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How Geographical Indication Certification Affects Robusta Coffee Farmer Operations in Central Java, Indonesia

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ABSTRACT

This study examines the economic performance of Geographical Indication (GI)-certified robusta coffee farming in Central Java, focusing on productivity, processing methods, cost analysis, and market potential. The research targeted MPIG-certified coffee farmers in Magelang and Temanggung Regency, with 256 respondents selected via a census method. Data collection involved structured questionnaires and interviews, and the analysis was quantitative, focusing on farm income and the Revenue/Cost (R/C) ratio, with qualitative insights on farmers' perceptions of GI adoption. GI-certified coffee farmers cultivate an average of 1.1 hectares, yielding 5.21 tons of cherry coffee per hectare—significantly exceeding the 3.3 tons per hectare reported in non-SOP robusta farms. This increased productivity is largely attributed to the adoption of standardized agricultural practices and optimized post-harvest processing. The findings reveal that dry processing is the predominant method due to its efficiency and cost-effectiveness, despite the potential for higher quality through wet and honey processing methods. Production costs average Rp 32,056,221 per hectare, with fertilizers as the largest expense, while average revenue from green bean and processed coffee is Rp 91,970,000 per hectare, yielding an R/C ratio of 2.86. This indicates that GI-certified coffee farming is profitable, and robusta coffee from Central Java meets strong domestic and international demand. However, challenges in branding, certification, and market differentiation persist, suggesting that further improvements in these areas could enhance economic benefits.

Keywords: geographical indication, farm income, economic performance, coffee processing, R/C ratio.

INTRODUCTION

Coffee has become an increasingly valuable global commodity, with consumption steadily rising each year. According to the International Coffee Organization (2022), global coffee consumption

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

grew by 3.3% between 2021 and 2022, increasing from 164.9 million tons to 170.3 million tons. This surge in demand has fueled the rapid expansion of coffee businesses, from small roadside vendors to large-scale cafés offering a wide variety of specialty coffee options. As coffee culture continues to spread, ensuring high-quality production has become more critical than ever to maintain competitiveness in the market.

The production process of coffee is shaped by diverse cultivation and post-harvest techniques, each of which plays a crucial role in determining the final quality of the beans. While traditional farming methods remain widely practiced, modern innovations in coffee cultivation and processing have introduced new ways to enhance flavor profiles and improve efficiency. However, the post-harvest stage is particularly significant, as even small errors in handling, drying, or fermentation can drastically impact the taste, aroma, and overall quality of coffee beans (Zuniyanto, 2019). Given the increasing global demand for premium coffee, there is a growing need for standardized practices that can help farmers produce consistently high-quality beans and maximize their economic returns.

Indonesia, particularly Central Java, is one of the country's leading coffee-producing regions (Central Bureau of Statistics, 2021). To preserve the distinctive characteristics and market value of Java coffee, local farmers have sought to implement structured cultivation and processing guidelines. The Geographical Indication Protection Society (MPIG) was established to create and enforce such standards, aiming to enhance product quality, strengthen market positioning, and ultimately boost the economic well-being of coffee farmers (Sumarjo et al., 2020).

Despite the potential benefits of MPIG's initiatives, widespread adoption among Central Java's coffee farmers remains limited. Many farmers perceive the certification process as complex and financially burdensome, while concerns about market access and payment mechanisms further discourage participation. These challenges highlight the need for a thorough evaluation of MPIG's economic performance—specifically, how its implementation affects the profitability and sustainability of coffee farming. Understanding the financial viability of adopting MPIG standards is crucial, as economic incentives play a major role in influencing farmers' willingness to comply with new agricultural regulations.

This study aims to bridge this gap by conducting an in-depth analysis of MPIG's impact on coffee farmers' livelihoods. Expanding upon previous research by Sumarjo et al. (2020) and Ihsnayati et al. (2020), which primarily focused on farmer education and awareness, this study introduces an economic perspective by incorporating an income analysis and a Revenue/Cost (R/C) ratio assessment. By quantifying the financial benefits of MPIG adoption, this research seeks to provide concrete evidence that adherence to geographical indication (GI) standards can lead to increased profitability and long-term sustainability for coffee farmers.

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

Ultimately, a comprehensive evaluation of MPIG's economic performance is essential to determining its effectiveness as a tool for improving coffee farming in Indonesia. If the findings demonstrate that MPIG implementation leads to higher income and financial stability, this could serve as a compelling argument for broader adoption among farmers. Moreover, such insights could inform policymakers and agricultural organizations in refining their support strategies, ensuring that quality certification programs not only enhance product competitiveness but also provide tangible economic benefits to the farmers they aim to assist.

METHOD

The research utilized a case study approach, focusing on coffee farmers who are members of the Geographical Indication Protection Society (MPIG) in Magelang and Temanggung Regency. These areas were selected as they represent key coffee-producing regions in Central Java. As stated by Audry and Djuwendah (2018), a case study is a research method that provides an in-depth exploration of a phenomenon concerning individuals or groups. This method was chosen to accurately depict the real-life farming activities of MPIG-affiliated coffee farmers.

The selection of respondents was conducted using a census method, targeting coffee farmers who are members of MPIG. A total of 256 coffee farmers participated in the study. In research, the census method involves selecting all individuals within a specific group and utilizing a questionnaire as a primary tool for data collection (Putra et al., 2021).

For data analysis, this study employed a quantitative approach, specifically evaluating the income of coffee farmers through farm income calculation and Revenue/Cost (R/C) ratio analysis. The total production cost was determined using the following equation:

$$\textbf{Total Production Cost = Total Fixed Cost + Total Variable Cost}$$

Meanwhile, total revenue was calculated using the formula:

$$\textbf{Total Revenue = Price × Quantity}$$

The R/C ratio serves as an indicator of business efficiency, obtained by comparing total revenue to total production costs. It is calculated as follows:

$$\textbf{R/C = (Pq × Q) / (TFC + TVC)}$$

The criteria for interpreting the R/C ratio are as follows:

- R/C ratio > 1: Indicates the business is profitable.

- R/C ratio = 1: Indicates the business is operating at the Break-Even Point (BEP).

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

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RESULT AND DISCUSSION

The average land area cultivated by coffee farmers who are members of the Geographical Indication Protection Society (MPIG) is approximately 1.1 hectares, yielding an average of 5.21 tons of cherry coffee per hectare. This level of productivity is notably higher than that of non-SOP (Standard Operating Procedure) geographical indication (GI) robusta coffee farms, which typically produce lower yields due to variations in farming techniques and post-harvest handling. Previous research by Wijaya (2017) reported that the productivity of robusta coffee farms in Magelang was around 3.3 tons per hectare, indicating that MPIG-certified farms achieve significantly better yields.

One of the key factors contributing to this increased productivity is the implementation of standardized agricultural practices and adherence to GI-based cultivation methods. According to Syahputra (2019), 1 hectare of coffee plantation can typically produce 2,000 kg of cherry coffee. However, post-harvest processing, particularly pulping using a pulper machine, results in a shrinkage ratio of approximately 1:3 to 1:4, meaning that every ton of harvested cherry coffee yields only 300–400 kg of green beans. This shrinkage factor aligns with findings from Syahputra's study, where 2,000 kg of cherry coffee was observed to produce around 800 kg of green beans after processing. This demonstrates that post-harvest shrinkage is an unavoidable aspect of coffee production, and efficient processing techniques are essential to maximizing output quality and reducing losses.

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

Harvesting Methods and Their Impact on Quality

Robusta coffee in Central Java typically enters the harvest season from July to September, with peak harvesting occurring in July. The process of coffee flowering to fruit maturation usually takes between 10 to 11 months. Harvesting is traditionally carried out manually through a selective picking method known as "handpicking" or "red picking," which ensures only fully ripe coffee cherries are collected. This method is widely recognized as superior to "strip picking," where all cherries, regardless of ripeness, are harvested at once. According to research by Rahmawati et al. (2020), the red-picking method significantly enhances the quality of coffee beans by maintaining lower moisture content and reducing the presence of unripe or overripe beans, which can negatively affect flavor consistency. Similarly, a study by Musfiroh et al. (2018) found that selective picking practices improve cupping scores and overall sensory attributes in robusta coffee.

A well-maintained coffee plant with optimal productivity can produce between 4–5 kg of coffee cherries per tree per season. Effective pruning practices further contribute to plant health and yield. Post-harvest pruning is conducted to eliminate unproductive branches, preventing them from diverting energy away from fruit-bearing stems. Wiwilan pruning, a specialized technique, involves removing unwanted water shoots that grow in improper directions, as these can disrupt coffee fruit production on the same branch. Such techniques are aligned with best agricultural practices that promote higher yields and healthier trees (Putra et al., 2021).

The Role of Shade Trees in Coffee Farming

Another important aspect of MPIG coffee cultivation is the integration of shade trees within coffee plantations. Farmers typically plant a mix of timber-producing trees such as sengon, mahogany, and lamtoro, alongside fruit-bearing trees such as cocoa, banana, and durian. These shade trees play a crucial role in mitigating the adverse effects of environmental factors, particularly excessive rainfall, which can cause flower and fruit loss in coffee plants. According to Rani et al. (2019), shade management in coffee farms enhances soil moisture retention, prevents erosion, and stabilizes temperature fluctuations—factors that are critical for sustaining coffee tree health and productivity. Furthermore, studies by Souza et al. (2021) indicate that well-structured agroforestry systems incorporating shade trees contribute to better soil organic matter and nutrient cycling, ultimately benefiting coffee yield and quality.

Economic Aspects: Production Costs and Input Utilization

MPIG-certified robusta coffee farmers in Central Java incur a total production cost of approximately Rp 32,056,221 per hectare. These costs are divided into fixed costs and variable costs. Fixed costs include expenses such as equipment depreciation, land taxes or rent, family

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

labor, and wages for post-harvest processing. Variable costs, on the other hand, cover expenditures on fertilizers, pesticides, coffee bags, and wages for hired labor. The investment in these agricultural inputs is justified by the improved yield and quality that adherence to MPIG standards offers.

Fixed costs include land tax (Rp 228,436), depreciation costs (Rp 967,169), family labor expenses (Rp 4,548,800), and post-harvest processing costs (Rp 4,035,692). Interestingly, land rent is recorded as Rp 0, indicating that most farmers own their land rather than leasing it. This is in line with previous studies (Rahmawati et al., 2020) that highlight land ownership as a significant factor in reducing financial burden and increasing long-term investment in coffee farming.

Table 1. Production Costs of Geographical Indication Cultivation

Cost Components	Total (Rp/ha/year)
Fixed Cost	
Land tax	228,436
Land rent	0
Depreciation	967,169
Family labor	4,548,800
Proccessing cost	4,035,692
Variable Cost	
Fertilizer	8,953,837
Pesticide	762,500
Bags	625,641
Transportation cost	1,004,462
Eksternal labor	7,417,436
Harvest cost	3,531,231
Total Production Cost	**32,056,221**

Variable costs encompass expenditures on fertilizers (Rp 8,953,837), pesticides (Rp 762,500), storage bags (Rp 625,641), transportation (Rp 1,004,462), external labor (Rp 7,417,436), and harvesting (Rp 3,531,231). The highest expense under variable costs is fertilizer, which aligns with research conducted by Prasetyo et al. (2020), emphasizing that proper fertilization is crucial for maintaining coffee productivity and bean quality.

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

Fertilization plays a critical role in sustaining coffee productivity. MPIG guidelines recommend that farmers fertilize their coffee plants twice a year—once at the start of the rainy season in October and again at the end of the rainy season in March. This timing is crucial, as fertilization during heavy rainfall may result in nutrient loss due to leaching. According to MPIG SOP, the recommended fertilizer dosages for coffee plants older than 10 years are Nitrogen (N) 160 g/tree, Phosphate (P) 80 g/tree, Potassium (K): 160 g/tree, and Urea: 400 g/tree.

This fertilization schedule aligns with research by Prasetyo et al. (2020), which emphasizes the importance of proper nutrient application to optimize coffee plant growth and enhance bean quality. Excessive or mistimed fertilization can lead to inefficient nutrient uptake, negatively impacting plant development. Comparative studies by Santoso et al. (2021) also support the benefits of targeted fertilization, showing that coffee farms with well-managed nutrient application achieve significantly higher yields than those with inconsistent fertilization practices.

Revenue and Income Analysis

Table 2 reveals that farmers achieve an average production of 1,632 kg of robusta coffee per hectare per year, with a market selling price of Rp 45,500 per kg. This results in a total revenue of Rp 69,360,000 per hectare per year. The net income is obtained by subtracting total production costs from total revenue, providing a clear picture of the profitability of MPIG-certified coffee farming.

Additionally, farmers generate non-cash income from processed coffee sales, totaling Rp 23,645,562 per hectare per year. The selling price of processed robusta coffee varies between Rp 80,000 and Rp 100,000 per kg, depending on production scale and processing costs. This pricing strategy is consistent with findings from Santoso et al. (2021), which suggest that farmers who engage in value-added processing—such as roasting and grinding—can command higher prices and increase overall profitability.

Table 2. Total revenue of coffee farmer members of MPIG.

Product	Production	Price	Revenue
	--kg--	--Rp/kg--	---Rp---
Greenbean	1.632	42.500	69.360.000
Coffee powder	266	85.000	22.610.000
		Total	91.970.000

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

It can be seen from Table 2 that the income received by farmers from processed coffee is Rp 22.610.000. The selling price set by farmers for their processed products varies from Rp 80,000,- to Rp 100,000,-. The difference in selling price depends on the production volume and production costs of each farmer in processing coffee powder.

The recommended coffee processing methods by MPIG include dry processing, wet processing, and honey processing. However, in reality, robusta coffee farmers who are members of MPIG only use the dry processing method in processing their coffee. The reason for using the dry processing method is considered more efficient and simpler because after harvesting, farmers only need to directly dry their coffee beans without going through a long process.

After coffee goes through the processing stage, then coffee farmers sell their products to consumers or through various marketing channels such as collectors, retailers, or cooperatives. During the harvest season, many farmers approach middlemen to sell their coffee. Generally, farmers sell. their coffee in the form of green beans, considering that the biggest demand from consumers is for green beans. The demand for Robusta coffee in Central Java is not only in the domestic market but also in the export market in Middle Eastern countries such as Egypt, Dubai, Iraq, and Iran. This is supported by the opinion of Septiani & Kawuryan [2021] that the total export is 200 thousand tons per year, and Temanggung and Magelang robusta coffee has contributed 60 percent to the export of Java Coffee to Europe, Asia, and America.

The average income of MPIG member robusta coffee farmers is Rp 91.970.000,-, which comes from the income of green bean and processed coffee. The total cost incurred by farmers in carrying out their agricultural activities is Rp 32,056,221,- per year Therefore, the average R/C ratio of robusta coffee farming based on geographical indication in Central Java is 2.86. This value means that for every Rp 1 million cost incurred by farmers, farmers will receive an income of Rp 2.86 million. Based on the R/C ratio, it can be concluded that robusta coffee farming based on geographical indication is profitable. This is supported by the opinion of Amir et al. (2017) that if the R/C ratio obtains a result > 1, then the farming is profitable, if the R/C ratio obtains a result of 1, then the farming is BEP (break-even point), and if the R/C ratio < 1, then the farming is experiencing a loss.

Processing Methods and Efficiency Considerations

MPIG recommends three coffee processing methods: dry processing, wet processing, and honey processing. However, field observations indicate that most MPIG-certified farmers rely solely on dry processing. This method is preferred due to its simplicity and efficiency, requiring minimal equipment and labor. Farmers can directly sun-dry the coffee cherries after harvest without undergoing complex procedures such as pulping and fermentation.

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

Comparative studies on processing techniques (Musfiroh et al., 2018) suggest that wet processing yields a cleaner and more refined coffee flavor but requires substantial water usage, fermentation time, and additional labor. Meanwhile, honey processing, a hybrid between dry and wet methods, enhances sweetness and complexity in flavor but demands careful monitoring of moisture levels during drying. Despite these benefits, MPIG farmers prioritize dry processing due to cost-effectiveness, scalability, and ease of implementation in large-scale farming operations.

Market Channels and Export Potential

Once coffee beans are processed, farmers distribute their products through various marketing channels, including direct sales to consumers, collectors, retailers, and cooperatives. During the peak harvest season, middlemen play a crucial role in facilitating transactions between farmers and buyers. The majority of robusta coffee farmers in Central Java prefer selling their produce as green beans, as this form remains in highest demand both domestically and internationally.

The demand for robusta coffee extends beyond the domestic market to export destinations, particularly in the Middle East. Countries such as Egypt, Dubai, Iraq, and Iran serve as major buyers of Central Java's robusta coffee. According to Septiani & Kawuryan (2020), Java coffee exports reach approximately 200,000 tons annually, with robusta coffee from Temanggung and Magelang accounting for 60% of Java coffee exports to Europe, Asia, and America. These findings highlight the strategic importance of Central Java in the global coffee trade and the need for enhanced marketing strategies to optimize export potential.

Comparative Perspective on Coffee Value Chains

The findings from this study are in line with research conducted by Souza et al. (2021), which emphasized that countries with strong coffee branding strategies, such as Colombia and Ethiopia, benefit from premium pricing and stable international demand. Ethiopia, for example, enforces strict GI regulations on its specialty coffee to maintain product authenticity and value, leading to higher income for smallholder farmers. Similarly, Colombia's Juan Valdez branding initiative has helped establish its coffee as a globally recognized premium product.

Compared to these countries, Indonesia's MPIG system still faces challenges in achieving widespread adoption and market differentiation. While robusta coffee from Central Java is well-regarded in Middle Eastern markets, additional efforts in branding, traceability, and quality consistency are needed to enhance its competitiveness in high-value coffee segments.

ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

CONCLUSION

Geographical Indication (GI)-certified robusta coffee farming in Central Java has proven to be both productive and profitable, with higher yields and greater economic returns compared to non-GI farms. The adoption of standardized agricultural practices, selective harvesting, and efficient post-harvest processing has significantly contributed to increased productivity. With an average landholding of 1.1 hectares, farmers achieve a higher yield (5.21 tons per hectare) compared to non-GI robusta farms (3.3 tons per hectare). Despite relatively high production costs, farmers benefit from substantial revenues, making GI-certified coffee farming a viable and sustainable endeavor. The resulting Revenue/Cost (R/C) ratio of 2.86 confirms that robusta coffee farming based on geographical indication is economically viable and profitable. However, challenges such as limited farmer participation, market access issues, and the dominance of dry processing over more refined methods hinder further growth. To maximize its potential, efforts should focus on increasing farmer awareness, strengthening branding strategies, expanding direct trade opportunities, encouraging processing diversification, and enhancing government and institutional support. With these improvements, Central Java's robusta coffee can achieve greater global recognition, ensuring long-term economic benefits for farmers and a stronger position in the international market.

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ISSN: 2455-8834

Volume:10, Issue:02 "February 2025"

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