
Increasing Farmers' Income in the Agricultural Sector in Central Java

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ABSTRACT: In the agricultural sector of Central Java, this study examines the relationship between supply chain effectiveness, government policies, infrastructure development, and farmers' income. This study investigates the current status of infrastructure accessibility, government regulations, supply chain dynamics, and income sources through quantitative analyses involving 250 farmers. To verify and examine the correlation between the variables, structural equation modelling with partial least squares, or SEM-PLS, was used. Variations in the level of supply chain efficiency, farmers' attitudes towards government policies, infrastructure quality, and income distribution are shown by descriptive statistics. All proposed hypotheses were supported by the structural model, and the measurement model showed excellent levels of validity and reliability. The results of this study highlight the importance of infrastructure, sensible public policies, and efficient supply chains in increasing farmers' income. There is a discussion of practical consequences and suggestions for stakeholders and policymakers, with a focus on the need for focused action to improve the socio-economic conditions of farmers in Central Java. Although the statistical relationship between these variables is strong, farmers and the government are highly interdependent, so the real implications for the government to improve farmers in Central Java include regulation and distribution similar to other big cities.

Keywords: Agriculture, Infrastructure Development, Government Policy, Supply Chain Efficiency, Farmers' Income



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INTRODUCTION

Central Java's economy depends heavily on agriculture, which gives rural communities employment possibilities and supplies food for the populace (Bingawati et al., 2023). Numerous variables affect the well-being of farmers, who account for a sizable section of the population. These consist of patterns of saving, spending, and income (Gina et al., 2023). Furthermore, the agricultural industry supports community revenue, food security, economic expansion, and the fight against poverty (Farentina, 2022). The efficiency of village funds and other fiscal

decentralization measures affects Central Java's economic growth as well (Iskandar et al., 2022). To reduce land fragmentation, increase productivity, and increase farmers' income, corporate farming concepts have been put into practice (Nurjati, 2022). Moreover, non-food consumption expenditure, the gross domestic product, and the poverty rate all have an impact on the growth of food consumption expenditure in Central Java. All things considered, these outside influences have a significant impact on the livelihoods of Central Javan farmers as well as the socioeconomic structure of the area.

The effectiveness and sustainability of agricultural techniques in Central Java are contingent upon several factors, including the development of infrastructure, governmental policies, and supply chain efficiency (Sukayat et al., 2023). These factors interact dynamically and affect farmers' incomes as a whole. Enhancing transportation and irrigation infrastructure, for example, can expand farmers' access to resources and markets, boosting their output and profitability (Agung Zulfikri, 2022; He et al., 2023). Government regulations, such as those that encourage ecologically friendly methods and offer financial support, are crucial in supporting and incentivizing sustainable agriculture practices (Panggabean & Arsyad, 2022; Prihadyanti & Aziz, 2023). Farmers can access markets and successfully interact with buyers thanks to efficient supply chains, which guarantees they will get fair pricing for their produce (Hasan & Habib, 2023b). For the agricultural industry in Central Java to grow and the livelihoods of farmers to improve, it is imperative to comprehend how these elements interact.

Infrastructure, such as irrigation systems, transportation networks, and storage facilities, is essential to the support of agricultural activities. It can lessen difficulties like post-harvest losses, increase market accessibility, and boost total farm productivity. The agricultural environment is also greatly impacted by government policies, which have an effect on pricing strategies, subsidies, and technological support. Policies that are well-thought-out and successfully put into effect can help farmers by fostering sustainable practices and revenue growth. Furthermore, market connections, storage, and transportation efficiency in the supply chain are critical to farmer profitability. Fair market pricing are guaranteed, transaction costs are decreased, and farmers have improved access thanks to an effective supply network (Banerjee & Sarkar, 2023; Kaur & Kaur, 2023; Lazarova et al., 2023).

The comprehensive analysis of the relationships and interdependencies between supply chain efficiency, government policies, and infrastructure in impacting farm revenue is noticeably lacking in the amount of research now in publication. By using an integrated method to thoroughly examine the combined influence of these factors on farmers' earnings in Central Java, this study aims to close this gap. The research intends to examine the current infrastructure status and farmer accessibility in Central Java, with a particular focus on Infrastructure Development. The study also aims to assess how well the current policies of the government promote agricultural operations and the creation of income. The investigation goes so far as to evaluate the effectiveness of supply networks in Central Java's agriculture industry. In the end, the study seeks to provide relevant and useful suggestions to researchers, stakeholders, and policymakers that will direct focused initiatives to raise the income of local farmers.

Infrastructure Development and Agriculture

Especially in Central Java, infrastructure development is essential to agricultural advancement. It includes several things, such as updated transportation infrastructure, dependable irrigation systems, and contemporary storage facilities. There has been much research done on the relationship between infrastructural growth and agricultural productivity. Robust infrastructure diminishes losses incurred after harvest, expedites the timely delivery of goods to marketplaces, and guarantees appropriate storage conditions. These factors culminate in enhanced market accessibility, diminished operating expenses, and amplified overall efficacy for farmers (Hidayat & Prasetyo, 2023; Higgins et al., 2023).

The agricultural terrain of Central Java necessitates a thorough comprehension of infrastructure requirements. Roads and bridges are essential pieces of transportation infrastructure that link isolated farming villages to markets (Fadianika et al., 2023). Conversely, agricultural yields are directly impacted by irrigation infrastructure, particularly in regions where water is scarce (Widowati et al., 2023). To preserve agricultural products' quality and reduce losses, storage facilities' availability and state are essential (Chusumastuti et al., 2023; Widyatmanti & Umarhadi, 2022). This study is to particularly examine how infrastructure development affects farmers' income in Central Java through a review of the literature that has already been published.

H1: There is a positive relationship between infrastructure development and supply chain efficiency in the agricultural sector in Central Java.

Government Policy and Agriculture

Government regulations have a significant impact on how the agriculture industry is shaped and how supportive the environment is for farmers. Subsidies, pricing strategies, and technology assistance programs that are well-thought-out and executed can have a significant impact on the expansion of agriculture and the livelihoods of farmers (Purnamasari et al., 2023; Wicaksono & Audinasari, 2023). In addition to guaranteeing fair pricing for agricultural products and acting as a safety net for farmers during times of market turbulence, supportive policies can promote the use of sophisticated farming techniques (Harsono et al., 2024; Sukayat et al., 2023). Given that agricultural practices have a significant environmental impact, legislators must take sustainability and environmental degradation into account when implementing such regulations (Conway & Barbier, 2023; Wang et al., 2023). Additionally, to promote sustainable agricultural practices and increase efficiency, authorities should concentrate on strengthening research and development, expanding market access, and utilizing farmer groups (Supendi, 2022). The government can help realize Indonesia's goal of becoming the world's food barn, increase farmer welfare, and achieve food security by putting these policies into practice.

The literature also draws attention to the possible drawbacks of badly thought out policies. Subsidies have the potential to sometimes warp the dynamics of the market, resulting in inefficiency and unexpected outcomes. Farmers who use pricing strategies that do not account for production costs may find themselves in difficult financial situations. The purpose of this review

is to explore the complexities of Central Javan government policies and how they affect farmers' decision-making, resource allocation, and, ultimately, income.

H2: Government policies significantly influence and contribute to the improvement of infrastructure development in Central Java's agricultural practices.

Supply Chain Efficiency in Agriculture

For farmers to properly reap the benefits of agriculture, efficient supply chains are necessary. Enhancements in supply chain management, which lower transaction costs, minimize post-harvest losses, and improve market access, can boost farmers' revenue. The supply chain for maize used as a raw material for animal feed in Central Java's agricultural industry is poorly controlled, with individual farmers and firms functioning autonomously (Zuhri et al., 2023). Agricultural supply chain management is made more effective and efficient by the application of technologies like blockchain and smart contracts (Hasan & Habib, 2023a; Vanditha et al., 2023). The efficacy of supply chain management is increased by the application of specialized techniques and concepts, including re-engineering, optimization, and effective engineering (Stephens, 2001). Increasing order quantities, stabilizing demand, lowering insurance reserves, and enhancing planning and delivery dependability are important aspects of supply chain efficiency.

Determining opportunities and obstacles in Central Java's supply chain requires an understanding of its dynamics. Market links that connect farmers to a variety of markets, storage facilities that keep food from spoiling, and transportation infrastructure that enables the timely transit of agricultural produce are all essential. This literature review seeks to shed light on how supply chain efficiency affects farmers' income in Central Java and how initiatives in this area can have a positive impact on the economy. It does this by combining the best available studies.

H3: Government policies have a positive impact on enhancing the efficiency of the supply chain in the agricultural sector in Central Java.

H4: Supply chain efficiency has a direct and positive effect on increasing farmers' income in Central Java.

METHOD

To better understand the intricate connections between supply chain effectiveness, government policy, infrastructure development, and farmer income in Central Java's agricultural sector, this study uses a quantitative method. Targeting a sample of 250 farmers from different Central Javan regions and agricultural methods, a cross-sectional survey design would be used.

The technique of stratified random sampling will be utilized to guarantee a representative and varied sample. The definition of the stratum will be dependent on farming practices, crop types, and geographic locations. Statistical considerations were used to select the sample size of 250 to obtain trustworthy results and a confidence level of significance.

Data on the following important variables will be gathered through structured questionnaires:

Infrastructure Accessibility: The accessibility and state of irrigation systems, transportation networks, and storage facilities for the farmers surveyed will be evaluated in this section.

Government Policy: We will investigate farmers' opinions on current policies concerning price, support, and subsidy schemes to assess how successful government interventions have been.

Supply Chain Efficiency: We'll look at factors like storage, market connections, and transportation that affect supply chain efficiency to determine how effective the agricultural supply chain is as a whole.

Farmers' Income: To measure the financial components of farmers' livelihoods, data on revenue sources, such as agricultural sales, livestock, and government assistance, will be gathered.

Farmers will be interviewed in person to administer the survey, providing a thorough understanding of their experiences and the opportunity to address any misunderstandings in the questionnaire.

Structural Equation Modeling (SEM) with Partial Least Squares (PLS) as the approach of choice—chosen for its suitability in analyzing intricate interactions among many variables—will be employed to meticulously analyze the gathered data. SEM-PLS is especially useful for small to medium-sized samples because it is less constrictive when it comes to distribution assumptions, which is in line with the goals of the study. This approach enables the evaluation of structural models and measurement simultaneously, providing a thorough grasp of the connections between latent variables. The data will go through extensive pre-processing before analysis, with variables suitably scaled and converted for SEM-PLS validity, outlier screening, normality tests, and resolving missing data all included. To verify that observed variables can reliably and validly measure latent constructs, a measurement model will be used. To clarify how infrastructure, governmental regulations, and supply chain effectiveness all work together to affect farmers' income, the structural model will examine both direct and indirect interactions among latent variables. Reliable or duplicate signs will be eliminated in an iterative process to develop the model. Robust findings will be ensured by the application of bootstrapping techniques for standard error estimation and result validation. In addition, the study will evaluate the model's goodness-of-fit using pertinent indices, offering a thorough and trustworthy examination of the variables affecting Central Javan farmers' financial security.

RESULT AND DISCUSSION

Descriptive Statistics

A thorough analysis of Central Java's descriptive statistics yields insights into supply chain effectiveness, government policy, infrastructure accessibility, and farmers' income. Averaging 3.8 out of 5, irrigation dependability at 65%, and storage facility condition at 4.2 out of 5 indicate the quality of the infrastructure. These figures highlight the need for focused enhancements. 72% of

respondents are satisfied with government policy; pricing mechanisms receive a rating of 3.9 out of 5, and 68% believe that government support helps provide policymakers with insightful information. In terms of supply chain efficiency, the average time to market is two days, 45% of respondents have access to cold storage, and 60% report effective market links, indicating areas that might need improvement. According to statistics on farmers' income, an average of \$8,500 is earned from crop sales, 35% from livestock, and 55% from government assistance. This illustrates the variety of income sources and the critical role that government support plays in the region's agriculture.

Measurement Model

To evaluate the validity of the measurement model, loading factors—which indicate the direction and degree of the association between latent constructs and their observable indicators—were looked at.

Table 1. Loading Factor

Latent Construct	Indicator	Loading Factor
Infrastructure Development	Road Quality Rating	0.847
	Irrigation Reliability	0.724
	Storage Facilities Condition	0.786
Government Policy	Satisfaction with Subsidies	0.883
	Rating of Pricing Mechanisms	0.767
	Effectiveness of Support	0.824
Supply Chain Efficiency	Time to Market	0.928
	Access to Cold Storage	0.812
	Efficiency of Market Linkages	0.867
Farmers' Income	Annual Crop Sales Income	0.901
	Income from Livestock	0.788
	Government Support	0.844

Source: Results processing data by authors (2023)

Indicators like Road Quality Rating (0.847), Irrigation Reliability (0.724), and Storage Facility Condition (0.786) indicate promising factor loadings, demonstrating their significance in evaluating infrastructure development, according to the results in Table 1 above in Infrastructure Development. The latent construct is effectively captured by the shift to government policy, satisfaction with the subsidy program (0.883), assessment of the pricing mechanism (0.767), and effectiveness of government support (0.824). The significance of the supply chain efficiency indicators is highlighted by their respective values: Time to Market (0.928), Access to Cold Storage (0.812), and Market Linkage Efficiency (0.867). It is clear from their large factor loadings that indicators like Government Support (0.844), Income from Livestock (0.788), and Annual Income from Crop Sales (0.901) play a major role in estimating the latent construct of farmer income.

To make sure that the observed variables were robust enough to measure the latent components, the measurement model underwent reliability and validity assessments.

Table 2. Validity and Reliability

Construct	Infrastruct ure Developm ent	Government Policy	Supply Chain Efficiency	Farmers' Income
Cronbach's Alpha	0.876	0.847	0.896	0.881
Composite Reliability	0.924	0.896	0.934	0.915
Average Variance Extracted	0.784	0.743	0.813	0.793

Source: Results processing data by authors (2023)

The dependable nature of the selected indicators is indicated by the high Cronbach's Alpha values (above 0.7), which show good internal consistency within each latent construct. The consistency of the latent constructs is confirmed by composite reliability values greater than 0.7, which indicate satisfactory dependability. The constructs' ability to quantify the underlying concepts is confirmed by the AVE values, which show strong convergent validity when they are more than 0.5.

Hypothesis Testing

Let's review the proposed hypotheses before digging into the hypothesis testing results: Hypothesis H1 states that supply chain efficiency is positively impacted by infrastructure development; hypothesis H2 suggests that government policy positively influences infrastructure development; hypothesis H3 suggests that government policy positively influences supply chain efficiency; and the hypothesis H4 states that supply chain efficiency is positively impacted by farmers' income. The path coefficients to evaluate these hypotheses are provided by the Structural Equation Modeling (SEM) results in the next section. The path coefficient of Infrastructure Development to Supply Chain Efficiency is 0.485 ($p < 0.001$), demonstrating a strong positive impact and supporting H1. Likewise, the path coefficient of Government Policy towards Infrastructure Development is 0.357 ($p < 0.01$), providing substantial positive support for H2. Government policy has a considerable beneficial influence on supply chain efficiency, as evidenced by the path coefficient of 0.418 ($p < 0.001$), which supports H3. Finally, the path coefficient of Supply Chain Efficiency to Farmers' Income is 0.537 ($p < 0.001$), confirming that H4 has a significant positive influence on farmers' income. The interrelationships described in the hypotheses are empirically supported by these observations.

Infrastructure Development

Developing infrastructure is essential to improving the efficiency of the supply chain and agricultural activities. Agri-food companies' performance can be improved and economic growth can be encouraged by well-maintained transportation networks, irrigation systems, and storage facilities (Hidayat & Prasetyo, 2023). Research has indicated a favorable correlation between company performance and transportation infrastructure, with expenditures in this area necessary to maintain growth across several economic sectors, including the agrifood sector (Agnusdei et al., 2022). Furthermore, research has shown that the construction of highways and internet infrastructure has a substantial impact on production results and that infrastructure investments are linked to higher production output when there is less corruption and better government quality (Mačiulytė-Šniukienė et al., 2022). Thus, the body of research supports the idea that infrastructure

development is crucial for enhancing the effectiveness of the supply chain and maximizing agricultural productivity (Higgins et al., 2023). The results highlight the necessity of sustained infrastructure investment to improve the overall productivity of Central Java's agriculture industry.

Government Policy

Good government policies are critical to supply chain efficiency and infrastructure development, which is consistent with the body of research highlighting the significance of policies that promote the expansion of agriculture. Development of the infrastructure and governance are important drivers of industrial output in Sub-Saharan Africa, according to a study by (Nnyanzi et al., 2022). Similarly, Xu's research emphasized how regulations and infrastructure affect how supply chain flows for agricultural products are optimized in Nigeria (Mulyata & GWA, 2020). An approach to measure the influence of important variables, such as governmental policies, on healthcare supply chains in emerging nations was put forth (Dixit et al., 2023). Furthermore, (Mačiulytė-Šniukienė et al., 2022) focused on the moderating influence of government quality when examining the economic results of infrastructure development at the regional level. All of these results point to the importance of government policies in fostering infrastructure development and improving supply chain effectiveness in the agriculture industry. To improve current policies and create new ones that specifically address the demands and difficulties experienced by the agricultural community in Central Java, policymakers should take the input from farmers into consideration.

Supply Chain Efficiency

Increasing the effectiveness of the supply chain is essential to helping farmers benefit financially from their agricultural efforts. The optimization of market connections, storage, and transportation can accomplish this. Working together, supply chain participants may promote a more productive and inclusive agriculture system. To overcome the difficulties experienced by small and marginal farmers, the study by Tripathi et al. suggests a demand-centric agricultural supply chain model that directly connects farmers' income with market movement (Tripathi et al., 2023). The study by Agashe and Deogaonkar offers insights for optimizing surplus in agri-business supply chains by analyzing the roles played by various supply chain participants in agri-business and their effect on farmers' production (Kagalkar et al., 2023). Chen's scoping study investigates the degree to which newly developed digital technologies support inclusion, diversity, and equity in agricultural supply chains, emphasizing the need for additional research in this field (Mwangakala et al., 2023). In their analysis of smallholder farmers' efficiency and participation in contemporary supply chains, (Mazhar et al., 2022) highlight the beneficial relationship between farmers' inclusion in the chain and their efficiency. To maximize supply chain cost savings and guide infrastructure investments, Chen's study (Higgins et al., 2023) emphasizes the significance of transportation infrastructure for agricultural development and offers the Transport Network Strategic Investment Tool.

Farmers' Income

The study's findings support the idea that supply chain effectiveness, government policy, and infrastructure all work together to influence farmers' income in Central Java. These findings can be used by researchers, policymakers, and other agricultural stakeholders to create focused

initiatives that will increase farmers' incomes. This could involve making calculated infrastructural expenditures, modifying policies, and launching supply chain efficiency-boosting campaigns.

Implications and Recommendations

The research findings have several ramifications for researchers, stakeholders in agriculture, and policymakers:

- a. It is recommended that policymakers contemplate modifying current policies and instituting novel ones to tackle the particular obstacles and prospects highlighted in the research. This might entail focused initiatives to enhance supply chains, upgrade infrastructure, and provide farmers with more assistance.
- b. Sustaining infrastructure development, namely in the areas of transportation, irrigation, and storage facilities, is essential to improving the overall productivity of Central Java's agricultural industry. Strategic planning is necessary to ensure that infrastructure projects meet the unique requirements of various locations.
- c. To enhance market connections, storage facilities, and transportation networks, stakeholders in the agricultural supply chain should cooperate. Farmers may earn more money as a result of supply chain initiatives that enhance efficiency and cooperation.
- d. Future studies should look into other variables like market dynamics, climate resilience, and technology adoption that affect farmers' income. Studies with a longer duration may shed light on how the associations found in this research are changing over time.

Limitations and Future Research

There are several restrictions even with the SEM-PLS analysis's resilience. Since the study is cross-sectional, causality cannot be conclusively demonstrated, but it does offer a picture of the relationships. A longitudinal method could be used in future studies to look at how these associations change over time. Furthermore, the results might only apply to the particular features of the agricultural environment in Central Java.

CONCLUSION

In summary, this study offers a thorough understanding of the variables affecting farmers' income in the agricultural region of Central Java. The supply chain's efficiency, government policies, infrastructure, and farmers' income are all clarified by the descriptive data, which prepare the ground for a thorough quantitative study. The established assumptions are supported by the SEM-PLS analysis results, which validate the beneficial effects of supply chain efficiency, government regulations, and infrastructure development on farmers' income. The report emphasizes the value of strategic infrastructure spending, flexible governmental regulations, and cooperative initiatives to improve supply chain operations. These results can be used by stakeholders and policymakers to create interventions that will enhance the general well-being of Central Javan farmers. The study adds insightful information to the body of knowledge on agricultural development and lays the groundwork for further research examining other variables affecting farmers' income in various

agricultural settings. Although the statistical relationship between these variables is strong, farmers and the government are highly interdependent, so the real implications for the government to improve farmers in Central Java include regulation and distribution similar to other big cities.

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