

## ANALYSIS OF PRODUCTION EFFICIENCY AND INCOME OF IRRIGATED RICE (ORYZA SATIVA L) FARMING IN BANDAR BARU DISTRICT, PIDIE JAYA REGENCY

Maidawati<sup>1</sup>, Adhiana<sup>2</sup>, Mawardati<sup>3</sup>

<sup>1</sup>Student of Master Agriculture Department, Faculty of Agriculture Universitas Malikussaleh, Indonesia.

<sup>2,3</sup> Faculty of Agriculture Universitas Malikussaleh, Indonesia.

Corresponding Author: [adhiana@unimal.ac.id](mailto:adhiana@unimal.ac.id)

Received : 28 May 2023

Revised : 10 June 2023

Accepted : 20 June 2023

Published : 29 June 2023

DOI : <https://doi.org/10.54443/ijeas.v3i3.3881>

Publish Link : <https://radjapublika.com/index.php/IJEBAJ>

### Abstract

This study aims to analyze the production efficiency and income of lowland rice (*Oryza sativa* L.) farming in Bandar Baru District, Pidie Jaya Regency. The study was conducted in June–July 2023 with 80 respondents. Data were obtained through interviews and questionnaires, and analyzed using stochastic frontier analysis (SFA) and dual cost functions. The results indicate that lowland rice farming has achieved technical efficiency, but is not yet allocatively or economically efficient. As a result, farmer income is not optimal, although it still has the potential to be increased through improved production input management.

**Keywords:** *Production efficiency, income, rice farming, stochastic frontier.*

### INTRODUCTION

Indonesia is an agrarian country that relies heavily on the agricultural sector, particularly the food crops subsector. Rice, as a primary commodity, contributes significantly to food security, employment, and maintaining national economic and political stability. Even a small increase in rice prices can trigger inflation, making increasing rice productivity a top government priority. Agriculture is the human use of biological resources to produce food, industrial raw materials, or energy sources, as well as to manage the environment. In the narrow sense, agriculture is the cultivation of crops on land to meet human needs. In the broadest sense, agriculture encompasses all agricultural activities, including food crops, horticulture, plantations, forestry, livestock, and fisheries. Rice is a crucial commodity in the food crops subsector of the agricultural sector, serving as a staple food for the Indonesian people, which is then processed into rice. Its role extends beyond generating added value and providing employment. It is also a commodity that significantly impacts national economic stability, particularly in terms of disrupting inflation and political stability. Aceh Province ranks eighth among Indonesia's largest rice producers. Pidie Jaya Regency, particularly Bandar Baru District, boasts extensive rice fields, but productivity remains low compared to other districts. This indicates a problem with efficiency in the use of production inputs. With a land area of 1,872 hectares, Bandar Baru District only produces around 5.07 tons/ha, lower than Meureudu District, which has less land but achieves a productivity of 7.57 tons/ha. Rice Land Area, Production, and Productivity by Sub-district in Pidie Jaya Regency in 2021

# ANALYSIS OF PRODUCTION EFFICIENCY AND INCOME OF IRRIGATED RICE (*ORYZA SATIVA* L) FARMING IN BANDAR BARU DISTRICT, PIDIE JAYA REGENCY

Maidawati et al

| No           | Kecamatan    | Luas Sawah<br>(Ha) | Luas Panen<br>(Ha) | Produksi<br>(Ton) | Produktivitas<br>(Ton/Ha) |
|--------------|--------------|--------------------|--------------------|-------------------|---------------------------|
| (1)          | (2)          | (3)                | (4)                | (5)               | (6)                       |
| 1            | Bandar Baru  | 1.872              | 3.609              | 18.303            | 5,07                      |
| 2            | Panteraja    | 235                | 426                | 2.853             | 6,70                      |
| 3            | Trienggadeng | 1.384              | 2.055              | 9.655             | 4,70                      |
| 4            | Meureudu     | 1.265              | 2.459              | 18.619            | 7,57                      |
| 5            | Meurah Dua   | 595                | 1.190              | 8.665             | 7,28                      |
| 6            | Ulim         | 785                | 1.570              | 11.215            | 7,14                      |
| 7            | Jangka Buya  | 501                | 986                | 6.025             | 6,11                      |
| 8            | Bandar Dua   | 2.187              | 3.990              | 25.934            | 6,50                      |
| <b>Total</b> |              | <b>8.824</b>       | <b>16.285</b>      | <b>101.270</b>    | <b>6.22</b>               |

Sumber: Dinas Pertanian dan Pangan dan BPS Kabupaten Pidie Jaya Tahun 2021

The formulation of the research problem is: (1) has the rice paddy farming business in Bandar Baru District achieved technical, allocative and economic efficiency? (2) how much income do farmers get from irrigated rice paddy farming in this area?

## LITERATURE REVIEW

Rice (*Oryza sativa* L.) is one of the most important cultivated plants in civilization and is also the most important crop in Indonesia because the staple food in Indonesia is rice, which is naturally produced by rice plants. As a major crop in the world, rice is thought to have originated in eastern North India, Northern Bangladesh, Burma, Thailand, Laos, Vietnam, and southern China (Suparyono, 1993). Rice grows well in both tropical and subtropical regions; adequate water availability to inundate the planting area is crucial. Rice is suitable for cultivation in coastal areas up to an altitude of 2,400 meters above sea level, from 530°N to 400°S. Prior to 1965, rice was cultivated conventionally. It was planted in rain-fed fields or paddy fields with simple maintenance. The rice varieties planted were local, long-lived, low-tilling, low-yielding, and generally planted only once a year. Eight rice varieties during this period included BB-5, PB-8, Pelita I-1, Pelita 1-2, PB-26, PB-28, and Si Ampat (Istiyastuti and Yanuharso, 1996).

In Indonesia, people consume milled rice (rice) as a great source of energy because it contains a lot of carbohydrates that act as fuel for the body and help in normal brain function. Another benefit is that it is cholesterol-free, which is very good for health, because rice does not contain harmful fats, namely cholesterol or sodium. Rice is one part of a balanced diet and is rich in vitamins such as niacin, vitamin D, calcium, fiber, iron, thiamine, and riboflavin. Before the rice planting process begins, land preparation is necessary. This can include plowing the rice fields using a tractor or using a buffalo or cow plow. Plowing is done twice. After plowing is complete, the land must be harrowed or smoothed to facilitate the rice planting process. Leveling the rice fields with a harrow is also necessary. Ditches are dug around the rice fields to prevent snails from pooling in the middle of the fields. Rice cultivation is not immune to weeds and pests, but the most significant problems are the pests and diseases that frequently attack rice plants. Weed control can be achieved by removing weeds that interfere with rice growth. Pests and diseases can be eradicated by spraying pesticides, depending on the pests and diseases affecting the rice.

**Agricultural processing subsystem** The agricultural processing subsystem is a whole processing activity, starting from simple processing at the farmer level, which is in the form of post-harvest handling, to more advanced processing in the form of creating added value to primary products (Hermawan, 2006). The agricultural processing subsystem is also often referred to as an agro-industrial activity or industrial activity that uses agricultural products as raw materials (Saragih, 2001). The agro-industrial subsystem can also be interpreted as downstream agribusiness which is an industry that processes primary agricultural products or commodities into processed products such as the food industry, beverages, feed, natural fiber goods, pharmaceuticals and even bio-energy (Nainggolan and Aritonang, 2012). In running a farming business, every farmer will inevitably incur costs, known as production costs. These production costs vary but serve the same purpose: to increase the farm's output. Therefore, the amount of these costs is independent of the amount of production achieved, while variable costs are influenced by the amount of production achieved. Fixed costs include land rent, taxes, agricultural equipment, irrigation fees, and others. Variable costs include the cost of production inputs, labor costs, harvesting costs, and transportation costs (Soekartawi, 2008).

The primary purpose of a trading business is to generate income, which can be used to support the livelihood and survival of the business. Income is received in the form of money, which serves as a means of payment or exchange. In modern economics, there are two main branches of theory: price theory and income theory. Income theory is a subset of macroeconomics, which studies broad issues such as:

1. Millions of rupiah consumer spending behavior
2. Business world investment
3. Purchases made by the government.

According to the pioneers of economics, income distribution is divided into three main social classes: workers, capitalists, and landlords. These three factors determine the three factors of production: labor, capital, and land. The income received by each factor of production is considered the income of each skilled family relative to national income. Income is the result of subtracting total output from total input. Income levels are determined by the ability of production factors to produce goods and services. The more capable production factors are of producing goods and services, the greater the income generated. Labor is a crucial factor in the production process and must be taken into account. The quality of the labor is also crucial in the production process. In farming, the majority of the labor force comes from the farmer's own family. This family labor contributes to overall agricultural production and is not necessarily valued in monetary terms, but sometimes requires additional labor, for example, in land cultivation, either in the form of livestock work or direct labor. Therefore, the amount of labor wages is determined by gender. Male labor wages are generally higher than female labor wages (Mubyarto, 2000). Farming efficiency is an important indicator of successful resource management. According to Soekartawi (2006), efficiency can be divided into technical efficiency, allocative efficiency, and economic efficiency. Technical efficiency is achieved when farmers are able to maximize output from a given combination of inputs. Allocative efficiency occurs when the combination of inputs results in minimum costs for a given level of output. Economic efficiency is achieved when both technical and allocative efficiency are met simultaneously. Previous studies have shown that limited access to technology, information, and capital often contribute to low rice farming efficiency in Indonesia.

## **METHOD**

The research was conducted in Bandar Baru District, Pidie Jaya Regency, from June to July 2023. Eighty farmers were selected as respondents using a purposive sampling technique. The data used consisted of primary data (interviews and questionnaires) and secondary data from the Statistics Indonesia (BPS) and the Department of Agriculture. Variables analyzed included land area, seed and fertilizer use, labor, and farmer income. Data analysis used a stochastic frontier approach to measure technical efficiency, which is the extent to which farmers are able to maximize production from a given combination of inputs. Allocative and economic efficiency were calculated using a dual cost function. Additionally, an income analysis was performed to determine farmers' net profits per growing season. The stochastic frontier model allows for a separation of the influence of random factors (climate, pests, luck) from technical inefficiency.

The population in this study were farmers who planted lowland rice in 2022-2023 and owned irrigated rice fields in the study area. The sample villages were selected using a purposive sampling method, which involved farmers in the sample villages. Of the 43 villages with rice fields, four were selected, considering they are rice production centers, have irrigated rice fields, and have the largest land area among the other villages. The calculation of respondents to be used in this study uses a simple random technique, this method was chosen because each village's population is homogeneous, so that any element selected as a sample can represent the population. The determination of the sampling method is done by taking 20% of each number of farmers from each sample village, so that the sample will be taken from each village.

## **RESULTS AND DISCUSSION**

Bandar Baru District is one of the districts in Pidie Jaya Regency. Geographically, Bandar Baru District is located at 04.47' North Latitude, 96.20' East Longitude with an altitude of 4-16 m above sea level. Bandar Baru District covers an area of 220.47 km<sup>2</sup>, consisting of 43 villages, 8 settlements, and 115 hamlets. The administrative boundaries of Bandar Baru District are as follows:

# ANALYSIS OF PRODUCTION EFFICIENCY AND INCOME OF IRRIGATED RICE (*ORYZA SATIVA* L) FARMING IN BANDAR BARU DISTRICT, PIDIE JAYA REGENCY

Maidawati et al

North : Strait of Malacca  
East : Pante Raja District  
South : Pidie Regency  
West : Pidie Regency

Bandar Baru District is located approximately 23 km from the district capital, with a travel time of approximately 27 minutes. Bandar Baru District consists of 43 villages and eight sub-districts: Nyong, Lancok, Keude Lueng Putu, Langieng, Tanoh Mirah, Musa, Cubo, and Jalan Rata (Central Statistics Agency, 2021). The characteristics of the respondent farmers show variations in age, education level, and farming experience. Most farmers are of productive age with more than 10 years of farming experience, but their education level is relatively low. This impacts their ability to adopt new technologies. Production factors that significantly influence rice farming yields are land area, seed quantity, fertilizer, and labor. Stochastic frontier analysis results show an average technical efficiency value of 0.86, indicating that farmers can still increase production by up to 14% if inputs are optimally managed.

Income outside of irrigated rice farming is a crucial factor in conducting farming activities. The greater the income a farmer has outside of irrigated rice farming, the easier it will be to finance the management of production factors within their farm, such as funding for planting, fertilizing, weeding, controlling crop production (HT), harvesting, and post-harvest operations. The average area of land planted with paddy rice in the research village is 0.28 hectares. Land size influences the scale of the farm, with the size of the farm dependent on the size of the land. Farmers with large plots of land typically produce larger yields. Allocative efficiency has not been achieved because the marginal product of some inputs is not proportional to their prices. For example, fertilizer use tends to be excessive, resulting in high costs but not significant additional yields. This also results in low economic efficiency.

One of the factors to obtain high production is by using good and quality seeds, the results of the data obtained are the paddy rice seeds used by respondents in the research location are various varieties namely Inpari 32 and Mikongga, the reason farmers choose this variety because it has a thin skin so it is easy to grow, as well as far superior resistance to pests and diseases. The average use of paddy rice seeds in the sample village is 11.3 kg with an average land area of 0.28 ha. The labor force in lowland rice farming in the research area consists of male and female workers. Both laborers are employed in activities including soil preparation, seeding, planting, fertilizing, weeding, spraying, harvesting, and post-harvest transportation. Labor utilization is based on activity components in conventional lowland rice farming systems with conventional planting systems in Bandar Baru District, Pidie Jaya Regency.

In this study, labor is calculated in units of Man-Days (HOK). The average use of labor in the process of rice farming in Pidie Jaya Regency is 8.81 HOK. The labor used in farming at the research location mostly comes from outside the family, this is because the labor in the family does not have much experience and is also still of school age, so that in terms of planting rice, labor is needed from outside the family who are already able to carry out the process of planting rice, usually farmers at the research site use labor from fellow farmers who also have rice farming businesses, in this case it is likely that the labor used already understands the planting process. Income analysis shows that the average farmer earns a profit, but the profit margin is relatively small due to high production costs. Factors that increase income include larger land areas and more appropriate input use. Farmers with efficient input management are able to achieve higher incomes than other farmers, even with the same land area.

Efficient use of production inputs leads to optimal plant growth, thus maximizing production. However, in reality, farmers often use a limited number of production inputs based on habitual factors. Farmers pay little attention to the proportion of input use, input prices, and the resulting marginal product. Allocative and economic efficiency in this study were obtained through analysis of the production input side using input prices prevailing at the farm level. Based on the results of the dual cost function derivation in the equation above, allocative and economic efficiency values can be calculated. This allocative efficiency analysis aims to determine the rationality of farmers in conducting farming activities with the goal of generating profits. Profits are maximized when the combination of production factors achieves the highest level of economic efficiency. Allocative and economic efficiency are obtained through an analysis of production inputs using prevailing input prices at the farm level. The production function used as the basis for the analysis is the stochastic frontier production function. Overall, the results of this study confirm that limitations in allocative and economic efficiency are the primary causes of low farmer incomes in Bandar Baru District. Government intervention in the form of fertilizer subsidies, farm management training, and access to cultivation technology is essential.

## **CONCLUSION**

1. Lowland rice farming in Bandar Baru District is technically efficient, with an average technical efficiency score of 0.86. However, allocative and economic efficiency have not yet been achieved.
2. Farmers' incomes are still relatively low due to high production costs, especially from the use of fertilizers and labor.
3. The potential for increasing production and income is still wide open with better input management.

### **Suggestion:**

1. Farmers need to improve their skills in farm management, especially the use of fertilizers and seeds.
2. The government needs to expand input subsidy programs and access to cheap credit.
3. Agricultural extension workers must be more active in providing guidance on efficient cultivation technology.
4. Further research is needed regarding farming business diversification strategies to increase farmers' income.

## **REFERENCES**

- Soekartawi. 2006. Farming Analysis. Jakarta: UI Press. Nicholson, W. 2002. Microeconomic Theory. Jakarta: PT Raja Grafindo Persada. Coelli, T. 1996. A Guide to FRONTIER Version 4.1c. CEPA Working Papers. Hernanto, F. 2003. Farming Science. Jakarta: Penebar Swadaya. Mubyarto. 2000. Introduction to Agricultural Economics. Yogyakarta: LP3ES. Daniel, M. 2002. Introduction to Agricultural Economics. Jakarta: Bumi Aksara. Djojosemarto, P. 2008. Rice Production Technology. Jakarta: Penebar Swadaya.