Sustainable Agriculture Policy Direction of Central Java Province by 2025

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Abstract. The agricultural sector in Central Java is essential to the regional economy, as it provides employment, supplies sustenance, and makes a substantial contribution to the Regional Gross Domestic Product (RGDP). Nevertheless, this industry encounters significant obstacles like climate fluctuation, restricted technological progress, and insufficient infrastructure. This study examines the future orientations of sustainable agricultural policies in Central Java until 2025, specifically focusing on enhancing resource efficiency, conserving the environment, and adapting to climate change. The study utilizes a qualitative descriptive methodology, which includes conducting in-depth interviews with stakeholders, analyzing policy documents, and making field observations. The data were gathered from primary and secondary sources, such as interviews, official documents, and scholarly publications. Thematic analysis techniques were employed to examine the data and uncover significant patterns and themes. The findings suggest sustainable agriculture policies include implementing intelligent irrigation technology, accepting climate-resistant high-quality seeds, and establishing organic marketplaces. Enhancing competitiveness and productivity in agriculture is contingent upon applying cutting-edge technologies and providing continuous education for farmers. The policies also stress the significance of conserving biodiversity, mitigating adverse environmental effects, and establishing a sustainable agriculture industry. In Central Java, implementing these sustainable agricultural policies is expected to boost agricultural productivity, enhance the well-being of farmers, promote food security, and preserve the environment in the long run.

Keywords: Sustainable Agriculture, Agricultural Policy, Climate Adaptation, Organic Markets

1 Introduction

The agricultural sector in Central Java plays a pivotal role in the region's economy, acting not only as a primary food provider but also as a significant driver of economic growth (Restiani & Widyastuti, 2022), (Bingawati et al., 2023). Agriculture contributes substantially to the Regional Gross Domestic Product (RGDP), employs a large portion

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of the population, and serves as the primary income source for farmers and rural communities (Mukhlis & Gurcam, 2022). Central Java's prominence in national and regional food security is evident through its status as one of Indonesia's key food producers (Iskandar et al., 2022). Furthermore, agriculture fosters social stability and aids in poverty alleviation in rural areas, where most residents rely on agricultural pursuits for their livelihoods (Suryanto et al., 2023).

Agriculture in Central Java plays a vital role in economic contributions and environmental sustainability, as highlighted in various research papers. Sustainable agricultural practices, such as organic farming, agroforestry, and soil and water conservation, are crucial for preserving biodiversity, mitigating climate change, and improving soil health (Muhaimin et al., (2023), (Rai et al., 2023). These practices reduce greenhouse gas emissions and enhance long-term productivity and food security, especially in the face of increasing climate change threats (Sukayat et al., 2023). To ensure_economic well-being and environmental preservation, local governments continue supporting and developing the agricultural sector by promoting modern technologies and sustainable practices among farmers (Al et al., 2022). Empowering farmers through education, policy support, and access to resources is essential for successfully implementing sustainable agricultural practices in Central Java.

Central Java's agriculture faces various challenges due to its diverse geographical conditions across 35 districts/cities. With a significant portion of the population dependent on this sector, attention and policy focus are necessary. According to the Central Statistics Agency (BPS), in 2023, Central Java had 4,176,270 farmers, 3,466,475 being small-scale farmers working on less than 0.5 hectares of land. Only about 2.5% of these farmers have adopted sustainable practices like organic farming and non-pesticide use. It indicates a substantial opportunity to increase the adoption of sustainable farming, which can contribute to improved productivity and farmer welfare.

Climate change significantly challenges agricultural productivity by impacting planting patterns and stability, as highlighted by (Lestari & Nugroho, 2020). The increase in climate variability leads to uncertainties in planting seasons and exacerbates the frequency and intensity of natural disasters like floods and droughts, disrupting agricultural production. Moreover, varying topography across regions, from lowlands to mountainous areas, results in diverse soil types and water availability, necessitating region-specific land management strategies. These challenges are further compounded by the depletion of water resources and a decline in agricultural production due to climate change, ultimately affecting food security and escalating global food inflation (Boas et al., 2023).

Enhancing infrastructure and accessibility in remote areas like Central Java is crucial for bolstering the agricultural sector's competitiveness. The existing infrastructure limitations negatively impact agricultural product distribution and farmers' market access. These constraints, coupled with the underutilization of technology, lead to increased transportation costs and reduced profitability. Furthermore, inadequate roads and poorly maintained irrigation systems hinder economic transformation in rural areas. As a result, these factors collectively suppress productivity and efficiency within the agricultural sector.The primary objective of this study is to investigate the policy trajectory

for achieving sustainable agriculture in Central Java by 2025. The study will specifically concentrate on optimizing resource utilization, preserving the environment, and adapting to climate change. The strategies outlined in the Regional Medium-Term Development Plan (RPJMD) and the strategic plan of the Department of Agriculture and Plantation encompass the promotion of organic farming, adopting intelligent irrigation technology, and utilizing climate-resilient superior seeds. Enhancing the competitiveness and productivity of the agricultural industry is a priority that can be achieved by improving the quality of human resources through farmer training and education.

Furthermore, it analyzes the strategic framework utilized to improve the competitiveness, human resources, and sustainability of the agricultural industry in Central Java by the year 2025. It encompasses the utilization of technology, enhancement of farmer capability, and efficient management of natural resources. The focus is on using innovative digital irrigation technology, resilient seeds, and organic and environmentally friendly farming practices.

2 Literature Review

The concept of sustainable agriculture emphasizes applying economic, environmental, and social principles to ensure that agricultural practices can meet current needs without compromising the ability of future generations to meet theirs. Velten et al. (2015) explain that sustainable agriculture involves efficiently using natural resources, maintaining biodiversity, and adopting environmentally friendly practices to minimize adverse impacts on ecosystems. Furthermore, this approach supports adopting innovative technologies and climate change adaptation measures, such as efficient water management, using renewable energy, and reducing greenhouse gas emissions (Polymeni et al., 2024). In Indonesia, sustainable agriculture empowers farmers through education and training to enhance their productivity and long-term welfare (Safiullinet al., 2020).

Policy studies on sustainable agriculture involve a comprehensive policy formulation, implementation, and evaluation analysis to assess their effectiveness and impact on society and related sectors. This study employs both qualitative and quantitative analyses to identify policy issues, evaluate various solution options, and assess policy outcomes. Dunn (2018) explains that public policy comprises actions taken by the government to address societal issues. These actions can be regulations, laws, programs, or resource allocations to guide or influence the behavior of society or specific sectors. Altobelli et al. (2024) highlight the importance of a multidisciplinary approach in policy studies because public policies often intersect with various social, economic, and political aspects.

Additionally, it highlights the importance of understanding the context and involving stakeholders in the policy process to improve its legitimacy and effectiveness. Policy studies also utilize models and theories to predict long-term impacts and adjust policies to respond more to changing conditions and societal needs (Polymeniet. al., 2024). These policies promote collaboration between the government, farmers, and research institutions in developing environmentally friendly and efficient agricultural practices.

Sustainable agricultural policies are implemented through various government-issued programs and regulations. The Strategic Plan (Renstra) of the Ministry of Agriculture for 2020-2024 emphasizes the importance of developing sustainable agriculture supported by modern technology and effective management. This policy includes improving land and water use efficiency, developing superior crop varieties that can withstand extreme conditions, and strengthening agricultural extension systems to support technology transfer to farmers (). Additionally, this policy encourages organic farming and agro-silvopastoral practices as strategies to preserve the environment and strengthen national food security. The focus of sustainable agricultural policies is on improving farmers' welfare, protecting biodiversity, and reducing negative environmental impacts while enhancing product quality and competitiveness in the global market (Renstra et al., 2024).

3 Method

This study employs a qualitative descriptive approach to deeply explore sustainable agricultural policies in Central Java. The data collection methods include stakeholder interviews and policy document analysis (Creswell et al., 2016). The data sources comprise information gathered through observations and secondary data, including official documents such as the Strategic Plan of the Central Java Agriculture and Plantation Service and the Regional Long-Term Development Plan (RPJP).

The collected data is qualitative, consisting of interview transcripts, observation notes, and policy documents. These data are analyzed using thematic analysis to identify patterns, themes, and categories related to sustainable agricultural policies (**Nowell et al., 2017**). This data analysis aims to understand the context of the policies, identify existing challenges and opportunities, and formulate policy recommendations to enhance the sustainability and competitiveness of the agricultural sector in Central Java.

In addition, the study involves conducting workshops and holding meetings with a diverse range of stakeholders, such as farmers, government officials, scholars, and private sector professionals. These sessions are designed to discuss and provide input on sustainable agricultural policies. Data from interviews, documents, and workshop discussions are systematically analyzed through content analysis to uncover emerging themes and patterns from the qualitative data. This content analysis aids in categorizing the data into relevant groups and generating meaningful interpretations regarding sustainable agricultural policies in Central Java. Through this approach, the study aims to provide concrete and practical recommendations to bolster the sustainability of the agricultural sector in Central Java.

4 Results and Analysis

Table 1. Barriers and Challenges in Sustainable Agriculture

Barriers and Challenges	Solutions

Climate variability	Implementation of intelligent irrigation technology and weather forecasting
Land degradation and environmental damage	Land rehabilitation and adoption of conservation farming practices
Limited technology and innovation	Development and adoption of modern agricultural technology
Lack of market access	Market access improvement through infrastructure development and e-commerce
Limited water resources	Optimization of water resource management and reservoir construction
Dependence on chemical fertilizers and pesticides	Promotion of organic fertilizers and biological pesticides
Limited capital and financial access	Enhanced access to microcredit and funding for farmers
Insufficient farmer training and education	Continuous training and education for farmers and empowerment of P4S and agricultural extension workers
Agricultural land fragmentation	Land consolidation programs and farmer group empowerment
Lack of cross-sectoral coordination	Formation of cross-sectoral coordination forums

To address the challenges highlighted in Table 1, the strategy for sustainable agriculture in Central Java by 2025 focuses on several key areas: improving competitiveness, using resources efficiently, promoting new technologies, and protecting the environment. Improving competitiveness involves adjusting planting times and using high-quality seeds that can withstand climate change, as described in the 2024 Strategic Plan of the Central Java Agriculture and Plantation Office. This method enhances agricultural production even in the face of increasingly unpredictable climate conditions. Additionally, creating markets for sustainable products, such as organic foods, is expected to increase the value and marketability of agricultural goods locally and internationally (Lamonaca et al., 2023).

Efficient use of resources like water and land is critical but has yet to be a significant focus. However, intelligent irrigation systems and modern farming tools are expected to help use water more efficiently and increase crop yields (Patle et al., 2020). Policies also support environmentally friendly farming practices and efforts to reduce the impact of climate change (Safiullin, 2020). Floods during the rainy season and droughts in the dry season often disrupt farming, reducing crop production and affecting farmers' livelihoods yearly.

Preserving biodiversity is a crucial part of this policy. Efforts include protecting local plant varieties and using farming methods that balance the ecosystem (). This comprehensive plan aims to balance productivity with environmental sustainability, ensuring long-term success for the agricultural sector.

Currently, technology in Central Java's agriculture has yet to reach its full potential for efficiency and sustainability. Innovative irrigation technology and modern tools are

expected to significantly improve water use and crop yields. Environmental sustainability is still a priority, with ongoing support for eco-friendly farming practices and measures to counter climate change (Safiullin, 2020). Efforts to conserve biodiversity focus on preserving local plant species and using farming methods that maintain the ecosystem's balance.

By 2025, Central Java's agricultural plan for climate change will focus on key actions to boost sustainability. These include optimizing planting schedules to reduce risks from natural disasters and increase crop yields, using certified seeds resilient to climate changes and diseases to ensure stable production, and adopting innovative irrigation systems for better water management in changing weather. Improving post-harvest processes with better storage and distribution will reduce crop losses and improve product quality. Promoting sustainable products, like certified organic foods, is expected to add value for farmers and encourage environmentally friendly farming. Research indicates that this combined approach can significantly improve the agricultural sector's sustainability and resilience against climate change (Safiullin, 2020). The production targets for major crops indicate a consistent increase in the production targets for rice, corn, and sugarcane in Central Java from 2021 to 2025.

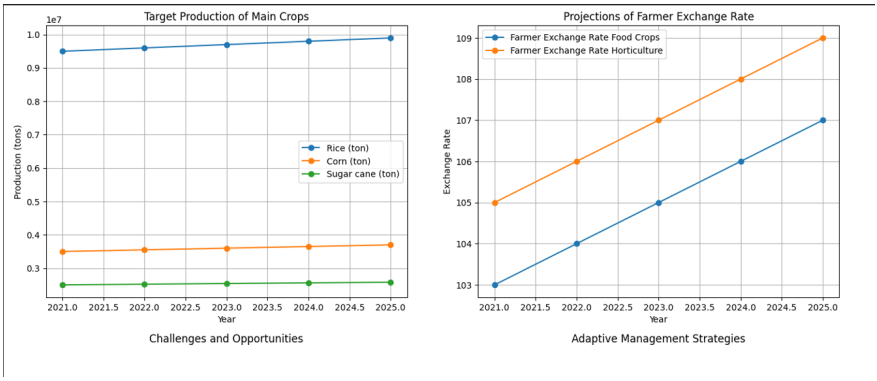

Figure 1. Production Targets and Farmers' Exchange Value Projections

The image contains two graphs depicting the projected production of key crops and farmer exchange rates in Central Java from 2021 to 2025. The left graph illustrates the anticipated production levels for three major crops: rice, corn, and sugarcane. Rice production is expected to increase gradually, reaching nearly 10 million tons. In contrast, corn and sugarcane production is projected to remain relatively steady, with corn at around 3 million tons and sugarcane at about 1 million tons. The right graph shows the projected farmer exchange rates, which exhibit a consistent upward trend over the same

period. The exchange rate for food crops is predicted to rise from 103 in 2021 to 107 in 2025, while the exchange rate for horticultural crops is expected to increase from 105 to 109. This upward trend indicates an improvement in farmers' welfare and reflects enhanced production efficiency in both local and international markets.

In the last four years, there has been a steady increase in the exchange value for farmers' produce. The exchange value for food crops rose from 103 in 2021 to a projected 107 by 2025, while the exchange value for horticultural crops increased from 105 in 2021 to a projected 109 by 2025. Refer to Table 2 for a detailed breakdown. This upward trend indicates an overall improvement in the living standards of farmers, which can be attributed to policies aimed at boosting agricultural production efficiency and effectiveness, as well as improving farmers' access to markets and resources (as outlined in the Strategic Plan of the Central Java Agriculture and Plantation Office, 2024). One of the key factors driving this progress is the optimization of state-managed seed gardens to produce high-quality, certified seeds.

Table 2. Projections of Farmers' Exchange Value

Year	Farmers' Exchange Value for Food Crops	Farmers' Exchange Value for Horticultural Crops
2021	103	105
2022	104	106
2023	105	107
2024	106	108
2025	107	109

Strengthening institutional capacity is a crucial focus of the Central Java Agriculture and Plantation Office's Strategic Plan for 2024-2026. The primary objective is to improve farmer economic organizations' capabilities by establishing and enhancing farmer corporations. This strategy aims to make farmers more efficient and competitive in local and international markets. Essential programs include expanding access to People's Business Credit (KUR) to provide farmers with more capital and offering continuous training and education to improve human resource quality.

The strategic plan prioritizes fostering collaboration across different sectors and amplifying the effectiveness of agricultural enterprises through implementing mechanization and modernization initiatives. It involves bolstering the capabilities of state-operated seed gardens to generate top-tier, officially endorsed seeds, thereby playing a pivotal role in boosting the region's overall revenue. By strengthening agricultural institutions in Central Java, the area becomes more resilient in addressing formidable issues such as globalization, climate change, and the changing dynamics of the market.

The adaptive governance strategies outlined in the plan focus on three essential areas: risk management, technological innovation, and cross-sector collaboration. The risk management aspect involves implementing agricultural insurance to safeguard farmers from potential losses caused by natural disasters. Additionally, it emphasizes the promotion of crop diversification to mitigate the risk of crop failures and ensure the overall stability of the agricultural industry.

Technological innovation involves adopting intelligent irrigation systems to optimize water usage and developing high-quality seed varieties that are resilient to climate change. Cross-sector collaboration is encouraged through partnerships between the government and the private sector and by establishing coordination forums to ensure cohesive policy implementation.

The following strategies have been meticulously developed to bolster the agricultural sector's resilience and adaptability. They specifically target the challenges posed by climate change, focusing on guaranteeing the sector's enduring sustainability in the face of evolving environmental conditions.

5 Conclusion

The proposed policies in the 2025 sustainable agricultural development plan for Central Java are effective through various implemented initiatives. These include using intelligent irrigation technology, adopting superior climate-resilient seeds, and developing markets for sustainable products like organic produce. Implementing these technologies is expected to enhance resource use efficiency, ultimately increasing yields and reducing losses due to climate variability.

Improving human resource quality through training and education also boosts productivity and farmer welfare, evidenced by the positive trend in farmers' exchange value over the years. However, the focus on sustainable agricultural policies has not received the necessary attention.

Furthermore, enhancing technology access and training farmers can boost productivity and efficiency. By implementing policies that prioritize infrastructure development and technology dissemination, these obstacles improve the agricultural sector's overall competitiveness.

Policymakers or stakeholders should emphasize concrete measures for implementing sustainable agriculture in Central Java. These include adopting intelligent irrigation technology, using superior seeds, optimizing state seed gardens, being resilient to climate change, and developing markets for organic products through certification and facilitating market access from production to distribution. Moreover, cross-sector collaboration and support are essential. The government, private sector, research institutions, and farmers must work together to ensure the effectiveness of these policies. Continuous training and education can enhance farmers' awareness and skills in environmentally friendly, sustainable agricultural practices.

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