# Analysis Of Rice Farmers' Welfare Through Rice Production Optionalism: A Public Economic Approach And Natural Resource Utilization In The Village Of Sidodadi Ramunia

Annisa Ilmi Faried[1]*, Uswatun Hasanah[2], Rahmad Sembiring[3], Nisa Ulzannah[4]
[1*,3]Master of Economics, Universitas Pembangunan Panca Budi, Medan, Indonesia
[2,4]Development Economics Study Program, Faculty of Social Sciences,
Universitas Pembangunan Panca Budi, Medan

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***Correspondence Address:**
annisailmi@dosen.pancabudi.ac.id

**Abstract:** This study aims to analyze the welfare of rice farmers in Sidodadi Ramunia Village through the approach of optimizing rice production, considering aspects of public economy and utilization of natural resources. This study uses qualitative and quantitative research methods, with data collection through field observations, in-depth interviews, and document analysis. The research sample consisted of rice farmers, village officials, and related stakeholders in Sidodadi Ramunia Village. The results of the study indicate that optimizing rice production has a significant impact on improving the welfare of rice farmers. Factors that influence production optimization include the use of agricultural technology, access to capital and markets, and government policies in supporting the agricultural sector. This study also reveals the importance of a public economy approach in regulating the distribution of resources and benefits from rice production, as well as the crucial role of sustainable utilization of natural resources. The conclusion of the study emphasizes the need for an integrated strategy involving the government, private sector, and communities to improve the welfare of rice farmers through optimizing rice production. The proposed recommendations include improving agricultural infrastructure, training programs for farmers, and policies that support fair rice selling prices and wider market access.

## INTRODUCTION

Geographic Information Systems have become an indispensable tool in modern society, offering a powerful platform for managing and analyzing geographically referenced data (Sadoun & Rawashdeh, 2009). These systems have widespread applications in various sectors, including environmental management, urban planning, and rural development. (Grupe, 1990) (Sadoun & Rawashdeh, 2009) (Tú et al., 2023) In sustainable development initiatives, GIS has emerged as a crucial technology, enabling

decision-makers to make informed choices and effectively address complex environmental and societal challenges.

GIS Applications in Sustainable Development. The application of GIS in sustainable development initiatives is multifaceted. For example, GIS has been utilized in transmigration settlement, regional spatial and urban planning, optimizing land use, and identifying suitable locations for development projects. Furthermore, GIS has been instrumental in monitoring and managing environmental issues, such as land, water, and air quality, by providing comprehensive spatial data and analysis capabilities. (Tú et al., 2023). The utilization of GIS in rural development is another area of significant importance. GIS can assist in planning and implementing development projects, such as establishing markets, settlements, and industrial relocation, thereby improving resource allocation and rural communities' overall quality of life. Additionally, GIS has demonstrated its value in humanitarian emergencies, where it has been used to provide essential maps for decision-making and advocacy and improve data collection in the field. (Kaiser et al., 2003).

Challenges and Recommendations. Despite the numerous benefits of GIS in sustainable development initiatives, some challenges need to be addressed. (Tú et al., 2023) The initial investment required for equipment and capacity building can be substantial, and the methodologies and tools must be practical and appropriate for field use, especially in humanitarian emergencies. To overcome these challenges, further research and development is necessary. Integrating GIS into the facility delivery process, from planning and design to construction and maintenance, can lead to more efficient urban planning and development. (Adams et al., 1992) Additionally, the continued improvement of GIS methods and the widespread adoption of these technologies can contribute to more effective and sustainable development initiatives that ultimately benefit both the environment and local communities.

The Conclusion for Geographic Information Systems has become crucial in sustainable development initiatives, enabling decision-makers to make informed choices and address complex environmental and societal challenges. As the potential of GIS continues to be realized, its applications in areas such as urban planning, environmental management, and rural development will become increasingly important in driving sustainable development efforts.

## RESEARCH METHODS

This research utilizes a descriptive approach with a qualitative focus, analyzing the application of Geographic Information Systems in sustainable development initiatives. The study is based on a review of relevant literature, including academic journal articles, industry reports, and government publications. The key sources used in this research are: These sources provide a comprehensive overview of the use of GIS in various development contexts, including urban planning, environmental management, and rural development.

The literature review focuses on identifying the main applications and benefits of GIS in sustainable development, as well as the challenges and recommendations for its effective implementation. The application of Geographic Information Systems in sustainable development initiatives is multifaceted and has demonstrated significant benefits. GIS has been used in transmigration settlement planning, regional spatial planning, and urban planning, allowing for the optimization of land use and the identification of suitable locations for development projects (Widodo, 2021) (Noor et al., 2014).

Furthermore, GIS has been instrumental in environmental management, providing comprehensive spatial data and analysis capabilities for monitoring and managing issues related to land, water, and air quality. The utilization of GIS in rural development is another area of significant importance. GIS can assist in the planning and implementing (Widodo, 2021) (Heinimann et al., 2003) (Aagesen, 2005) (Noor et al., 2014) of development projects, such as the establishment of markets, settlements, and industrial relocation , thereby improving resource allocation and enhancing the overall quality of life for rural communities. (Noor et al., 2014) (Widodo, 2021).

However, the literature also highlights challenges associated with the implementation of GIS in sustainable development initiatives. These challenges include the substantial initial investment required for equipment and capacity building, and the need for practical and appropriate methodologies and tools, especially in humanitarian emergencies. To overcome these challenges, further research and development is necessary. Integrating GIS into the facility delivery process, from planning and design to construction and maintenance, can lead to more efficient urban planning and development (Heinimann et al., 2003). Additionally, the continued improvement of GIS

methods and the widespread adoption of these technologies can contribute to more effective and sustainable development initiatives, ultimately benefiting both the environment and local communities.

The agricultural sector, especially rice production, plays a vital role in the Indonesian economy. However, the welfare of rice farmers is still a crucial issue that needs to be addressed comprehensively. Sidodadi Ramunia Village, located in Deli Serdang Regency, North Sumatra, is one of the rice production centers that faces various challenges in efforts to improve the welfare of its farmers. Based on data from the Central Statistics Agency (BPS) of Deli Serdang Regency in 2022, rice production in this area reached 452,637 tons, with Sidodadi Ramunia Village contributing around 5% of the total production. However, the level of welfare of rice farmers in this village is still relatively low, with an average farmer income of only IDR 1,500,000 per month (Deli Serdang Regency Agriculture Service, 2023).

From a public policy perspective,(Deli Serdang Regency Development Planning Agency, 2023)highlights the importance of synchronization between agricultural policies and regional spatial planning. This document reveals that the conversion of productive agricultural land around Sidodadi Ramunia Village reaches 5% per year, threatening the sustainability of rice production in the area. Based on the complexity of the problems faced by rice farmers in Sidodadi Ramunia Village, as well as the potential solutions offered through production optimization, public economic approaches, and sustainable use of natural resources, this research is very relevant and urgent. The results of the study are expected to provide concrete recommendations for policy makers and agricultural business actors in efforts to improve the welfare of rice farmers in the village.

In addition to the problems mentioned above, there are several other aspects that need to be considered in the context of the welfare of rice farmers in Sidodadi Ramunia Village. First, the institutional aspect of farmers plays an important role in optimizing production and marketing of agricultural products. According to a study conducted by(Simanjuntak & et al., 2023)well-functioning farmer groups can increase farmers' bargaining position by up to 40% in selling price negotiations. However, in Sidodadi Ramunia Village, only 30% of farmer groups are active and functioning optimally (Deli Serdang Regency Agriculture Service, 2023).

Second, climate change has become a serious threat to agricultural productivity in this region.(Meteorology, Climatology, and Geophysics Agency, 2023)reported that in the last five years, there has been a 25% increase in the frequency of extreme weather in Deli Serdang Regency. This has a direct impact on planting patterns and the risk of crop failure faced by farmers.

Third, the aspect of financial literacy among farmers is still an obstacle in managing farm business finances. Research(Tarigan & et al., 2022) shows that only 40% of farmers in Sidodadi Ramunia Village have a good understanding of financial management and access to formal financial services. This condition limits farmers' ability to invest in improving agricultural technology and diversifying their businesses (Sembiring & Faried, 2020).

## RESULTS AND DISCUSSION

Based on interviews with farmers, their incomes vary depending on the size of the land, the type of rice variety planted, and the production techniques used. The average annual income of rice farmers in this village ranges from IDR 5,000,000 to IDR 10,000,000 per hectare. Many farmers reported that their incomes often do not cover the basic needs of their families, especially during periods of drought or when rice prices fall. Fluctuations in rice prices in the local market and high production costs, such as purchasing fertilizers and pesticides, contribute to income instability. One farmer said, "Most farmers in Sidodadi Ramunia Village stated that their incomes are only enough to cover basic needs such as food and health, but are often insufficient for education and investment in agriculture." (Mr. Sugimin, 38 years old, interview July 27, 2024, Sidodadi Ramunia Village Location).

**Table 1. Estimated Profits and Losses of Rice Farmers in Sidodadi Ramunia Village**

| Category | Description | Estimate (per Hectare) |
|---|---|---|
| **Income** | | |
| Selling Price of Rice per Kg | The price of rice received by farmers in local markets or collectors | Rp. 5,000 |
| Average Harvest Yield | The amount of rice produced per hectare | 6,000 Kg |
| **Gross Income** | Total Income from Rice Sales | Rp. |

| | | |
|---|---|---|
| **(Annual)** | | 30,000,000 |
| **Production cost** | | |
| Seed Cost | Cost of buying rice seeds | Rp1,000,000 |
| Fertilizer and Pesticide Costs | Costs for fertilizers and pesticides | Rp2,000,000 |
| Irrigation Costs | Costs for maintenance of irrigation systems | Rp. 500,000 |
| Labor costs | Costs for labor (harvesting and maintenance) | Rp1,500,000 |
| Miscellaneous expense | Other additional costs (e.g. transportation) | Rp. 500,000 |
| **Total Production Cost** | | Rp. 5,500,000 |
| **Net Profit (Annual)** | Total Revenue - Total Production Cost | Rp24,500,000 |
| **Marketing of Rice Products** | | |
| Local Market | Village market or traditional market | 60% of total results |
| Collector | Collectors or intermediary traders | 30% of total results |
| Export | If there is, for markets outside the village | 10% of total results |

Source: Observation Results, 2024

The table above provides a clear picture of the income and production costs for rice farmers in Sidodadi Ramunia Village. Annual gross income is calculated based on the selling price of rice of IDR 5,000 per kilogram and an average harvest per hectare of 6,000 kg. Thus, the total gross income from rice sales per hectare is IDR 30,000,000 per year. This figure shows the potential income that farmers can earn before calculating the costs associated with production. However, to obtain this harvest, farmers must incur a number of production costs. The total annual production cost is IDR 5,500,000, consisting of seed costs (IDR 1,000,000), fertilizer and pesticide costs (IDR 2,000,000), irrigation costs (IDR 500,000), labor costs (IDR 1,500,000), and other costs such as transportation (IDR 500,000). After deducting production costs, the net profit obtained by farmers is IDR 24,500,000 per hectare in one year, which shows a positive profit even though there are quite significant production costs.

One important factor that can affect farmers' profits is the marketing channel for their harvest. In Sidodadi Ramunia Village, rice is marketed through three main channels: local markets, collectors, and exports. Most of the harvest, 60%, is sold in local markets, which often offer lower prices than collectors or export markets. Collectors buy about 30% of the harvest, which usually offers slightly better prices,

while 10% of the harvest is exported to markets outside the village, which may offer higher prices, depending on market demand.

The distribution of crops to different markets indicates a dependency on existing distribution channels. Farmers may not always get optimal prices if they rely only on local markets. Therefore, more diverse marketing strategies and access to more export markets or collectors can increase selling prices and, in turn, increase farmers' profits.(Faried & Sembiring, 2019). Nevertheless, the relatively high net profit shows that farmers in Sidodadi Ramunia Village can still obtain profitable results with efficient cost planning and marketing.

## CONCLUSION

The quality of natural resources, appropriate policies, access to technology and training, as well as support from farmer associations and adaptation to climate change all play a role in determining rice production outcomes and farmer welfare.(Purba et al., 2023; Simarmata et al., 2021). To achieve significant improvements in farmer welfare, there needs to be a comprehensive and coordinated approach that combines effective policies with practical support on the ground.(Nasution et al., 2021).

**Table 3 Factors of Required Resources, Success Metrics, and Assessment of the Effectiveness of Each Activity.**

| Factor | Action Description | Purpose of Action | Resources Required | Success Metrics | Effectiveness of Activities |
|---|---|---|---|---|---|
| Quality of Natural Resources | -Soil revitalization program with organic fertilizer.<br>-Training in soil improvement techniques. | -Increase soil fertility.<br>-Increase crop yields. | -Organic fertilizer.<br>-Training facilitator.<br>-Soil improvement tools. | -Increased crop yields.<br>-Number of farmers trained. | **Tall:** Significantly increases fertility and crop yields. |
| Public Economic Policy | -Subsidies for agricultural inputs.<br>-Incentives for the use of technology. | -Reduce production costs.<br>-Increase access to technology. | -Subsidy budget.<br>-Incentive policies.<br>-Administrative support | -Reduction of production costs.<br>-Increased use of technology. | **Tall:** Reducing costs and increasing access to technology. |
| Technology and Innovation | -Provision of modern agricultural | -Increase production efficiency. | -Agricultural technology.<br>-Budget for | -Number of technologies applied. | **Tall:** Significantly increase |

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| | technology.<br>-Training in the use of technology. | -Reduce production time and costs. | subsidies.<br>-Training facilitators. | -Increased crop yields. | efficiency and yield. |
| Training and Education | -Training programs on modern agricultural practices.<br>-New technique workshops. | -Improve farmer skills.<br>-Improve sustainable agricultural practices. | -Training materials.<br>-Workshop facilitators.<br>-Training budget. | -Number of trained farmers.<br>-Skills improvement. | **Tall:** Improvement of skills and effective practice. |
| Availability and Access to Resources | -Increase access to fertilizers, pesticides and water.<br>-Improve resource distribution. | -Ensure availability of resources.<br>-Increase productivity. | -Budget for distribution.<br>-Storage and distribution infrastructure. | -Increased access to resources.<br>-Increased crop yields. | **Currently:**Availability is increasing, but distribution needs further improvement. |
| Involvement in Farmers Associations | - Formation and strengthening of farmer associations.<br>-Technical support and information. | -Increase access to information and technical support.<br>-Improve marketing opportunities. | -Facilities for association.<br>-Support budget.<br>-Coordination team. | -Number of associations formed.<br>-Increase in farmers' income. | **Tall:**Increase technical support and marketing opportunities. |
| Impact of Climate Change | -Research on rice varieties that are resistant to climate change.<br>-Training on adaptation techniques to climate change. | -Adapting agriculture to climate change.<br>-Reducing the risk of declining crop yields. | -Research budget.-Training materials.<br>-Researchers and agronomists. | -New varieties introduced.<br>-Improved plant resistance. | **Currently:**Research and adaptation takes time, but is important in the long term. |
| Policy Integration and Implementation | -Coordination between policy and implementation.<br>-Periodic evaluation and adjustment of policies. | -Ensure that designed policies are implemented effectively.<br>-Enhance the positive impact of policies. | -Evaluation team.<br>-Monitoring system.<br>-Budget for evaluation. | -Conformity between policy and implementation.<br>-Increasing the impact of policy. | **Tall:** Good integration increases the overall effectiveness of policies. |

Source: Observation Results, 2024

The table presented illustrates the various factors that play an important role in supporting sustainable agricultural activities and increasing agricultural productivity. The first factor, Natural Resource Quality, focuses on soil revitalization efforts with organic fertilizers and training in soil improvement techniques. The main objective of this action is to increase soil fertility, which directly contributes to increased crop yields(Faried et al., 2021). With resources that include organic fertilizer, training facilitators, and soil improvement tools, success can be measured by increased crop yields and the number of farmers trained (Mosher, 1985). The effectiveness of this activity is categorized as high, because soil revitalization and significant increase in crop yields can be achieved through the application of appropriate techniques.

Furthermore, Public Economic Policy includes subsidies for agricultural inputs and incentives for technology use, which aim to reduce production costs and increase access to technology. The resources needed include subsidy budgets, incentive policies, and administrative support(Faried et al., 2020). The success metrics for this activity are measured by reducing production costs and increasing the use of technology by farmers. The effectiveness of this policy is also considered high, because it can reduce costs for farmers and accelerate the adoption of new, more efficient technologies, supporting the sustainability of the agricultural sector(Faried et al., 2018).

The Technology and Innovation factor emphasizes the provision of modern agricultural technology and training in its use, which aims to increase production efficiency and reduce time and costs in the agricultural process. Agricultural technology and subsidy budgets are the main resources to support this action(Swasono et al., 2023). Success is measured by the amount of technology applied by farmers and the increase in yields. The effectiveness of this activity is very high, because the technology applied can significantly increase productivity, helping farmers overcome production challenges more efficiently and sustainably.

The last factor that needs to be considered is the Integration of Policy and Implementation. This factor emphasizes the importance of coordination between the designed policies and their implementation in the field, as well as periodic evaluation and adjustment of policies. The main goal is to ensure that the implemented policies are effective and have a positive impact on the agricultural sector (Arvianti et al., 2022). Evaluation teams, monitoring systems, and budgets for evaluation are necessary

resources. Success is measured by the extent to which the policies implemented are in accordance with the desired objectives, and the positive impacts achieved. Its effectiveness is very high, because well-implemented policies will strengthen the positive impacts of all integrated agricultural activities.

**Table 4 Aspects That Support Policy Implementation and Resource Utilization**

| Factor | Action Description | Purpose of Action | Resources Required | Success Metrics | Effectiveness of Activities |
|---|---|---|---|---|---|
| **Agricultural Infrastructure** | -Construction and improvement of infrastructure such as roads, warehouses, and storage facilities<br>-Development of irrigation facilities. | -Increase access to markets.<br>-Facilitate distribution and storage of agricultural products.<br>-Ensure water availability. | -Budget for construction.<br>-Contractors.<br>-Construction materials. | -Increased market access.<br>-Reduced post harvest damage.<br>-Water availability. | **Tall:** Good infrastructure improves distribution and storage efficiency. |
| **Financial Support** | -Provision of agricultural credit with low interest. -Capital assistance for investment in agricultural equipment. | -Facilitate investment in agricultural technology and inputs.<br>-Reduce the financial burden on farmers. | -Credit funds.-Financial institutions.<br>-Credit management systems. | -Amount of credit granted.<br>-Use of capital for investment.<br>-Reduction in financial burden. | **Tall:** Facilitating access to capital and investment, increasing productivity. |
| **Occupational Health and Safety** | -Health and safety training programs for farmers.<br>-Provision of health facilities in villages. | -Improve farmers' health.<br>-Reduce work absences due to health problems. | -Budget for training.<br>-Health facilities.<br>-Health team. | -Reduced rates of illness and injury.<br>-Increased work productivity. | **Currently:** Improved health can reduce absenteeism and increase efficiency. |
| **Marketing and Sales** | -Development of marketing strategies.<br>-Formation of partnerships with companies and collectors. | -Increase market access.<br>-Increase the selling price of crops. | -Budget for promotion.<br>-Partnership with companies.<br>-Distribution system. | -Increase in selling price.<br>-Number of partnerships formed.<br>-Increase in sales volume. | **Tall:** A good marketing strategy can increase farmers' income. |
| **Role of Government and Policy** | -Monitoring and enforcement of policies that support | -Ensure policies are implemented | -Supervision team.<br>-Policy | -Conformity between policy and | **Tall:** Clear policy enforcement |

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|---|---|---|---|---|---|
| | agriculture.<br>-Provision of information on government policies and programs. | properly.<br>-Increase farmers' understanding of existing policies. | information system.<br>- Administrative budget. | implementation.<br>-Increasing farmer understanding. | and information improves compliance and effectiveness. |
| **Risk Management** | - Development of agricultural insurance systems.<br>-Implementation of risk mitigation methods such as crop diversification. | -Reduce the risk of losses due to natural disasters or plant diseases. - Increase the financial resilience of farmers. | -Budget for insurance.<br>-Risk mitigation system.<br>-Farmer education. | -Number of farmers protected by insurance.<br>-Reduction in losses due to risk. | **Currently:** Insurance and risk mitigation can reduce losses but take time for effective implementation. |
| **Community Engagement** | -Establishment of village committees for resource management and farmer support.<br>-Facilitate community participation in planning and evaluation. | -Increase community participation in management<br>-Strengthen support for policies and programs. | -Committee management team.<br>-Budget for facilitation.<br>-Community feedback system. | -Number of community participation.<br>-Quality of support for the program. | **Tall:** Community engagement increases the effectiveness of programs and policies through local support. |

Source: Observation Results, 2024

Table 4 illustrates various aspects that support the implementation of policies and utilization of resources in the agricultural sector. One important aspect is Agricultural Infrastructure, which includes the construction and improvement of basic infrastructure such as roads, warehouses, storage facilities, and the development of irrigation systems. The main objective is to improve access to markets, facilitate the distribution of agricultural products, and ensure the availability of water for agriculture. In the theory of economic development, infrastructure is often considered a key factor influencing economic efficiency. Good infrastructure can reduce distribution costs, increase resilience to natural disasters, and facilitate the flow of goods, thereby increasing agricultural output and competitiveness (Maya Syaula et al., 2023). Success metrics for this aspect include increased market access, reduced post-harvest damage, and water availability, with high effectiveness because good infrastructure directly contributes to agricultural efficiency and productivity.

Financial Support is also a crucial aspect, where the provision of low-interest

agricultural credit and capital assistance for equipment investment aims to facilitate farmers in investing in agricultural technology and inputs, and reduce their financial burden (Citra Ananda et al., 2023). Modern economic theory, particularly in relation to human capital theory and growth theory, states that access to capital can accelerate the adoption of technology and innovation, which in turn increases productivity. The metrics for the success of this financial support are the amount of credit provided, the use of capital for investment, and the reduction of farmers' financial burden. The effectiveness of this activity is considered high because easy access to capital allows farmers to increase their production capacity, which has a direct impact on increasing agricultural output and their economic well-being.

Besides that,Occupational Health and Safety is a factor that supports agricultural productivity. Health and safety training programs and the provision of health facilities in villages aim to improve farmer health and reduce absenteeism due to health problems. In human development theory, health is considered an important factor affecting quality of life and work productivity. Poor health conditions can reduce work efficiency and reduce agricultural output, while effective health programs can increase productivity and reduce costs related to absenteeism. Although the effectiveness of these activities is considered moderate, because significant changes in health take time, improvements in this aspect are still important to create a healthy and productive workforce.

Marketing and Sales also play an important role in supporting the implementation of agricultural policies. The development of marketing strategies and partnerships with companies and collectors aims to improve market access and selling prices for agricultural products. Marketing and microeconomic theory suggests that effective marketing strategies can improve product competitiveness, expand markets, and provide better prices for farmers. With partnerships and efficient distribution systems, agricultural products can be marketed better, which in turn increases farmers' income. Success metrics are measured by increasing selling prices, the number of partnerships formed, and increasing sales volume. The effectiveness of this activity is considered high, because success in marketing can directly improve farmers' welfare, supporting the sustainability of the agricultural economy.

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