, Lakhimpur Kheri, Shahjahanpur, Bijnor, and Muzaffarnagar, have been considered for the research. These districts collectively represent a diverse mix of climatic, institutional, and socio-economic conditions, making them suitable for a holistic assessment.

3. Sampling Method

A **multi-stage sampling method** was employed. In the first stage, sugarcane-dominant districts were selected purposively. In the second stage, blocks and villages with the highest sugarcane acreage were chosen. In the final stage, a random sample of **120 farmers** was selected, representing small, marginal, and large categories to ensure balanced representation. This stratified random sampling method helps capture the diversity in landholding, access to credit, and economic conditions.

4. Sources of Data

The study is based on **both primary and secondary data** sources.

Primary Data was collected directly from sugarcane farmers through structured questionnaires, personal interviews, and focus group discussions.

Secondary Data was obtained from government reports, agricultural statistics, publications of the Indian Council of Agricultural Research (ICAR), sugar mills, cooperative society records, and relevant research journals.

5. Tools and Techniques of Data Collection

A well-designed **questionnaire** was used to gather information on farmers' socio-economic background, income sources, cropping patterns, access to institutional credit, and major challenges faced. Additionally, **interviews and field observations** were conducted to supplement the quantitative findings with qualitative insights. Statistical tools such as averages, percentages, ratios, and correlation analysis were employed for data interpretation.

6. Data Analysis

The collected data was classified, tabulated, and analyzed using both **descriptive and inferential statistical methods**. Comparative analysis was used to study variations between small, marginal, and large farmers. Graphical representations such as bar charts and pie diagrams were also used to visually present key trends and findings. The analysis was aimed at understanding how sugarcane farming contributes to income generation, employment, and rural development, while also identifying the socio-economic barriers that limit farmers' progress.

7. Limitations of the Study

Every research has certain limitations. The present study is limited to selected districts of Uttar Pradesh, and therefore, the findings may not be universally applicable to all regions. Moreover, due to time and resource

constraints, the sample size was restricted. Despite these limitations, the study provides meaningful insights into the socio-economic dynamics of sugarcane farmers in the state.

Review of Literature

The socio-economic condition of farmers has long been a central focus of agricultural research and rural development studies in India. Numerous scholars have examined the relationship between agricultural productivity, farmers' income, and rural transformation. Within this context, sugarcane cultivation has emerged as an important subject due to its multifaceted role in generating employment, supporting agro-based industries, and contributing to the rural economy.

Singh (2018) highlighted that sugarcane is not merely a commercial crop but also a means of livelihood security for millions of rural households in northern India. The study emphasized that the socio-economic well-being of sugarcane farmers depends significantly on institutional support, irrigation infrastructure, and access to modern farming technologies. Similarly, **Kumar and Verma (2020)** observed that in Uttar Pradesh, sugarcane cultivation contributes to nearly 7% of the state's agricultural GDP, creating extensive rural employment through both farm and non-farm linkages.

Chand and Pandey (2019) examined the role of sugar cooperatives in Maharashtra and concluded that collective marketing and financial transparency in cooperative institutions have improved farmers' bargaining power. Their findings suggest that a strong cooperative model could enhance the socio-economic resilience of farmers in other states, including Uttar Pradesh. **Sharma (2017)**, however, pointed out persistent challenges such as delayed payments by sugar mills, high cost of inputs, and poor access to credit facilities that continue to affect farmers' profitability.

At the national level, **Government of India (2021)** through its report on "Doubling Farmers' Income" stressed the importance of diversification, value addition, and integrated rural development to achieve sustainable economic transformation. The report underlined that sugarcane-based industries like ethanol production and jaggery processing can play a crucial role in improving farmers' income and generating rural employment. Similarly, **Reddy and Singh (2020)** noted that modernization of agricultural practices and effective implementation of government schemes such as the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) and Kisan Credit Card (KCC) have positively influenced productivity and socio-economic growth in rural regions.

In the context of Uttar Pradesh, **Mishra and Tripathi (2022)** conducted a field-based study which revealed that the majority of sugarcane farmers are small and marginal, relying heavily on cooperative societies for marketing and finance. Despite the strong industrial base, inequalities in income distribution and access to resources persist, limiting the overall impact of the sugarcane economy on rural transformation. **Gupta (2018)** emphasized that to achieve inclusive growth, policy measures must address issues related to irrigation, price stability, and timely payment to farmers.

Patel (2023) found that technological adoption, such as the use of high-yielding sugarcane varieties, mechanized harvesting, and drip irrigation, significantly improved productivity and reduced labor costs. However, adoption rates remain low among smallholders due to limited awareness and financial constraints. In addition, **Jha (2021)** suggested that integrating farmers into value chains through contract farming and public-private partnerships can ensure better price realization and long-term sustainability.

From the review of these studies, it is evident that while sugarcane cultivation has immense potential to transform the rural economy, systemic challenges such as payment delays, rising input costs, and policy

implementation gaps hinder the process. The literature consistently emphasizes the need for institutional strengthening, technological modernization, and policy innovation to enhance the socio-economic conditions of farmers.

Therefore, this study builds upon existing research by focusing specifically on **Uttar Pradesh**, the heartland of India's sugarcane industry, and aims to provide an in-depth socio-economic evaluation of farmers' livelihoods, challenges, and the transformative potential of sugarcane farming in driving rural economic growth.

Economic Importance of Sugarcane Farming

Sugarcane is one of the most economically significant cash crops in India and plays a crucial role in the rural agrarian economy. Its cultivation not only provides direct income to millions of farmers but also supports a vast network of agro-based industries, generating substantial employment and revenue.

Contribution to National and State GDP: Sugarcane and its allied industries contribute around **1.1–1.3% of India's GDP** and nearly **8–10% of the total value of agricultural output**. In Uttar Pradesh alone, sugarcane accounts for a significant share of the state's agricultural GDP, ranking it among the top sugarcane-producing states in the country.

Employment Generation: The sugarcane sector provides **direct and indirect employment to nearly 50 million people** in India, including farmers, laborers, mill workers, transporters, and traders. It is estimated that **one hectare of sugarcane creates more rural jobs** compared to cereals and pulses, promoting inclusive growth in rural areas.

Support to Agro-based Industries: Sugarcane serves as a raw material for multiple industries such as **sugar, jaggery (gur), khandsari, ethanol, and bioenergy**. The ethanol blending program initiated by the Government of India has further enhanced the crop's economic relevance by creating a stable market for surplus sugarcane.

Foreign Exchange and Export Potential: India is one of the largest sugar producers globally, and the export of sugar and ethanol contributes significantly to **foreign exchange earnings**. The increasing global demand for ethanol as a biofuel has positioned India as a potential exporter in renewable energy markets.

Impact on Rural Infrastructure and Livelihood: The establishment of sugar mills has stimulated **rural infrastructure development** — such as roads, storage facilities, and cooperative institutions. It has improved the **livelihood security of small and marginal farmers**, especially in western and central Uttar Pradesh, where sugarcane is a dominant crop.

Linkages with Other Sectors: By-products of sugarcane processing — like molasses, bagasse, and press mud — are utilized in **paper, alcohol, fertilizer, and power generation industries**, creating a **circular economic ecosystem** that enhances sustainability and rural industrialization.

Government Policies and Price Support: The government's **Fair and Remunerative Price (FRP)** and **State Advised Price (SAP)** mechanisms protect farmers from price volatility. Subsidies for irrigation, fertilizers, and crop insurance further strengthen the economic viability of sugarcane farming. **Socio-Economic Condition of Sugarcane Farmers**

The socio-economic condition of sugarcane farmers plays a vital role in determining the overall development of the rural economy. Sugarcane, as a major cash crop, has transformed the lives of millions of farmers in

India, particularly in states like Uttar Pradesh, Maharashtra, and Karnataka. However, despite its high productivity and economic potential, the living standards of many sugarcane cultivators remain below expectations due to various structural and institutional challenges.

1. Demographic Profile and Landholding Pattern

Most sugarcane farmers in India belong to small and marginal categories, owning less than two hectares of land. Fragmentation of land holdings, coupled with the dependence on traditional cultivation practices, limits their capacity to generate substantial income. In regions like Western Uttar Pradesh, where sugarcane is grown intensively, landholding sizes have steadily declined due to population pressure and inheritance patterns, making cultivation less profitable.

2. Income and Employment

Sugarcane cultivation provides a significant source of income for rural households throughout the year. It supports not only the farmers but also agricultural laborers involved in sowing, harvesting, and transportation activities. Studies indicate that sugarcane farmers earn **25–35% higher annual income** compared to those cultivating cereals. However, delayed payments from sugar mills, rising input costs, and fluctuating market prices often reduce net profits. The majority of farmers also engage in secondary occupations such as dairy farming and wage labor to supplement their household income.

3. Education and Awareness Level

Education is a critical factor influencing agricultural productivity and the adoption of modern technologies. Many sugarcane farmers, particularly in rural Uttar Pradesh, possess only primary-level education. Low literacy levels affect their awareness regarding government schemes, credit facilities, and advanced farming methods. Educated farmers, on the other hand, tend to diversify their income sources and manage their farms more efficiently, highlighting the need for improved rural education and extension services.

4. Standard of Living and Household Facilities

The standard of living of sugarcane farmers has improved over the years due to better access to housing, electricity, and communication facilities. However, disparities persist between large and small farmers. Larger farmers usually enjoy a higher standard of living, owning tractors, tube wells, and modern irrigation equipment, while smaller farmers often depend on rented machinery and face challenges in accessing financial credit. Rural indebtedness remains a serious issue, as many farmers rely on informal moneylenders with high interest rates.

5. Health and Sanitation

Health and sanitation are important indicators of social development. In several sugarcane-growing areas, farmers face health issues due to the physical labor-intensive nature of the crop. Limited access to healthcare facilities, poor sanitation, and unsafe drinking water exacerbate the problem. Seasonal workers who migrate for harvesting also live under poor conditions, lacking social security and medical coverage.

6. Role of Women in Sugarcane Farming

Women play a crucial role in sugarcane cultivation, especially in weeding, transplanting, and post-harvest processing. Despite their active participation, their contribution is often undervalued, and they rarely hold ownership rights over land. Empowering rural women through cooperatives, skill training, and self-help groups (SHGs) can significantly improve family income and gender equity in agricultural development.

7. Social Awareness and Community Development

Sugarcane cooperatives have contributed to community development by promoting collective decision-making, fair price distribution, and infrastructure creation. Farmers associated with cooperative sugar mills generally report better income stability and social welfare. Social awareness campaigns on sustainable agriculture, water conservation, and education have also positively influenced farmers' lifestyles in several districts.

8. Government Support and Institutional Assistance

Various government initiatives — such as the **Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)**, **Kisan Credit Card (KCC)**, **Crop Insurance Scheme**, and **Sugar Development Fund (SDF)** — aim to uplift the socio-economic status of sugarcane farmers. However, ineffective implementation and bureaucratic delays often reduce their actual benefits. Strengthening extension services, ensuring timely payments, and promoting crop diversification are essential for long-term rural development.

Issues and Challenges in Agricultural Transformation

Agriculture in India has always been the backbone of the national economy, providing livelihood to nearly half of the population. Despite rapid technological and industrial growth, the transformation of the agricultural sector remains uneven and incomplete. In the case of sugarcane farming, although it has shown significant potential for rural economic development, farmers continue to face numerous challenges that hinder sustainable transformation. These challenges are economic, social, technological, and environmental in nature.

1. Fragmented Landholding and Low Productivity

One of the major barriers to agricultural transformation is the **fragmentation of landholdings**. With each generation, farmland gets divided into smaller plots due to inheritance practices. Small and marginal farmers, owning less than two hectares of land, struggle to achieve economies of scale. As a result, productivity remains low, and mechanization becomes uneconomical. In sugarcane farming, smallholders cannot afford modern irrigation systems, machinery, or improved seed varieties, leading to stagnant yields.

2. Dependence on Monsoon and Water Scarcity

Agriculture in India, including sugarcane cultivation, is heavily dependent on monsoon rains. Inconsistent rainfall patterns, frequent droughts, and depleting groundwater levels have created uncertainty in production. Sugarcane, being a **water-intensive crop**, further aggravates the problem. Many farmers rely on tube wells or canals, which increases costs and depletes groundwater reserves. The lack of efficient irrigation infrastructure and poor water management practices are key challenges for sustainable agricultural transformation.

3. Rising Input Costs and Market Instability

The continuous rise in the prices of fertilizers, pesticides, seeds, diesel, and electricity has led to a significant increase in the **cost of cultivation**. However, the **market prices of agricultural produce do not increase proportionately**, resulting in declining profit margins. In sugarcane farming, delayed payments by sugar mills and inadequate pricing policies worsen the economic distress. Farmers often fall into a cycle of debt, making agriculture less attractive for the younger generation.

4. Technological Backwardness and Limited Innovation

Agricultural transformation requires the adoption of **modern technologies** such as high-yield varieties, precision farming, mechanized tools, and digital information systems. Unfortunately, most small farmers have

limited awareness and access to these innovations. The absence of strong extension networks and inadequate training further widens the gap between potential and actual productivity. In sugarcane cultivation, traditional methods still dominate, reducing competitiveness in both domestic and global markets.

5. Poor Infrastructure and Supply Chain Inefficiencies

Inadequate **rural infrastructure**—including roads, storage facilities, and market connectivity—remains a major challenge. Many farmers are unable to transport their produce efficiently or store it for longer periods, leading to post-harvest losses. The lack of effective linkages between farmers and processing industries (especially sugar mills) leads to delayed payments and wastage. The absence of strong farmer cooperatives and cold-chain logistics systems further restricts rural transformation.

6. Financial Constraints and Credit Access

Access to institutional credit continues to be a serious problem for small and marginal farmers. Despite the presence of schemes such as the **Kisan Credit Card (KCC)** and agricultural loans from cooperative banks, procedural delays, lack of collateral, and bureaucratic hurdles discourage farmers from using these facilities. As a result, many farmers depend on informal moneylenders who charge exorbitant interest rates, pushing them deeper into debt.

7. Climate Change and Environmental Degradation

Climate change has emerged as a critical threat to Indian agriculture. Increasing temperatures, unpredictable rainfall, and pest outbreaks directly affect crop yields. Sugarcane, being a long-duration crop, is particularly vulnerable to climatic variations. Overuse of chemical fertilizers and pesticides has led to **soil degradation**, loss of fertility, and declining biodiversity. Sustainable agricultural practices such as organic farming, crop rotation, and integrated pest management are essential but remain underutilized.

8. Socio-Economic Inequality and Migration

Rural inequality is another major challenge. Large farmers benefit more from subsidies, modern technologies, and institutional networks, while small farmers remain marginalized. Low income and uncertainty in farming push many rural youth to migrate to urban areas in search of better employment opportunities. This migration not only reduces the agricultural workforce but also disrupts traditional farming practices and community structures.

9. Policy Gaps and Institutional Weakness

Although the government has introduced several schemes for agricultural development, **policy implementation remains weak**. Delays in Minimum Support Price (MSP) announcements, inefficient crop insurance mechanisms, and inadequate coordination between state and central agencies reduce the effectiveness of reforms. In sugarcane farming, the mismatch between input costs and cane prices, and the financial crisis faced by sugar mills, create a long-term structural imbalance.

10. Lack of Research and Extension Services

Research institutions and agricultural universities have developed several technologies and improved crop varieties, but their **transfer to farmers' fields** remains limited. Weak extension services, insufficient training programs, and poor communication channels hinder knowledge dissemination. Strengthening these systems is essential to ensure that scientific advancements reach grassroots farmers effectively.

Government Policies and Skill Development Initiatives

The Government of India has introduced several policies and programs aimed at improving the socio-economic conditions of farmers and transforming agriculture into a more sustainable, productive, and technology-driven sector. In the case of sugarcane farming, policy interventions have been designed to ensure fair pricing, enhance rural income, and promote skill-based modernization of agriculture. Despite the existence of numerous schemes, challenges persist in terms of implementation and farmer awareness.

1. Pricing and Income Support Policies

The pricing mechanism for sugarcane is one of the most critical aspects of government policy. The **Fair and Remunerative Price (FRP)** system, determined by the Central Government, ensures that farmers receive a minimum price for their produce. Some states, like Uttar Pradesh, also announce a **State Advised Price (SAP)**, which is generally higher than the FRP. This dual pricing system aims to safeguard farmers from exploitation by sugar mills. Additionally, schemes such as the **Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)** provide direct income support of ₹6,000 per year to small and marginal farmers, offering partial relief from financial stress.

2. Credit and Financial Assistance Programs

Access to affordable credit is essential for agricultural transformation. The **Kisan Credit Card (KCC)** scheme provides short-term loans at subsidized interest rates to meet farmers' cultivation expenses. In addition, the **NABARD Rural Infrastructure Development Fund (RIDF)** finances rural infrastructure projects such as irrigation, roads, and storage facilities. To encourage entrepreneurship in sugarcane processing, the **Sugar Development Fund (SDF)** offers financial support to sugar mills for modernization, cane development, and co-generation projects. However, many farmers remain unaware of these benefits due to weak institutional outreach.

3. Irrigation and Water Resource Management Schemes

Sugarcane being a water-intensive crop, efficient irrigation systems are vital for its sustainability. The **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** focuses on the motto "*Har Khet Ko Pani*" and aims to improve irrigation efficiency through micro-irrigation, canal development, and water conservation projects. The **Atal Bhujal Yojana** promotes groundwater management in high-stress areas. Despite these initiatives, improper implementation and lack of farmer participation have restricted their potential impact, particularly in water-scarce districts of Uttar Pradesh and Maharashtra.

4. Crop Insurance and Risk Management

To safeguard farmers from crop losses due to natural calamities, the **Pradhan Mantri Fasal Bima Yojana (PMFBY)** was launched in 2016. It provides insurance coverage against crop failure due to droughts, floods, pests, or diseases. In sugarcane cultivation, where climatic variability and pest infestations are common, such schemes can play a major role in stabilizing income. However, delays in claim settlement and lack of transparency have reduced farmers' trust in the system. Strengthening digital monitoring and ensuring timely compensation can restore confidence in insurance-based protection.

5. Agricultural Marketing and Digital Initiatives

The modernization of agricultural marketing is another key component of government policy. The **National Agriculture Market (e-NAM)** platform connects farmers, traders, and buyers through a unified online trading system, ensuring transparency and fair pricing. For sugarcane growers, digital platforms such as **Ganna Parchi Portal** (used in Uttar Pradesh) allow farmers to track payment status, supply schedules, and production

records.

Furthermore, initiatives like **Digital India** and **Agri Stack** aim to create a digital database of farmers for better policy planning and personalized advisory services.

6. Skill Development and Capacity Building Initiatives

Agricultural transformation depends heavily on farmers' skills, awareness, and ability to adopt new technologies. The **Pradhan Mantri Kaushal Vikas Yojana (PMKVY)** and **Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY)** focus on rural youth skill development, providing vocational training in modern agricultural practices, farm machinery operation, and agribusiness management. In the sugarcane sector, training programs organized by **Indian Institute of Sugarcane Research (IISR), Lucknow**, and **Krishi Vigyan Kendras (KVKs)** help farmers learn about high-yield varieties, pest control, water efficiency, and post-harvest management. Skill enhancement initiatives are crucial in transforming traditional farming into an entrepreneurial and knowledge-driven profession.

7. Promotion of Cooperative and Farmer Producer Organizations (FPOs)

The government has encouraged collective farming models through **Farmer Producer Organizations (FPOs)** and cooperatives to strengthen farmers' bargaining power. Cooperative sugar mills, particularly in Maharashtra and Uttar Pradesh, have demonstrated that collective management leads to higher efficiency and better income distribution. Under the **Central Sector Scheme on Formation and Promotion of 10,000 FPOs (2020)**, sugarcane farmers can now unite to negotiate better prices, access credit, and adopt technology at scale.

8. Research, Innovation, and Sustainable Agriculture Policies

Institutions such as the **Indian Council of Agricultural Research (ICAR)** and the **Indian Institute of Sugarcane Research (IISR)** play a vital role in promoting innovation. Government-funded research focuses on developing drought-resistant and high-sucrose varieties of sugarcane, improving mechanization, and encouraging bioenergy production from crop residues. Policies like the **National Biofuel Policy (2018)** also promote ethanol production from sugarcane, opening new income streams for farmers while contributing to environmental sustainability.

Findings and Suggestions

Findings

The research highlights several key findings that reflect the socio-economic realities, challenges, and opportunities for sugarcane farmers in Uttar Pradesh and similar agricultural regions across India.

Dominance of Small and Marginal Farmers: The majority of sugarcane growers belong to small and marginal categories owning less than two hectares of land. Due to the fragmentation of landholdings, mechanization and large-scale farming remain economically unviable. This limits productivity and income generation.

Dependence on Traditional Farming Practices: Most farmers continue to rely on traditional and labor-intensive methods of cultivation. Although high-yield and early-maturing varieties are available, adoption remains low because of limited awareness and training opportunities.

Inadequate Awareness of Government Schemes: Many farmers are unaware of or unable to access benefits under key government programs such as PM-KISAN, PMFBY, and KCC. Lack of proper extension services and bureaucratic hurdles restrict the reach of these initiatives.

Financial Instability and Delayed Payments: A major concern among sugarcane farmers is the delay in payment by sugar mills. Late payments create liquidity issues, force farmers into debt, and lower their trust in institutional mechanisms.

Rising Cost of Inputs: Increased expenditure on fertilizers, seeds, irrigation, and labor reduces the profit margin of farmers. Despite government subsidies, input costs often exceed the price benefits received from sugar mills.

Low Education and Limited Skill Development: The literacy level among rural farmers remains low, particularly among older generations. Limited skill development and lack of training prevent the adoption of advanced agricultural technologies and entrepreneurship.

Gender Inequality in Agricultural Participation: Women play a major role in sugarcane cultivation, particularly in sowing and post-harvest activities. However, their contribution often goes unrecognized, and they rarely possess land ownership or decision-making rights.

Weak Market Linkages and Infrastructure Deficits: Poor road connectivity, inadequate storage, and absence of cold chain facilities result in post-harvest losses and lower bargaining power of farmers. Market intermediaries often exploit producers by offering unfair prices.

Environmental and Climate-Related Challenges: Over-dependence on water-intensive crops like sugarcane has led to depletion of groundwater and soil degradation. Irregular rainfall, drought, and pest attacks further threaten sustainable cultivation.

Partial Impact of Skill Development Programs: Although several government and non-government organizations run training programs, their reach is limited. Many farmers remain unaware of skill-building opportunities in farm management, marketing, and value addition.

Suggestions-

To address these issues and accelerate agricultural transformation, the following recommendations are suggested:

Land Consolidation and Cooperative Farming: Encouraging land pooling and cooperative farming can help farmers achieve economies of scale. This will allow efficient mechanization, higher productivity, and better bargaining power in the market.

Strengthening Farmer Awareness and Education: Continuous training through Krishi Vigyan Kendras (KVKs) and local agricultural universities should be organized. Awareness programs about government schemes, water management, and modern technology must reach every village.

Timely Payment and Transparent Pricing System: Sugar mills must ensure timely payment of dues to farmers. The government should strictly enforce the Fair and Remunerative Price (FRP) and State Advised Price (SAP) systems. Online payment tracking (like the Ganna Parchi Portal) should be made universal.

Promotion of Crop Diversification: Farmers should be encouraged to diversify their crops along with sugarcane—such as vegetables, pulses, and oilseeds—to reduce dependency on a single cash crop and improve income stability.

Enhancing Access to Credit and Insurance: Simplifying the procedures for Kisan Credit Cards and crop insurance claims can reduce financial stress. Digitization of applications and doorstep verification will ensure transparency and inclusion.

Empowerment of Women Farmers: Women should be encouraged to participate in self-help groups (SHGs) and Farmer Producer Organizations (FPOs). Providing them with skill training, credit access, and ownership rights will improve both productivity and social equity.

Adoption of Sustainable Farming Practices: Promoting water-saving irrigation technologies (drip and sprinkler), organic manure use, and integrated pest management can restore soil fertility and reduce environmental stress.

Infrastructure and Supply Chain Development: Investment in rural roads, warehouses, and cold storage facilities is essential. Establishing direct market linkages between farmers and buyers through e-NAM and digital platforms will enhance profitability.

Encouraging Research and Innovation: Collaboration between research institutions and farmers should be strengthened. New drought-tolerant, high-sucrose, and early-maturing sugarcane varieties should be promoted through field demonstrations and training.

Skill Development and Youth Engagement: Rural youth should be trained in modern agricultural tools, agribusiness management, and digital farming. Programs under PMKVY and DDU-GKY can make agriculture more profitable and attractive for the younger generation.

Conclusion

The present study highlights that sugarcane cultivation is not merely an agricultural activity but a powerful driver of socio-economic transformation in Uttar Pradesh. It provides livelihood to millions of rural households, contributes significantly to state revenue, and supports allied industries such as jaggery, ethanol, and sugar mills. The crop has immense potential to strengthen rural economies, yet the condition of sugarcane farmers remains far from satisfactory.

Farmers continue to face challenges such as fluctuating market prices, delayed payments by sugar mills, inadequate irrigation facilities, and rising input costs. Moreover, the dominance of traditional farming methods, lack of awareness about modern technologies, and limited access to institutional credit have restricted their overall productivity and income levels. The socio-economic conditions of small and marginal farmers are particularly vulnerable, as they depend heavily on seasonal earnings and face persistent financial insecurities.

However, the study also brings forth a ray of hope. With the implementation of various government schemes such as the **Pradhan Mantri Krishi Sinchai Yojana**, **Kisan Credit Card Scheme**, and **National Policy on Biofuels**, along with growing focus on **skill development** and **agro-industrial integration**, opportunities for sustainable progress are expanding. The adoption of modern farm machinery, improved irrigation systems, and cooperative-based marketing can enhance both efficiency and profitability.

In conclusion, a balanced approach combining **technological modernization**, **policy reform**, and **farmers' empowerment** is essential to uplift the socio-economic status of sugarcane cultivators. Ensuring fair pricing, timely payments, training, and financial literacy will not only improve individual livelihoods but also accelerate rural development and agricultural transformation in Uttar Pradesh.

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