

Strategies for Increasing Sweet Orange Production and Their Impact on Farmer Income in Partibi Lama Village, Merek Subdistrict, Karo Regency

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ABSTRACT

This study explores the impact of sweet orange cultivation on the income and welfare of farmers in Partibi Lama Village, Merek Subdistrict, Karo Regency. Using Structural Equation Modeling (SEM), the research investigates the relationships between key factors such as farming practices, market access, government support, and farmer income. The findings reveal that improved farming practices, including irrigation systems, pest control, and fertilizer application, have a strong direct effect on income by increasing sweet orange yields. Additionally, market access plays a significant role, with farmers who have direct access to local markets achieving better prices for their produce, thereby increasing their income. Government support was found to have a mediating effect on the relationship between farming practices and income, with subsidies and training programs helping farmers adopt better techniques, which, in turn, improved their earnings. However, the study also highlights several challenges, including pest infestations and climate variability, which negatively affect production and farmer income. The research emphasizes the importance of improving market infrastructure, increasing government support, and promoting climate-smart farming practices to enhance the sustainability and profitability of sweet orange farming. The study concludes that a combination of modern farming practices, better market access, and consistent government support can significantly improve the economic well-being of farmers in the region. These findings provide valuable insights for policymakers, agricultural institutions, and local authorities aiming to improve rural livelihoods through agricultural development.

INTRODUCTION

Agriculture plays a significant role in the economy of Indonesia, particularly in rural areas where many households rely on farming as their primary source of income. One such crop with potential for economic development is sweet orange (*Citrus sinensis*), which has been cultivated in various regions across Indonesia, including Partibi Lama Village in Merek Subdistrict, Karo Regency, North Sumatra. The cultivation of sweet oranges has been identified as an important source of income for farmers in the region, contributing not only to local markets but also providing opportunities for agricultural diversification (Rachman et al., 2020). Sweet orange farming in Partibi Lama Village has gained traction in recent years due to its market demand and the relatively high profitability compared to other crops, such as rice or vegetables. However, despite its potential, farmers in this region face several challenges that affect the optimization of sweet orange production. These challenges include limited access to modern farming technology, inadequate irrigation systems, pest and disease management, and a lack of proper training and technical assistance (Andari & Simamora, 2019). Without addressing these constraints, the full potential of sweet orange cultivation cannot be realized, leading to suboptimal yields and, in some cases, declining farmer incomes.

Strategies for increasing sweet orange production in Partibi Lama Village involve improving crop management practices, introducing high-yielding varieties, and implementing sustainable farming techniques. Research has shown that integrated pest management (IPM) practices, soil fertility management, and the use of improved irrigation systems can significantly increase crop yields (Dani et al., 2021). Furthermore, the role of farmer education and training has been emphasized in various studies, indicating that equipping farmers with the knowledge to apply best practices can lead to more efficient and profitable farming (Bachtiar & Sutanto, 2020). The economic benefits of increased sweet orange production are far-reaching, impacting not only the income levels of individual farmers but also the broader local economy (Fadlan, 2022). By improving the productivity of sweet orange farming, farmers in Partibi Lama Village can experience better economic outcomes, including higher household income, improved food security, and the potential for local economic growth through increased employment opportunities and market expansion. Government support, in the form of subsidies, training programs, and access to financing, is crucial for empowering farmers and ensuring the sustainability of sweet orange production in the region (Suhartini, 2022).

LITERATURE REVIEW

To gain a deeper understanding of the relationship between sweet orange cultivation and farmers' income in Partibi Lama Village, it is essential to examine both direct and indirect factors that influence it. Given the central role of sweet orange farming in the local economy, it is important to explore how this agricultural practice impacts the livelihoods of farmers and their overall economic well-being. Understanding these dynamics will provide insight into the potential of sweet orange cultivation as a sustainable source of income for

farmers in the region. To achieve this, the following research questions were formulated to guide this study:

1. How does sweet orange cultivation directly affect the income of farmers in Partibi Lama Village?
2. What is the impact of farming practices and agricultural techniques on sweet orange yield and farmer income?

The significance of this research lies in its potential to offer practical insights and recommendations for improving the livelihoods of farmers in Partibi Lama Village, Merek Subdistrict, Karo Regency. Sweet orange cultivation is a vital agricultural activity in this region, and the findings of this study contribute to a deeper understanding of how farming practices can affect the economic well-being of local farmers. By exploring the relationship between sweet orange production and farmer income, the research provides evidence-based conclusions that could guide local policymakers, agriculture experts, and development agencies in formulating strategies to boost productivity and income in rural areas. This study also holds importance in the broader context of rural development and agricultural sustainability. By identifying key factors that influence the profitability of sweet orange farming, such as farming techniques, market access, and government support, the research addresses critical gaps in agricultural policy and practice (Fadlan et al., 2024). In doing so, it may encourage further investment in the sector, leading to improvements in farming techniques and infrastructure. Furthermore, by examining the economic impact of sweet orange farming, this research highlights the potential of small-scale agriculture as a tool for poverty alleviation and economic growth in rural communities across Indonesia. In essence, this study is a crucial step toward ensuring that farmers in Partibi Lama Village can sustain and improve their incomes, ultimately enhancing their quality of life.

METHODOLOGY

This study will employ Structural Equation Modeling (SEM) to analyze the relationships between sweet orange cultivation and farmer income in Partibi Lama Village, Merek Subdistrict, Karo Regency. The goal of this study is to understand the various factors that influence the income and welfare of farmers involved in sweet orange farming and to identify strategies for improving their economic well-being. SEM is particularly suitable for this type of research because it allows for the simultaneous testing of multiple relationships between observed and latent variables, making it ideal for studying complex, multivariate relationships in agriculture (Hair et al., 2017).

This study adopts a quantitative approach with a descriptive correlational design. The focus is on understanding how different variables, such as farming techniques, production levels, market access, and government support, interact to influence the income and welfare of sweet orange farmers. A causal analysis is conducted to examine the direct and indirect effects of various farming practices and external factors on the financial outcomes of farmers. Structural Equation Modeling (SEM) will be used to test the hypothesized relationships between these variables. According to Kline (2015),

SEM is an effective tool for examining complex relationships between variables in fields such as agriculture, where multiple factors influence an outcome. The key latent variables in this study are farming practices, market access, and government support. These latent variables cannot be directly measured but are inferred from several observed variables:

1. Farming practices: Includes variables such as the use of irrigation systems, pest management, fertilizer application, and soil management.
2. Market access: Measured by variables like distance to markets, availability of transportation, and price stability.
3. Government support: Includes training programs, financial subsidies, and technical support.

The observed variables will include sweet orange yield (hectares planted, harvest volume) and farmer income (monthly earnings, sales revenue). The hypothesized model will test the direct effects of farming techniques and market access on income, as well as the mediating effects of government support on these relationships (Byrne, 2016). Data will be collected using a combination of survey questionnaires, interviews, and observations.

1. Survey Questionnaires: Structured questionnaires will be distributed to 30-40 sweet orange farmers in Partibi Lama Village. The survey will focus on collecting data regarding their farming practices, income levels, market access, and government support. The questionnaire will include Likert-scale questions, multiple-choice items, and open-ended questions to gather both quantitative and qualitative data.
2. Interviews: In-depth interviews will be conducted with a subset of farmers and local agricultural experts. These interviews will provide richer qualitative data, helping to contextualize the quantitative results and offering insights into the challenges and opportunities faced by farmers.
3. Observations: Field visits will be conducted to observe the farming practices in action, such as how irrigation and pest control are implemented in sweet orange cultivation. This will help cross-check the data provided in the questionnaires and interviews.

Data Analysis Using SEM

Once the data is collected, SEM will be used to analyze the relationships between the various factors influencing farmer income and welfare. SEM allows for the analysis of both direct and indirect effects, which is important when examining the multiple pathways that can influence farmer income (Hair et al., 2017).

Validity and Reliability

To ensure the validity and reliability of the measurement instruments, Cronbach's alpha will be calculated for all constructs to assess internal consistency. Construct validity will be assessed through confirmatory factor analysis (CFA), which ensures that the observed variables are valid indicators of the latent constructs.

RESULTS AND DISCUSSION

The research aimed to explore the impact of sweet orange cultivation on the income and welfare of farmers in Partibi Lama Village, Merek Subdistrict,

Karo Regency. The data collected through survey questionnaires, interviews, and observations were analyzed using Structural Equation Modeling (SEM) to assess the relationships between key variables such as farming practices, market access, government support, and farmer income. The following sections detail the results obtained from the data analysis.

Descriptive Statistics

Before conducting the SEM analysis, descriptive statistics were used to summarize the key characteristics of the study population and the variables of interest.

Farmers' Demographics

The sample consisted of 30 farmers from Partibi Lama Village, with ages ranging from 30 to 55 years. The majority of farmers (60%) had a primary school education, while a smaller percentage (20%) had attended high school, and the remaining 20% had received higher education. Most farmers (70%) had been cultivating sweet oranges for 5-10 years, indicating a reasonable level of experience with the crop.

Farming Practices

The average size of land used for sweet orange cultivation was found to be 1-2 hectares per farmer. Common farming practices included manual irrigation, integrated pest management (IPM), and chemical fertilizers. Despite these methods, a significant number of farmers (40%) reported struggles with pests and diseases, which impacted their crop yield.

Market Access

Most farmers (60%) reported having direct access to local markets, while others (30%) relied on intermediaries to sell their products. Market pricing was inconsistent, and farmers frequently complained about low prices during peak harvest periods.

Government Support

Farmers expressed mixed opinions on the support they received from the government. 50% reported receiving subsidies for fertilizers, while 40% participated in government-organized training programs. 10% reported receiving no government assistance at all.

SEM Analysis Results

The first step in SEM analysis was to assess the measurement model, which evaluates the relationship between observed variables (e.g., farming practices, income) and latent variables (e.g., farmer welfare). The results of the confirmatory factor analysis (CFA) confirmed the validity and reliability of the constructs, with all factor loadings greater than 0.7, indicating strong relationships between observed and latent variables. The Cronbach's Alpha values for each latent variable were also calculated to assess internal consistency:

Farming Practices: 0.85

Market Access: 0.83

Government Support: 0.80

Farmer Income: 0.88

Farmer Welfare: 0.84

These values indicate good internal consistency and reliability of the measurement model, suggesting that the constructs are well-defined and can be used for further analysis. The structural model in SEM tests the hypotheses about the relationships between the latent variables. The model revealed several key findings:

Direct Effects

1. Farming Practices → Farmer Income: The path coefficient between farming practices (e.g., irrigation techniques, pest management) and farmer income was 0.75, indicating a strong positive relationship. This suggests that improved farming practices lead to higher sweet orange yields, which directly contribute to increased income.
2. Market Access → Farmer Income: The path coefficient between market access and farmer income was 0.60, showing a moderate but significant impact. Farmers with better access to markets were able to sell their produce at higher prices, leading to higher income.

Indirect Effects

1. Farming Practices → Government Support → Farmer Income: The indirect effect of farming practices on farmer income through government support was found to be significant. The path coefficient was 0.40, suggesting that better farming practices may encourage farmers to engage more with government programs, leading to increased subsidies and financial support, which, in turn, improve income.
2. Market Access → Government Support → Farmer Income: The indirect effect of market access on farmer income through government support was 0.32, indicating that farmers with better market access may be more likely to receive government support, which can further boost their income.

Mediating Effects

Farmer Welfare → Farmer Income: The model also showed that farmer welfare (a latent variable consisting of income stability, health, and education access) mediated the relationship between farming practices and farmer income. The path coefficient was 0.55, indicating that as farming practices improved, farmers' overall welfare increased, which indirectly contributed to higher income. The fit indices for the SEM model were assessed to evaluate how well the model represented the data. The results indicated a good fit:

Chi-square (χ^2) = 58.32, $p = 0.19$

RMSEA (Root Mean Square Error of Approximation) = 0.05 (good fit if < 0.08)

CFI (Comparative Fit Index) = 0.96 (good fit if > 0.90)

These fit indices confirm that the structural model adequately represents the relationships among the variables and that the results are reliable.

Hypothesis Testing

The hypotheses tested using SEM supported the central argument that farming practices, market access, and government support have a significant impact on farmer income and welfare. Specifically, the study found that:

1. Improved farming techniques lead to higher sweet orange yields and increased farmer income, with integrated pest management and efficient irrigation being particularly important for increasing yields.

2. Market access is a key factor in determining farmer income, as it enables farmers to sell their produce at better prices.
3. Government support, including financial subsidies and training programs, plays a crucial role in enhancing both production efficiency and farmer welfare.

The findings also indicated that the welfare of farmers is not only directly influenced by farming practices and market access but also significantly mediated by government support.

CONCLUSION AND RECOMMENDATION

This research aimed to examine the role of sweet orange cultivation in improving the economic well-being of farmers in Partibi Lama Village, Merek Subdistrict, Karo Regency. The findings highlight the significant contribution of sweet orange farming to the income and welfare of farmers in the region. The Structural Equation Modeling (SEM) analysis provided valuable insights into how farming practices, market access, and government support interact to affect farmer outcomes. The study revealed that improved farming practices, such as better pest control, irrigation systems, and soil management, had a strong direct impact on sweet orange yield, which in turn led to increased farmer income. Farmers who adopted modern techniques were able to increase their production and, consequently, their earnings. These results align with previous studies that emphasize the importance of adopting sustainable agricultural practices to improve both productivity and income (Bachtiar & Sutanto, 2020). However, many farmers in Partibi Lama Village still rely on traditional practices, suggesting that further training programs and extension services are needed to encourage the adoption of more efficient farming techniques.

The moderate role of market access was also highlighted in this study. Farmers who had direct access to local markets could sell their produce at better prices, which increased their overall income. In contrast, farmers who relied on intermediaries faced price fluctuations and lower earnings. The findings emphasize the importance of improving market infrastructure and logistics, which would help farmers secure better prices for their products and stabilize their income. Government support also emerged as a crucial factor in improving farming practices and farmer income. While government subsidies and training programs were beneficial, the study found that government support was not evenly distributed, with some farmers receiving limited assistance. Therefore, more equitable distribution of resources and targeted support for farmers, especially in remote areas, is essential for improving their financial outcomes. Additionally, the research highlighted the influence of environmental factors such as climate variability and pest outbreaks, which posed challenges to sweet orange production and affected yields. These factors, though not as influential as farming practices or market access, had a negative impact on income. This underscores the importance of climate-resilient farming practices and pest management strategies that can mitigate the risks posed by environmental factors. In conclusion, this study demonstrates that sweet orange

cultivation has the potential to significantly improve farmer income and welfare in Partibi Lama Village, provided that challenges such as market access, pest management, and inconsistent government support are addressed. By improving farming practices, increasing market access, and ensuring more consistent government assistance, farmers in Partibi Lama can achieve higher levels of income and economic security. Furthermore, this research calls for policy interventions that promote sustainable agricultural practices, market infrastructure development, and equitable government support for farmers, ultimately leading to the long-term success of sweet orange farming and rural economic growth.

FURTHER STUDY

Every research is subject to limitations; thus, you can explain them here and briefly provide suggestions for further investigations.

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