FINAL REPORT

FEASIBILITY STUDY OF THE OPPORTUNITY TO DEVELOP A SUSTAINABLE RICE PLATFORM (SRP) TOWARDS 1 MILLION HECTARES OF LAND IN INDONESIA

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PREFACE

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We praise and give thanks to God Almighty, for it is through His grace and blessings that this Feasibility Study Report on the Development of a Sustainable Rice Platform (SRP) Towards 1 Million Hectares in Indonesia has been successfully completed. This report was prepared as part of efforts to support the transformation of the national rice sector towards a more sustainable, competitive production system that is adaptive to the challenges of climate change and global market dynamics.

The rice and rice sector plays a strategic role in the national economy, both as a pillar of food security, a source of livelihood for millions of farmers, and as part of a global food system that increasingly prioritizes the principle of sustainability. Amid increasing climate pressures, commodity price volatility, and increasingly stringent environmental and social standards, a new approach to the rice production system is needed. The Sustainable Rice Platform (SRP) serves as an instrument that bridges the interests of productivity, economic efficiency, and environmental sustainability in an integrated manner.

This report is a final report, presenting all the results of a comprehensive analysis of the technical, economic, market, institutional, and business risks aspects related to the implementation of SRP, with a focus on the potential for large-scale development to reach the target of 1 million hectares. The discussion in the report covers an analysis of regional and institutional readiness, domestic and global market opportunities, including the development of low carbon rice as a specialty rice, as well as the formulation of strategies, development models, and a roadmap for the gradual and measurable implementation of SRP. All analyses are based on data, empirical findings, and applicable policy approaches.

We hope that this report can be a reference for policy makers at the central and regional levels, business actors, financial institutions, and other stakeholders in formulating strategic steps for SRP development in Indonesia. Moreover, this report is expected to contribute to promoting a national rice system that is not only productive but also inclusive, sustainable, and capable of improving the welfare of farmers in a sustainable manner.

Finally, we would like to express our appreciation and gratitude to all parties who have contributed to the preparation of this report, whether through data support, discussions, or substantive input. We hope that this report will provide tangible benefits for the development of rice farming. berkelanjutan di Indonesia.

Jakarta,   November 2025
Team Leader of Writers/Researchers,

M. Rizal Tauifikurahman

EXECUTIVE SUMMARY

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This report presents a comprehensive study on the feasibility of developing a Sustainable Rice Platform (SRP) as a framework for transforming Indonesia's rice cultivation system towards more sustainable, efficient, climate-adaptive, and competitive practices in both domestic and global markets. This study is specifically aimed at assessing the feasibility and strategies for achieving the target of implementing the SRP on a large scale of up to 1 million hectares. The urgency of this study stems from the structural challenges facing the national rice sector, ranging from the pressures of climate change, price volatility, high greenhouse gas emissions from flooded rice fields, to increasing market demands for environmental and sustainability standards as a prerequisite for market access.

Methodologically, this study uses a mixed-methods approach that combines quantitative and qualitative analysis. The analysis was conducted through the processing of national and global secondary data, field surveys and focus group discussions with key stakeholders, as well as a comparison of farming performance between SRP and non-SRP practices. Various analytical tools were used, including cost and income analysis, economic impact simulations per hectare and nationally, production risk analysis, spatial mapping of regional readiness, and a gravity model to assess the competitiveness of Indonesia's sustainable rice exports. This approach enabled the study to assess not only technical feasibility, but also institutional, economic, and market dimensions in an integrated manner.

The analysis shows that regional and institutional readiness for SRP in Indonesia is heterogeneous. Several regions in Java, such as Boyolali and Klaten, show a relatively high level of readiness due to the support of active farmer groups, adequate extension capacity, and experience in partnerships with mills and offtakers. In contrast, other regions such as Sragen and a number of areas outside Java still face limitations in institutional capacity, low technical understanding of SRP, and weak cross-sector coordination. These findings confirm that achieving the target of 1 million hectares is only realistic if done through a region-based approach, rather than a uniform national approach.

From a technical cultivation perspective, empirical evidence shows that the implementation of SRP is able to maintain and even increase the stability of rice yields compared to conventional practices. Time series data shows that the productivity of SRP land is relatively more stable between years, especially during periods of climate disturbance. Practices such as more controlled water management, balanced fertilization, and systematic cultivation monitoring contribute to a reduction in crop yield fluctuations. This production stability is a key factor in increasing the resilience of farming businesses, especially for small farmers who are highly vulnerable to crop failure risks.

Economic analysis shows that SRP provides tangible benefits through increased production cost efficiency. Input costs per hectare on SRP land tend to be lower than on non-SRP land, mainly due to savings in water, fertilizer, and pesticide use. This reduction in costs directly strengthens farming margins, even in conditions of fluctuating grain prices. Income simulations show that at the farmer level, SRP not only increases net income but also improves the risk profile of farming through more stable incomes.

In addition to cost efficiency, SRP also contributes significantly to reducing production risks. The probability of crop failure on SRP land is lower than on non-SRP land, especially during periods of increased climate stress. The SRP-based cultivation approach, which is more adaptive to local agroecological conditions, has been proven to increase the resilience of rice production systems. From a policy perspective, these findings reinforce the role of SRP as an instrument for climate change adaptation in the agricultural sector, rather than merely as an environmental standard.

From a market perspective, this shows that there are significant opportunities for the development of low carbon rice as a specialty rice category. Global trends show an increase in demand for sustainable food products, especially in countries with high purchasing power and strict environmental regulations. In addition, increasingly stringent environmental standards as non-tariff barriers are encouraging producers to adopt credible certification schemes. In this context, SRP serves as a standard that bridges the needs of producers and market demands.

The results of the trade gravity model estimation confirm that Indonesian rice exports are significantly influenced by the income of partner countries and trade costs, while the domestic exchange rate also plays a role in determining competitiveness. These findings indicate that it is difficult for Indonesia to compete solely on price, making product differentiation through sustainability certification and positioning as value-added sustainable rice an increasingly relevant strategy. In this case, SRP provides a strong basis for such a differentiation strategy.

Further analysis shows that SRP opens up opportunities for premium pricing through contract mechanisms, offtaker partnerships, and modern retail. The potential for premium pricing stems not only from sustainability labels, but also from improved quality consistency, traceability, and supply certainty. In addition, the opportunity for price stacking through carbon market integration and green financing schemes has the potential to strengthen economic incentives for farmers and businesses participating in SRP.

The most effective SRP development model is the cluster-based development approach. This model integrates farmers, extension services, mills, offtakers, financing institutions, and policy support into a coordinated ecosystem. The cluster approach is considered more capable of ensuring consistency in standards, logistical efficiency, and market certainty, while facilitating supervision, assistance, and incentive schemes.

Overall, this report concludes that the development of the Sustainable Rice Platform to cover 1 million hectares in Indonesia is technically, economically, and strategically feasible. The success of this program is highly dependent on a region-based readiness approach, strengthening farmer institutions, integration with markets and offtakers, and consistent policy support. With a phased implementation roadmap starting from the pilot phase, scale-up, to mainstreaming, the SRP has the potential to succeed. become the main pillar of the transformation of the national rice

system towards a more sustainable, competitive system that supports the welfare of farmers.

The policy recommendation offered is that the development of the Sustainable Rice Platform (SRP) in Indonesia towards the target of 1 million hectares requires targeted, gradual policies based on regional readiness. The central government needs to place the SRP as an integral part of the sustainable food system transformation agenda through integration into national planning, strengthening fiscal incentives and green financing, and harmonizing cross-ministerial policies related to standards, MRV, and market access. At the same time, local governments play a strategic role as the main implementers through a spatial-based approach, prioritizing high-readiness regions as drivers of acceleration, while strengthening institutions, extension services, and cross-sectoral coordination in regions with medium and low readiness.

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Keywords: SRP, Low Carbon Rice, Sustainability, Added Value, Clustering

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CHAPTER 1. INTRODUCTION

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1.1 Background

The transformation of the global food system is encouraging rice-producing countries to adopt more environmentally friendly cultivation practices, especially since the rice sector has been proven to be one of the largest contributors to methane emissions in agriculture. This trend coincides with increasing global consumer demand for products with traceable sustainability, including low-carbon rice. In this context, the Sustainable Rice Platform (SRP) has emerged as a global standard that encompasses sustainable rice cultivation practices involving environmental, social, economic, institutional, and human rights aspects. This standard is increasingly relevant as it provides a comprehensive framework for producing countries to reduce emissions, improve production quality, and strengthen market access.

The development of the SRP standard shows that the transformation of rice farming is not solely focused on cultivation practices, but also on social justice, improving farmers' welfare, and integrating technology and supply chain management. The SRP allows for local adaptation through the National Interpretation Guideline (NIG) document, so that each country can adjust sustainability indicators to the agroecological conditions and capacities of its farmers. The integration of SRP and NIG has been proven to improve water use efficiency, minimize greenhouse gas emissions, increase soil fertility, and expand opportunities to obtain premium prices in the global market. Countries such as Thailand and Vietnam have adopted SRP into their national policy frameworks as part of their agricultural sector decarbonization strategies.

In the Indonesian context, the rice sector's contribution to national food security is significant, but at the same time, this sector is also one of the largest sources of carbon emissions from the food crop sub-sector. Structural challenges are increasingly apparent because most farmers, especially in Central Java and East Java, are smallholders who control less than 0.5 hectares of land. Land constraints, dependence on chemical inputs, and high use of flooded irrigation systems result in low farmer productivity, while the risk of flooding, drought, and pest attacks exacerbate their economic vulnerability. These conditions indicate that sustainable rice production cannot be achieved without systemic improvements in technology, access to inputs, institutions, and financing management.

The situation has become increasingly urgent as Indonesia has set a target of achieving a net sink for forestry and land use by 2030 as part of its commitment to reducing emissions from the forestry and land use sectors.

However, to date, there are no policy instruments specifically regulating carbon market incentives for the rice sub-sector. This is despite Indonesia's enormous potential to participate in the global voluntary carbon market, with international transactions already exceeding USD 2 billion per year. The unavailability of incentive schemes risks hampering the adoption of low-carbon agricultural practices, while also causing Indonesia to lag behind other rice-producing countries in taking advantage of new sustainability-based economic opportunities.

In this context, research on the development of SRP towards 1 million hectares of coverage and the exploration of low-carbon rice as a specialty rice becomes relevant. This research is part of a collaborative initiative to accelerate Indonesia's transition to sustainable and low-carbon rice production. This initiative combines the EU SWITCH-Asia Low Carbon Rice Project, the RICEsilience Project, and the Sustainable Rice Platform (SRP) Secretariat. The project is implemented by Preferred by Nature, the People's Coalition for Food Sovereignty (KRKP), PERPADI (Indonesian Rice Millers Association), and Rikolto Indonesia. Funding support is provided by the European Union through the SWITCH-Asia grant program for the Low Carbon Rice Project and by CISU (Civil Society in Development) under the RICEsilience Project. The aim is to assess regional feasibility, institutional readiness, and market potential, as well as the need to adapt SRP standards through NIG Indonesia. This activity also identifies opportunities for implementing low-carbon rice as a strategy to improve farmers' welfare while contributing to emission reduction.

Initial results show that the implementation of SRP not only increases production efficiency and reduces emissions, but also provides verifiable sustainability assurance through a traceability system. From a business perspective, global trade trends show an increase in demand for low-carbon rice, opening up opportunities for premium price incentives for farmers. However, the study concludes that academic research on economic benefits, socio-environmental impacts, green financing strategies, and the integration of SRP–NIG into carbon market schemes is still limited. A national roadmap linking these three aspects is also not yet available.

On the other hand, opportunities for developing low-carbon rice as a specialty rice commodity with high competitiveness in the international market are wide open. Standardized and certified low-carbon rice cultivation practices are projected to fetch a premium price of 10–30% compared to conventional rice in developed countries such as Japan, the European Union, and the United States (GIZ, 2023). In addition to the potential for added market value, the integration of low carbon rice into carbon trading schemes has the potential to generate economic value of between USD 7 million and USD 177 million per year, depending on the implementation scenario of 20-40% of the total national rice land area. With structural advantages in the form of large production capacity and diversity of local rice varieties, Indonesia has a strategic opportunity to become a major player in the global agenda for low-carbon agriculture based on SRP and competitiveness in the sustainable rice market. The situation analysis as a gap analysis and opportunities for the development of Low Carbon Rice in Indonesia can be seen in Table 1.1 below.

Table 1.1 Gap Analysis Matrix and Development Opportunities for Low Carbon Rice in Indonesia Over the Last 5 Years

Aspect	Current Situation (Fact)	Root Cause	Impact	Research /Policy Needs	Potential Solutions/Opportunities
National Rice Farming Structure	Rice field area: 7.4 million ha; 63% smallholder farmers (<0.5 ha) (BPS, 2023; KRKP, 2024)	Fragmentation of land ownership; low access to financing	Low productivity and income of farmers	Study on the optimization of farmer institutional models	Cooperative-based partnership model; microfinance scheme
Environmental Impact of Rice Farming	Major contributors to methane emissions from flooded rice fields (IRRI, 2022)	Conventional irrigation systems; excessive use of inputs	High GHG emissions; ecosystem degradation	Research on AWD & SRP integration for large scale	Adoption of the Sustainable Rice Platform + efficient water management
Production Resilience and Climate Adaptation	The high incidence of flooding, drought, and pest attacks	Global climate change; local ecosystem degradation	Decline in production and risk of crop failure	Research on the adaptation of rice varieties resistant to extreme climates	Development of climate-resilient rice varieties
Low Carbon Agriculture Incentive Policy	Indonesia does not yet have a carbon pricing scheme for rice farming.	Absence of specific regulations for the rice sub-sector	Loss of potential revenue from the global carbon market (USD 2 billion, World Bank 2024)	Policy review of SRP integration + carbon credits + green finance	Design of a national rice farming carbon market scheme
Academic Research Gap	Lack of empirical studies on the economic potential of	Limited field-based research; minimal	Lack of a national SRP roadmap; risk of	Research on the socio-economic impact of	Development of an incentive-based national SRP

	SRP + carbon markets in Indonesia	policy integration	losing export opportunities	SRP and the design of a national roadmap	adoption model
Potential for Low Carbon Rice Development	Specialty rice export markets in Japan, EU, US (GIZ, 2023)	Premium market demand for climate-smart products	Additional selling price opportunity + carbon credits USD 7–177 million/year	Market research, certification model, national branding design	Development of Low Carbon Rice as a leading SRP-based export product

Thus, this study emphasizes the importance of developing a scientific basis for drafting policy papers and academic papers for advocacy at the international, national, and local levels. The SRP approach is considered to be a key instrument in the comprehensive reform of Indonesia's rice farming system: from production, processing, distribution, to waste management. In addition to contributing to food security and sustainable development, this approach strengthens social justice, gender equality, protection of vulnerable groups, preservation of local culture, and attention to the younger generation as the future heirs of the agricultural sector.

This study requires the involvement of experts to evaluate the government and public's acceptance of the adoption of SRP guidelines in Indonesia. In addition, in-depth research is needed to identify opportunities for the recognition of low carbon sustainable rice as a special category of rice that is widely recognized at the international, national, and local levels. It is hoped that the results of this study can form the basis for the preparation of academic papers and policy papers as advocacy materials to accelerate the recognition of low carbon rice internationally, nationally, and locally, in order to support the development of an inclusive and sustainable rice farming sector for all stakeholders.

1.2 Research Question

The agricultural sector, particularly rice production in Indonesia, plays a crucial role in national food security and the welfare of millions of farmers. However, this sector faces various serious structural and environmental challenges. Highland fragmentation, dependence on chemical inputs, and inefficient irrigation practices have led to increased greenhouse gas (GHG) emissions, especially methane, which exacerbates the impacts of climate change. On the other hand, efforts to improve the welfare of small farmers and promote the adoption of sustainable agricultural practices, such as the Sustainable Rice Platform (SRP) and low-carbon rice, are still very limited in Indonesia.

Unlike countries such as Thailand and Vietnam, which have integrated SRP into national policies and leveraged opportunities in carbon markets as well as premium rice markets, Indonesia has yet to have a structured national policy framework to support the adoption of low-carbon rice farming. The absence of incentive policies, the weak carbon pricing scheme for agriculture, and the low integration of the SRP program into the national agricultural institutional system are the main factors hindering the transformation of the rice production system in Indonesia.

Additionally, the lack of empirical studies that comprehensively assess the potential economic, social, and environmental impacts of implementing SRP and low-carbon rice in Indonesia is a significant research gap. There is no analysis available on the potential added value through premium prices, potential income from carbon trading, and social impacts on the welfare of smallholder farmers, women's empowerment, and reduction of child labor in the context of SRP adoption. Therefore, this study is designed to answer the following basic questions:

1. To what extent can the development of the Sustainable Rice Platform (SRP) be applied to cover 1 million hectares of land in Indonesia?
2. What are the policy, institutional, and socio-cultural barriers faced in the implementation of SRP as low-carbon rice in Indonesia?
3. How can evidence-based policy strategies for SRP development be proposed to encourage national adoption of SRP?

1.3. Purpose and Objective

Purpose:

This research is intended to provide significant benefits to the SRP Secretariat, including encouraging the widespread adoption of sustainable rice farming practices tailored to local conditions, expanding the scope and global impact of the SRP platform, and supporting the development of low carbon rice as a specialty rice product that can reduce the environmental footprint of rice production while opening up new market opportunities and enhancing the SRP's reputation in climate-smart agriculture. In addition, this research is also expected to create transparency through credible verification, strengthen stakeholder confidence, attract investor interest, and improve the welfare of farmers with broader market access to environmentally friendly rice products.

General Objectives:

This study generally aims to comprehensively identify and analyze opportunities for developing the Sustainable Rice Platform (SRP) system to cover 1 million hectares of land and explore the potential for recognizing and developing low carbon rice as a specialty rice product in Indonesia using a National Interpretation Guideline (NIG) approach tailored to the local context. In addition, this study aims to formulate evidence-based policy recommendations that can encourage the integration of SRP and low carbon rice into national policies on sustainable agriculture and climate change mitigation in Indonesia.

Specific Objectives

1. Analyze the potential and opportunities for developing a sustainable rice cultivation system (SRP) on a large scale in Indonesia, particularly to achieve the target of 1 million hectares.
2. Identify global market opportunities and prospects for the recognition of low carbon rice as a specialty rice product category with added value in both domestic and export markets.
3. Develop a strategy for the development and location of SRP in Indonesia. Specifically, this involves data-driven scenarios for priority locations, development models, and a roadmap to encourage large-scale adoption of SRP in Indonesia.
4. Developing policy recommendations in the form of a roadmap and evidence-based development model for the SRP and low-carbon rice program that can be adopted nationally to support food security, improve farmer welfare, and contribute to climate change mitigation.

1.4. Scope

This study focuses on the feasibility of implementing SRP cultivation practices on 1 million hectares of rice fields in Indonesia. This initiative aims to align national agricultural development with sustainability goals, climate commitments, and market competitiveness. The study will be conducted in a multidimensional manner to obtain comprehensive results, covering geographical, policy, technical, economic, socio-cultural, institutional, and research outcome aspects. The detailed scope of the study covers several dimensions as shown in Table 1.2.

Table 1.2 Scope of Study Matrix

Dimensions	Scope of Activities	Objective	Expected Output
Geographical	Field studies in several selected rice production centers (Klaten, Boyolali, Sragen, Madiun, and Ngawi Districts)	Mapping the potential for SRP implementation in various agroecoregions	Identification of priority areas for adoption of SRP + low carbon rice
Policy	*Policy analysis, regulatory gap analysis, institutional mapping*	Assess the suitability and gaps of national regulations and the potential for integration of SRP into national policies.	Recommendations for a national policy framework for low-carbon rice farming
Technical	*Environmental Impact Assessment (EIA) , Life Cycle Assessment (LCA) , Field trial plot comparison*	Measuring the impact of SRP implementation on emissions, water use, and productivity	Empirical data on the technical benefits of SRP compared to conventional systems
Economy	*Cost-benefit analysis, market access analysis, carbon pricing scenario, willingness to pay survey*	Calculating the potential for increasing farmer income, *carbon credit value* , and market opportunities *for specialty rice*	*Business case* model for adopting SRP and *low carbon rice* in Indonesia
Socio-cultural	*Social impact assessment, stakeholder participation analysis, cultural acceptability analysis*	Analyzing the social impact and community acceptance of SRP practices	Recommendations for implementation models based on social inclusion and local wisdom
Institutional	*Institutional mapping, capacity building needs assessment*	Analyzing the role of actors and the need to strengthen the institutional capacity of farmers	Model of institutional strengthening and multi-stakeholder partnerships in *low carbon rice development*
Study Output	Preparation of *academic papers, policy papers, roadmaps* for SRP adoption models	Making a real contribution to the formulation of evidence-based policies	*Draft policy recommendation* and national scale adoption model for SRP + *low carbon rice*

1.5. Expected Output

Based on the above scope, the expected output of this study is as follows:

1. The compilation of a document mapping the regional and institutional feasibility of SRP in Indonesia towards 1 hectare of land. The main document consists of research results containing field findings and regional and institutional feasibility maps related to opportunities for

developing the Sustainable Rice Platform (SRP) towards a target coverage of 1 million hectares of land and a study of the potential of low carbon rice as a specialty rice category in Indonesia.

2. The existence of a document containing the results of studies and recommendations for SRP development and location strategies in Indonesia. Specific, data-driven recommendation documents on priority location scenarios, development models, and roadmaps to encourage large-scale adoption of SRP in Indonesia.
3. Increased opportunities for global market access and increased farmer income. The study results are expected to help expand the global market for sustainable rice, enhance Indonesia's reputation in climate-smart agriculture practices, and provide economic benefits in the form of increased farmer income through entry into the environmentally conscious premium rice market.

CHAPTER 2. LITERATURE REVIEW

CHAPTER 2. LITERATURE REVIEW

The Sustainable Rice Platform (SRP) concept was developed as a global framework to improve the sustainability of rice production through the application of environmentally friendly, resource-efficient cultivation practices that contribute to the welfare of farmers (SRP, 2021). The SRP offers Performance Indicators that cover aspects of water use, chemical inputs, carbon footprint, and social aspects such as worker welfare and gender mainstreaming. The implementation of the SRP at the global level has been adopted in more than 15 countries, including Vietnam, Thailand, India, and Pakistan (IRRI, 2022). In Indonesia, although this approach has been introduced through pilot projects in Central Java and East Java, the integration of SRP into national policy is still relatively limited and sporadic, with no formal roadmap to regulate it (KRKP, 2024).

Previous studies have shown that the application of sustainable agriculture principles in rice production systems has positive ecological and socio-economic impacts. Haque et al. (2021) in Agricultural Systems show that the use of Alternate Wetting and Drying (AWD) technology, which is part of SRP practices, can reduce methane emissions by up to 48% in Southeast Asian rice fields. Research in Vietnam conducted by SNV and GIZ (2023) also shows that the combination of SRP and the use of adaptive rice varieties can increase water use efficiency by 20% and provide farmers with an additional 10-20% income. In Indonesia, a similar approach has been trialed, but its scale is still limited and has not been integrated with the potential of carbon market schemes.

2.1. Concept and Implementation of the Sustainable Rice Platform (SRP) Globally and Nationally

The Sustainable Rice Platform (SRP) is a global initiative established by the United Nations Environment Programme (UNEP) and the International Rice Research Institute (IRRI) in 2011 to improve the sustainability of rice production systems (SRP, 2021). The SRP aims to reduce environmental impacts, improve resource efficiency, and promote farmer welfare through the application of internationally standardized SRP Performance Indicators. The SRP also promotes water management practices such as Alternate Wetting and Drying (AWD), efficient fertilizer use, and social standards such as fair wages and the elimination of child labor (IRRI, 2022).

Globally, SRP has been adopted by more than 15 countries with significant success in Vietnam, Thailand, Pakistan, India, and Japan (GIZ & SNV, 2023). In Indonesia, SRP has only recently been introduced through pilot programs in several regions in Central Java and East Java. However, the integration of SRP into Indonesia's national policy has not yet formally occurred, leaving ample opportunity for its development into a national standard.

The Sustainable Rice Platform (SRP) was created in response to the high contribution of rice production systems to greenhouse gas emissions, land degradation, and market uncertainty for smallholder farmers in developing countries. The SRP was officially declared in 2011 by the International Rice Research Institute (IRRI) and the United Nations Environment Programme (UNEP), with a mission to create global standards for sustainable rice cultivation practices (SRP, 2021).

The SRP offers the SRP Standard for Sustainable Rice Cultivation, which contains 8 main criteria and 41 specific indicators, covering aspects of water management, fertilizer and pesticide use, soil conservation, waste control, social welfare, and workers' rights (SRP, 2021). The SRP concept integrates a climate-smart agriculture approach, with methods such as Alternate Wetting and Drying (AWD), adaptive rice varieties, and efficient use of inputs to reduce methane emissions, which are known to be one of the largest contributors to greenhouse gas emissions in the agricultural sector (IRRI, 2022).

Table 2.1 Implementation of the SRP Model in Several Countries

No.	Country	Description in SRP Implementation
1	Vietnam	Integrating SRP into national policy The Vietnamese government has issued the “1 million hectares of high quality rice” program, which recommends the use of SRP standards as one of the sustainable farming practices.
2	Thailand	Large-scale implementation in Chai Nat, Chainat Rice Farmer Cooperative The Rice Department under the Ministry of Agriculture and Cooperatives has developed a new locally adapted Rice Standard, which aligns with the SRP Standard.
3	India	The use of SRP in Punjab, Haryana, West Bengal
4	Pakistan	SRP in Punjab and Sindh for Basmati rice export
5	Indonesia	Pilot project in Central Java, East Java, and Sumatra
6	Philippines	IRRI & PhilRice conducted an SRP implementation study in Luzon
7	Myanmar	SNV and Helvetas support the introduction of SRP in the Bago Region
8	Cambodia	SRP pilot program for jasmine rice export
9	China	Integration of SRP with low-carbon agriculture programs in several provinces
10	Japan	The implementation of AWD & SRP in Hokkaido and major production areas
11	Sri Lanka	Pilot project in the main agricultural zone for emission reduction
12	Nepal	IRRI, together with the Nepalese government, started SRP trials in 2020
13	Laos	SRP pilot program for farming communities in the northern province
14	Bangladesh	IRRI & SNV support the implementation of SRP for local varieties
15	Nigeria	The only country in Africa that joined the SRP program through IRRI & IITA

Empirically, the implementation of SRP has shown positive impacts. Haque et al. (2021) in a meta-analysis study published in Agricultural Systems stated that the implementation of AWD, which is an integral part of SRP practices, can reduce methane emissions by up to 48% compared to conventional rice field practices. Additionally, SNV and GIZ (2023) in Vietnam noted that the implementation of SRP and adaptive varieties increased water use efficiency by 20% and increased farmers' income by 10–20%.

Globally, SRP has been adopted by more than 15 countries (SRP, 2021). Countries such as Vietnam have made SRP part of their national sustainable agriculture strategy since 2018, with the support of incentive policies, multi-stakeholder partnerships, and integration into Nationally Determined Contributions (GIZ & SNV, 2023). Japan and China have also utilized SRP to support their low-carbon agriculture programs, with China even including rice fields in its carbon trading pilot project scheme to support its low-emission agriculture agenda (FAO, 2022). Some of these countries are listed in Table 2.1.

The implementation of SRP has developed into a global multi-stakeholder alliance with implementation in Southeast Asia, South Asia, and initial penetration into Africa (Nigeria). The dominant areas of implementation are Southeast Asia (Vietnam, Thailand, Indonesia, Cambodia, Philippines, Myanmar, Laos) as the world's rice production center. Thailand, through the National Bureau of Agricultural Commodity and Food Standards (ACFS), has developed sustainable rice standards aligned with SRP standards and signed an MoU with SRP on September 2, 2025, for technical cooperation and capacity building. The Vietnamese government has recommended the use of SRP standards as one of the sustainable agricultural practices to improve quality, reducing emissions, and increasing the value of rice in the “1 million hectares of high-quality rice” program. Finally, Indonesia is still in the early adoption pilot phase (not yet a national policy).

In Indonesia, SRP initiatives have been introduced in pilot programs in Central Java and East Java through collaboration between Preferred by Nature and the People's Coalition for Food Sovereignty (KRKP, 2024). However, Indonesia is still in the early stages as there is no national roadmap or formal regulation that makes SRP a mandatory standard in rice farming policy (KLHK, 2022). Indonesia has only included agriculture in general in its FOLU Net Sink 2030 target, but the rice sub-sector specifically is not yet covered in carbon mitigation or carbon pricing policy schemes (World Bank, 2024).

2.2. Implementation of Sustainable Agriculture, SRP, and Global Low Carbon Rice

Previous studies have also shown that the implementation of SRP and sustainable rice farming approaches can significantly reduce emissions and increase productivity. Haque et al. (2021) in a meta-analysis published in

Agricultural Systems showed that AWD technology can reduce methane emissions by up to 48% compared to conventional rice field systems. The IRRI (2022) study also confirmed that the use of adaptive rice varieties and measured input management within the SRP framework increases water use efficiency by 15–20% and increases crop yields.

Sustainable agriculture in the context of rice production has been a global concern in the last two decades, mainly because this sector contributes significantly to greenhouse gas (GHG) emissions, particularly methane (CH_4). According to IRRI (2022), flooded rice field systems, which are common in Asian countries, account for nearly 11% of total global methane emissions from the agricultural sector. The concept of sustainable intensification has been proposed to balance high productivity with minimal environmental impact, including GHG emission reduction, water conservation, and efficient use of inputs (FAO, 2022).

A number of empirical studies have demonstrated that the SRP approach, which adopts climate-smart agriculture principles such as Alternate Wetting and Drying (AWD), the use of adaptive rice varieties, and optimal nitrogen management, can reduce emissions and increase crop yields. Haque et al. (2021) in Agricultural Systems conducted a meta-analysis of 24 studies and found that AWD practices can reduce methane emissions by an average of 30%–48% compared to conventional irrigation methods. The study also showed that AWD does not cause a decline in crop yields, thus providing a win-win solution between productivity and sustainability.SNV dan GIZ (2023) di Vietnam melaporkan bahwa implementasi SRP pada skala 200.000 hektar di Mekong Delta mampu menurunkan penggunaan air hingga 20%, mengurangi biaya input petani, serta meningkatkan pendapatan petani sebesar 10–20% melalui peningkatan produktivitas dan efisiensi rantai pasok. Vietnam menjadi negara percontohan karena mampu memasukkan SRP ke dalam strategi nasional pengurangan emisi dalam *Nationally Determined Contributions (NDC)*.

In Indonesia, formal studies on the economic and environmental impacts of SRP are still very limited and experimental in nature. Research by Preferred by Nature (2025) shows that the adoption of SRP and low carbon rice in pilot areas in Central Java and East Java has the potential to reduce emissions by 1–3 tons of CO_2e per hectare per year, as well as open up opportunities for additional income through voluntary carbon markets of up to USD 7 million – USD 177 million per year if adopted on 20–40% of the total national rice fields.

Another study conducted by IRRI and PhilRice (2022) in the Philippines also confirms that the adoption of AWD and SRP increases water efficiency by 15%, reduces nitrogen fertilizer use by 10%, and increases crop resilience to climate stress. In general, previous studies confirm that SRP not only provides ecological benefits but also increases the economic competitiveness of farmers amid global demands for low-emission agricultural practices.

2.3 *Lesson Learned* from Various Countries Around the World that Have Implemented SRP

The experiences of various countries show that the successful adoption of SRP is greatly influenced by national policy support and incentive schemes. Vietnam is the best example in Southeast Asia because its government has integrated SRP into its Green Growth Strategy and Nationally Determined Contributions (NDC) documents since 2018 (GIZ & SNV, 2023). Japan has implemented a performance-based subsidy scheme for farmers who adopt AWD and SRP, which has successfully reduced methane emissions by up to 50% (IRRI, 2022).

The experiences of countries that have actively adopted and implemented the Sustainable Rice Platform (SRP) show that the success of sustainable rice farming is greatly influenced by the synergy of national policies, technical capacity, market support, and clear incentives for farmers.

Vietnam is a country that has successfully implemented SRP nationally. Since 2018, the Vietnamese government has officially integrated SRP into national policy through the Green Growth Strategy and made it part of the Nationally Determined Contributions (NDC) document (GIZ & SNV, 2023). The implementation of SRP in the Mekong Delta has been proven to reduce greenhouse gas emissions by up to 25%, reduce water use by 20%, and increase farmers' income by 10-20%. This success was achieved because Vietnam was able to build a policy ecosystem, multi-stakeholder partnerships (government, NGOs, private sector, farmer groups), and provide incentive schemes that support SRP adoption at the farmer level (SNV, 2023).

Thailand has also successfully implemented SRP in the export sector, particularly in Chai Nat and Chainat Rice Farmer Cooperative. Thailand utilizes SRP as an instrument to increase the competitiveness of rice in the international market by providing a sustainability label that commands a premium price (SRP, 2021). In addition, through the National Bureau of Agricultural Commodity and Food Standards (ACFS), Thailand has developed the Thai Agricultural Standard for Sustainable Rice (TAS 4408-2022), which is internationally recognized as being fully aligned with the SRP Standard. This collaboration enables Thailand to issue dual recognition labels—both national certification and SRP—which strengthens trust among global buyers (SRP, 2025).

India and Pakistan utilize SRP in the states of Punjab and Haryana for export-oriented Basmati Rice varieties. IRRI research (2022) shows that the use of AWD technology in India and Pakistan can reduce methane emissions by up to 30% without significantly reducing crop yields.

Japan uses a performance-based subsidy approach for farmers who implement AWD systems and SRP practices, which contributes to a 50% reduction in methane emissions (IRRI, 2022). The Japanese model shows that results-based policy support can encourage the rapid adoption of environmentally friendly technologies.

China has pioneered the inclusion of rice fields in a carbon trading pilot project, whereby farmers who implement low-carbon agricultural practices can receive compensation in the form of carbon credits (FAO, 2022). This model provides inspiration that domestic carbon markets can be an additional source of incentives for farmers. In China, the government has developed carbon trading pilot projects for the agricultural sector that include rice fields in the carbon finance scheme (FAO, 2022). These countries show that a combination of an enabling policy environment, multi-stakeholder partnerships, and incentive-based financing is key to the successful adoption of SRP at the national level. Indonesia is expected to learn from the experiences of these countries to develop similar policy schemes that are relevant to the local context.

Several other countries such as the Philippines, Myanmar, Bangladesh, and Nigeria (the only one in Africa) have also implemented SRP pilot programs with results showing increased water efficiency, reduced fertilizer use, and increased local crop yields (SRP, 2021; IRRI, 2022).

The main lessons from these countries confirm that the successful implementation of SRP depends on five key factors, namely: (1) integration of SRP into national policy, (2) availability of attractive incentive schemes, (3) strong technical support for farmers, (4) active involvement of all stakeholders, and (5) development of market access for certified sustainable rice. Indonesia can learn from these experiences to develop an integrated and contextual sustainable rice farming policy model tailored to local characteristics. This can be seen in Table 2.2.

Table 2.2 Lessons Learned from the Implementation of the SRP Model in Several Countries

Country	Implementation Approach	Key Achievements	Lesson Learned for Indonesia
Vietnam	Integration of SRP into national policies, government incentive support, multi-stakeholder partnerships (government, private sector, NGOs, farmers)	GHG emissions reduction 25%, water efficiency 20%, increase in farmers' income 10–20% (GIZ & SNV, 2023)	Policy integration + incentives proven to accelerate national adoption
Thailand	Use of SRP for export certification (Certified Sustainable Rice)	Access to international premium markets with higher selling prices (SRP, 2021)	Sustainability certification boosts export competitiveness
India	Implementation of SRP + AWD in	A 30% reduction in methane	The combination of technology and local

	Punjab and Haryana for Basmati varieties	emissions, without a decrease in crop yield (IRRI, 2022)	varieties can reduce emissions
Pakistan	Implementation of SRP in Sindh and Punjab for emission reduction and improvement of export quality	Stable harvest, reduced emissions, increased competitiveness of Basmati	Water management + SRP is very suitable for export rice
Jepang	Performance-based subsidies for farmers implementing AWD + SRP	Methane emissions reduction of up to 50% (IRRI, 2022)	Results-based incentives are very effective in encouraging the adoption of technology
Tiongkok	Integration of rice fields into the carbon trading pilot project scheme	Farmers earn additional income from carbon credits (FAO, 2022)	The domestic carbon market becomes a new incentive mechanism for farmers
Philippines	Implementation of SRP in Luzon by IRRI + PhilRice	Water efficiency 15%, fertilizer reduction 10% (IRRI, 2022)	Local research support facilitates the adaptation of SRP technology
Myanmar	SRP pilot project in Bago Region by SNV + Helvetas	Reduction in fertilizer use, production efficiency	Pilot model is important for development on a larger scale
Bangladesh	Application of SRP for improving land efficiency and reducing emissions	Water and fertilizer efficiency increased, yield remained stable	Local adaptation is important for optimal resultsl
Nigeria	SRP pilot program in Africa by IRRI + IITA	Reduction of water and fertilizer use, increase in productivity	SRP's potential for adaptation outside Asia has been proven

2.4. Various Policies and Regulations Related to SRP in Indonesia

Indonesia has demonstrated its commitment to reducing carbon emissions through the FOLU Net Sink 2030 Roadmap document established by the Ministry of Environment and Forestry (KLHK, 2022). However, emission mitigation policies for the agricultural sector, particularly the rice sub-sector, have not been explicitly regulated in national policy documents. The agricultural sector has not been included in carbon pricing schemes as has been done in the forestry and energy sectors (World Bank, 2024).

To date, Indonesia does not have a regulatory instrument that formally supports the implementation of SRP as a national standard. This is in contrast to Vietnam, which has officially established SRP as part of its national sustainable agriculture strategy. Therefore, there is a great opportunity to develop evidence-based policy designs that integrate SRP, National Interpretation Guidelines (NIG), and carbon market potential into national strategic planning documents such as the RPJMN and the Ministry of Agriculture's RENSTRA. The following are some policies and regulations closely related to the implementation of SRP in Indonesia.

1. Climate Policy Framework and Low Carbon Development (PRK)

Indonesia's climate policy framework provides the normative foundation for the development of the Sustainable Rice Platform (SRP) as a standard for low-carbon rice cultivation. Since the enactment of Presidential Regulation (Perpres) No. 71 of 2011 on the Implementation of National Greenhouse Gas Inventory, the government has developed an emissions inventory system that covers all sectors, including agriculture. This Perpres regulates the procedures for data collection, reporting, and periodic updating of GHG inventories so that emissions from the rice sub-sector are no longer viewed as a purely technical issue, but as part of the national commitment to reduce emissions.

This framework is reinforced by Presidential Regulation No. 61 of 2011 concerning the National Action Plan for Greenhouse Gas Emission Reduction (RAN-GRK), which explicitly allocates a role for the agricultural sector in achieving national emission reduction targets. In the RAN-GRK appendix, the agricultural sector—including rice—is directed to adopt more efficient and environmentally friendly cultivation practices, such as improving irrigation water and fertilizer management. The RAN-GRK then became the main reference for technical ministries in designing mitigation programs, and it is at this point that the SRP can be positioned as a standard instrument that bridges emission reduction targets with practices at the farm level.

Indonesia's commitment at the global level is outlined in the Enhanced Nationally Determined Contribution (NDC) submitted to the UNFCCC on September 23, 2022. This document updates emission reduction targets and confirms the contribution of the agricultural sector along with the energy, waste, IPPU, and FOLU sectors. The Enhanced NDC places emission mitigation as part of the national development strategy, not merely an international obligation. This opens up opportunities for large-scale integration of low-carbon cultivation standards—such as SRP—into the mitigation policy mix because their contributions can be measured, reported, and verified (MRV) through structured indicators.

Furthermore, the Long-Term Strategy for Low Carbon and Climate Resilience (LTS-LCCR) 2050 and the study Indonesia's Climate Actions Towards 2030 emphasize that a low-carbon development pathway will provide dual benefits: sustained economic growth and long-term emissions reductions. These strategic documents explicitly mention the need to integrate mitigation actions in the agricultural sector into national planning and budget documents. In this context, SRP can be positioned as an "implementation platform" that translates various macro commitments into measurable packages of cultivation practices, performance indicators, and incentive schemes for the rice sub-sector.

2. Regulations on the Agricultural Sector and Sustainable Rice

Indonesian agricultural regulations have provided a technical framework that is compatible with SRP principles. Ministry of Agriculture Regulation No. 48/2006 on Good Agricultural Practices establishes guidelines for efficient and environmentally friendly food crop cultivation, ranging from nutrient, water, and pesticide management to occupational safety, which are parallel to SRP indicators. Ministerial Regulation No. 64/2013 on Organic Farming Systems provides comparative standards that strengthen environmental aspects, even though SRP is not identical to organic farming; both emphasize input efficiency and reduction of externalities.

In addition, the Ministry of Agriculture (Kementan) has set a policy direction for the 2024–2029 period that focuses on increasing sustainable productivity, food self-sufficiency, and low-carbon agriculture. Innovation and technology utilization, such as the application of biochar, are part of the strategy to achieve these goals.

At the sectoral level, the Ministry of Agriculture has developed a number of regulations that are substantially compatible with SRP principles. Permentan No. 48/Permentan/OT.140/10/2006 concerning Guidelines for Good Agricultural Practices (GAP) regulates the fundamental aspects of food crop cultivation—including rice—ranging from seed, fertilizer, pesticide, and water management to occupational safety. Many indicators in GAP, such as input use efficiency and environmental protection, are in line with the main criteria of SRP, so this document can be seen as an “initial bridge” for the adoption of SRP in Indonesia.

Another relevant policy is Minister of Agriculture Regulation No. 64 of 2013 concerning Organic Farming Systems, which, although focused on organic systems, emphasizes the importance of environmental quality, soil health, and chemical residue reduction. SRP itself does not require an organic system, but emphasizes input efficiency and minimization of environmental impact, so there is room for synergy between the organic approach and SRP, especially in the dimensions of soil health, biodiversity conservation, and food security. These regulations help formulate a spectrum of practices: from improved conventional intensification to systems closer to organic or low-input, with SRP as the cross-spectrum performance standard.

In terms of spatial planning and resource protection, Law No. 41 of 2009 concerning the Protection of Sustainable Food Agricultural Land (LP2B) and its derivative instruments emphasize that strategic food rice fields must be protected from uncontrolled conversion. This law requires the central and regional governments to establish, protect, and manage LP2B as the basis for food security. SRP adds a layer of quality on top of this quantitative protection of land: not only maintaining the area of rice fields, but also ensuring that their management is efficient, climate-adaptive, and low-emission. Thus, LP2B provides the “physical space” while SRP provides the “management standards” for that space.

In addition, various technical guidelines under the Directorate General of Agricultural Infrastructure and Facilities (PSP) related to irrigation management and water resource conservation aim to reduce inefficiency and enhance the resilience of irrigation systems against climate variability. Approaches such as Alternate Wetting and Drying (AWD) water management and tertiary network improvements are relevant for SRP indicators that assess water use efficiency and the potential for methane emission reduction. Several environmentally friendly rice and ecological rice programs promoted by the Ministry of Agriculture also indicate that the production paradigm is beginning to shift from merely pursuing quantity to production governance that takes into account the environmental carrying capacity of the space, where SRP can be mainstreamed as a technical standard as well as a monitoring instrument.

The LP2B regulations emphasize the obligation to maintain the sustainability of strategic food land, including soil and water conservation, which form the basis for implementing low-emission rice cultivation. The technical guidance from the Directorate General of Food Crops on climate-adaptive irrigation also clarifies that rice field water management is a key component of mitigation, for example through AWD (Alternate Wetting and Drying), which is one of the SRP indicators. Various policies on environmentally friendly or ecological rice increasingly indicate that the government is beginning to adopt production approaches in line with SRP principles, even though they have not yet been formalized in policy nomenclature.

3. SRP Specific Documents & Implementation Initiatives in Indonesia

At the global level, the Sustainable Rice Platform (SRP) has developed the SRP Standard for Sustainable Rice Cultivation along with a set of Performance Indicators as the world's first standard for measuring the sustainability of rice cultivation. Since its launch in 2015, the standard has undergone several revisions to strengthen its relevance and ease of implementation. This standard covers environmental, social, and economic dimensions, and assesses farmer practices from pre-planting, cultivation, to post-harvest phases. For Indonesia, this global standard provides a general framework that then needs to be interpreted and adapted to the national regulatory and agroecological context. Winrock International+1

On the program side, the Low Carbon Rice project, funded by the European Union through the SWITCH-Asia scheme and implemented by Preferred by Nature together with KRKP and PERPADI, focuses on reducing the climate impact of rice production while strengthening the competitiveness of milling businesses and farmers. The project helps dozens to hundreds of small mills and farmers in Java adopt energy-efficient practices, improve post-harvest efficiency, and develop low-carbon rice business models. Activities such as training, mentoring, and business model development operationally use SRP principles and tools as a reference.

The International Sustainable Rice Forum (ISRF) 2025 in Jakarta further consolidates the position of SRP in the national policy discourse. The forum emphasized the need to accelerate the adoption of sustainable farming practices, strengthen the policy framework through the establishment of NWG and the development of Indonesia's NIG, and connect farmers and mills with domestic and international markets for sustainable and low-carbon rice. In several public statements, the National Food Agency also welcomed the idea of adopting SRP model rice standards as a candidate for the Indonesian National Standard (SNI), which, if realized, would formally position SRP within the national standardization and quality assurance system.

The global SRP standard (version 2.2) serves as the main reference that regulates rice cultivation from upstream to post-harvest in a measurable way through performance indicators. Indonesia has established the SRP National Working Group (NWG) to adapt this standard into National Interpretation Guidelines (NIG), allowing global criteria to align with local regulations, agroecology, and farmers' practices. These NIG will serve as the official reference for the national-level implementation of SRP. The Low Carbon Rice program (SWITCH Asia) and RICEsilience, run by Preferred by Nature and KRKP, accelerate the adoption of SRP through farmer assistance, institutional strengthening, and the development of SRP suitability maps aiming for coverage of 1 million hectares.

The National Food Agency also provided formal support by encouraging SRP to become a draft Indonesian National Standard (SNI), paving the way for the integration of SRP into the national standardization system. The 2025 International Sustainable Rice Forum (ISRF) in Jakarta consolidated the entire process, while also providing international legitimacy that Indonesia is moving towards a more sustainable and low-emission rice production system.

4. Agricultural Emission Policies, Carbon Trading, and Low-Carbon Rice

Scientifically, the contribution of the rice sector to greenhouse gas emissions, particularly methane from flooded fields, has been a concern in various studies and technical workshops. Presidential Regulation 71/2011 mandates the recording of emissions from the agricultural sector, and several technical guidelines for GHG inventory highlight the importance of methodologies for calculating emissions from rice fields. This has driven improvements in data quality and methodologies, which then serve as the basis for assessing mitigation scenarios, including through changes in cultivation practices.

At the policy level, the Enhanced NDC and various recent interpretations of climate policy emphasize that the agricultural sector should begin to be seen not only as a source of emissions but also as part of the solution, through climate-smart agriculture approaches and innovative financing schemes such as climate finance and carbon mechanisms. Forums like ISRF 2025 highlight the issue of climate financing opportunities for sustainable and low-carbon rice, indicating that SRP practices have the potential to receive additional financial support if they can demonstrate credible emissions reduction impacts.

The concept of low-carbon rice pursued in the SWITCH-Asia Low Carbon Rice project positions rice as a commodity that is evaluated not only based on physical quality and price but also on the carbon footprint across its value chain. This project includes efforts to improve energy efficiency in milling, reduce post-harvest losses, and enhance cultivation practices at the farmer level. Thus, SRP standards and low-carbon rice initiatives complement each other: SRP provides a framework of cultivation standards and performance indicators, while low-carbon rice projects offer models for implementation, financing, and market access.

In the future, if the government integrates SRP and low-carbon rice into fiscal incentive schemes, green credits, or the domestic carbon market, then farmers and rice business actors will have a stronger economic reason to transition. The key challenge is to build an MRV system that is simple yet credible at the farmer and milling levels, align SRP indicators with the national GHG inventory methodology, and ensure governance and fair benefit sharing for small farmers. This is where the role of cross-ministerial coordination, research institutions, and development partners becomes crucial so that SRP does not stop as a project, but transforms into a part of sustainable public policy.

The development of SRP cannot be separated from the framework of agricultural emission mitigation and carbon market opportunities. Various workshops and technical studies by the Ministry of Agriculture through BBSDLP provide a basis for calculating emissions from rice fields, including methane from flooded irrigation systems. This scientific data is crucial for validating the mitigation impact of SRP implementation, especially indicators of water efficiency and crop residue management. Policy briefs from WRI and international agencies emphasize that agricultural decarbonization must be incorporated into national planning and budgeting, so that instruments like SRP can become part of incentive schemes, offsets, or performance-based payments.

In addition, BRIN's study on low-carbon rice farming shows that the integration of precision technology, efficient mechanization, and data-driven fertilizer management can significantly reduce emissions, supporting the claim of 'low-carbon rice' as a value-added product. All of these frameworks provide a scientific and policy basis for SRP to serve as a mitigation instrument rather than merely a cultivation standard.

2.5. Some Scientific Literature and Learning on SRP Implementation in Indonesia

Beyond regulatory documents, scientific literature and program reports provide a strong empirical basis for assessing the relevance and effectiveness of SRP in Indonesia. The article “Analysis of rice cultivation sustainability in rice production centre areas, Indonesia” by Salassa et al. (2025) demonstrates that SRP can be used to assess the sustainability of rice cultivation systems based on social, economic, and environmental indicators. This study also highlights that measurement results can serve as direct input for policymaking in the development of sustainable rice production areas and the development of the SRP NIG in Indonesia.

Various publications by Preferred by Nature, Rikolto, and other partners document field experiences in implementing SRP and low-carbon rice practices in Java and other regions. These reports generally indicate that applying SRP practices such as adjusting fertilizer doses, improving water management, and enhancing harvesting and post-harvesting practices can reduce production costs, increase yield stability, and open access to more environmentally conscious market segments. Some reports also note increased institutional capacity of mills and farmer groups in managing data and meeting standard requirements.

In the policy realm, articles on low-carbon agricultural development in Indonesia emphasize that the transformation of the food system is determined not only by technology at the farmer level but also by price incentives, fiscal support, infrastructure, and market governance. SRP is seen as one of the standardization instruments that can help reduce information asymmetry between farmers, mills, traders, and consumers, as it provides a clear indicator of what is meant by 'sustainable rice.' Thus, SRP has a dual function: as a management tool at the farm and milling level, and as a tool for communicating added value in the market.

Overall, the combination of policy frameworks, technical standards, and scientific evidence indicates that Indonesia has a fairly strong foundation to mainstream SRP as one of the pillars of national rice system transformation. The next challenges are more institutional and implementation-oriented: ensuring consistency among regulations, building institutional capacity in the field, designing financing schemes that favor smallholder farmers, and integrating SRP monitoring results into the development planning and budgeting process.

CHAPTER 3. METHODOLOGY

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3.1. Mehtodology Framework

This scope-based methodology is designed to produce comprehensive, empirical, and practical analyses in addressing the opportunities for national-scale SRP development towards 1 million hectares and the recognition of low carbon rice as specialty rice. This model will also contribute to the formulation of policies and implementation strategies based on field data. Figure 3.1 illustrates the methodological framework arranged as a complete cycle consisting of eight interconnected components.

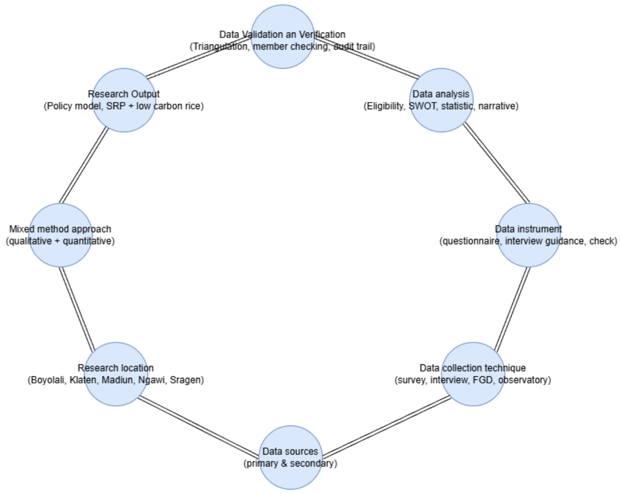

Figure 3.1. Methodological Framework Used in the Study

This study began with the use of a mixed-method approach, which is the integration of qualitative and quantitative methods to obtain a comprehensive picture of regional feasibility, institutional dynamics, and the potential for SRP development. The research locations included Klaten, Boyolali, Sragen, Madiun, and Ngawi as representations of rice-producing areas with agroecosystem diversity relevant for analysis. Data were obtained from primary sources such as surveys, in-depth interviews, focus group discussions (FGDs), and field observations, while secondary sources included official reports, statistical data, policy documents, and technical literature. Data collection techniques involved structured questionnaires, interview guides, and checklists to ensure that aspects of cultivation, institutional arrangements, irrigation, and value chains were well documented. All of these instruments support the collection of rich and credible information for further analysis.

The data analysis phase includes regional feasibility analysis, SWOT analysis, descriptive statistical analysis, as well as narrative analysis to formulate findings comprehensively. The analysis results are then validated through triangulation of data sources, member checking with local stakeholders, and audit trails to ensure the integrity and reliability of the research process. Through this methodological chain, the study produces outputs in the form of policy models and strategic recommendations for SRP development, including regional feasibility maps, institutional strategies, and directions for low-carbon rice development. Thus, the diagram represents a systematic, credible research workflow oriented toward formulating policy recommendations that can be implemented to encourage large-scale SRP adoption in Indonesia.

3.2. Study Approach and Design

This study uses a mixed method approach, which combines qualitative and quantitative methods in a complementary manner. The qualitative approach is used to explore in depth the perceptions, motivations, challenges, and opportunities of implementing the Sustainable Rice Platform (SRP) and developing low-carbon rice, through in-depth interviews, Focus Group Discussions (FGDs), and field observations. Meanwhile, the quantitative approach is applied to obtain a general statistical overview of the technical, economic, social, and environmental impacts of SRP implementation and the various potentials for development towards a national-scale target of 1 million hectares. This research design is exploratory-descriptive in nature, with the main focus on providing empirical analysis results that can be used as material for formulating evidence-based policy.

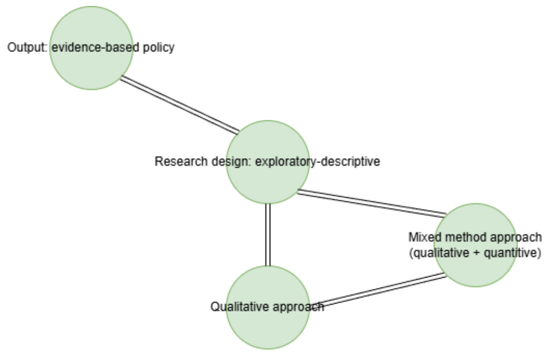

Figure 3.2. Study Approach and Design

3.3. Location and Study Subject

This study was conducted within the scope of the implementation locations or pilot projects of the SRP model over a period of 4 years. It was carried out in five regencies in Indonesia that are potential rice production centers, namely Klaten Regency, Boyolali Regency, Sragen Regency (Central Java Province), as well as Madiun Regency and Ngawi Regency (East Java Province). The selection of these locations considered factors such as the availability of potential land, experience in implementing sustainable agricultural practices, and the readiness of farmer institutions. The research subjects included farmers who were members of farmer groups, managers of farmer group associations (Gapoktan), agricultural cooperatives, rice mill managers, field agricultural extension agents (PPL), officials from regency and provincial agriculture offices, members of the SRP National Working Group, representatives from private sector

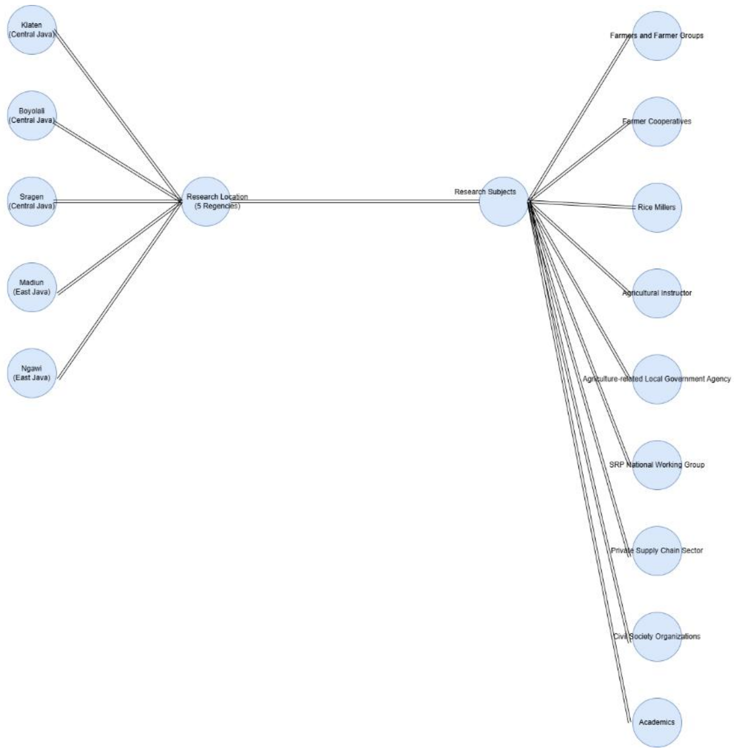

Figure 3.3. Location and Studi Subject

Figure 3.3 illustrates the structure of the mapping of research locations and subjects used in the SRP development study. On the left side of the diagram, five research locations are shown, selected based on their representation of rice production centers in two provinces, Central Java and East Java. These locations include Klaten, Boyolali, and Sragen in Central Java, as well as Madiun and Ngawi in East Java. Each district is directly connected to a central node labeled Research Locations (5 Districts), indicating that this study was conducted across regions, taking into account agroecological variations, institutional heterogeneity, and the technical conditions of rice production. The relationship structure in the diagram shows that all research locations serve as the geographical foundation that enriches the empirical context of the study.

On the right side of the diagram, various research subjects involved in the study are displayed, ranging from upstream to downstream actors in the rice production and governance system. These subjects include farmers and farmer groups, farmer associations (Gapoktan) and cooperatives, rice mill managers, field agricultural extension workers, as well as district and provincial Agriculture Offices that act as technical policy stakeholders. In addition, other important subjects such as the SRP National Working Group, the private sector within the supply chain, civil society organizations, and academics are also listed as key stakeholders. The involvement of these diverse actors indicates that this study not only assesses the technical and institutional conditions at the farmer level but also encompasses a cross-stakeholder perspective related to the implementation of SRP, the expansion of adoption, and the formulation of evidence-based policies..

3.4. Types and Sources of Data

This study utilizes two types of data, namely primary data and secondary data. Primary data are obtained directly from the field through surveys of farmers, extension workers, local government, mills, and other stakeholders. The techniques used include in-depth interviews with key stakeholders, Focus Group Discussions (FGD), interviews, and direct observation of rice farming practices at the research sites. Primary data include technical production information, water management, input use, farmers' costs and income, as well as social perceptions regarding the adoption of SRP principles. Meanwhile, secondary data are obtained from official documents such as BPS statistical data, reports from the agricultural department, national policy documents (RPJMN, FOLU Net Sink 2030), SRP project implementation reports, and various academic literature related to sustainable agriculture and climate change mitigation.

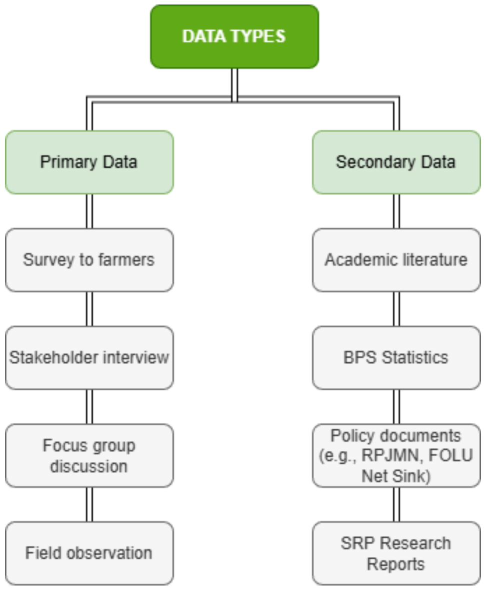

Figure 3.4. Types and Sources of Data Used

3.5. Data Collection and Sampling Techniques

The data collection techniques in this study include several methods. A structured questionnaire survey was conducted with farmers to collect quantitative data on production conditions, SRP technology adoption, production inputs, harvest yields, and income. In-depth interviews were carried out with stakeholders such as the agricultural office, cooperatives, the private sector, and academics to explore policies, challenges, and the potential development of SRP and low carbon rice. Focus Group Discussions (FGDs) were held at the district level involving farmer groups and local organizations to understand collective perspectives. Field observation was used to document the implementation of SRP practices and compare them with conventional farming practices. Finally, a literature study was conducted to enrich the analysis with previous research findings and relevant policies.

This study uses a multi-stage sampling approach to determine the locations and respondents for the Sustainable Rice Platform (SRP) program. The selection of locations was carried out purposively in five selected districts based on the potential for SRP implementation, agroecosystem conditions, and regional institutional support. Each district was then designated to have eight potential SRP locations, totaling 25 sites. At each site, around six main respondents and one additional respondent from related institutions were selected, resulting in a total of 240 respondents from outside the agricultural agency and 5 respondents from the District Agriculture Office. Furthermore, respondents were divided into two main groups, namely Pilot SRP and Non-Pilot SRP, where the pilot had already implemented the SRP, On the other hand, non-pilot respondents did not have any cultivation based on SRP principles. Each group consisted of 120 people. Respondent selection was carried out using a combination of purposive, quota, convenience, and snowball sampling techniques to obtain a diverse representation in the field.

The details of the sample selection process and the respondent structure in the study conducted in five selected regencies can be seen in Figure 3.5. Each regency was mapped into eight potential SRP locations, resulting in a total of 25 locations used as observation units. At each location, 6+1 respondents were designated, consisting of six main respondents and one accompanying enumerator. Thus, the total number of respondents reached 240 main respondents plus 5 enumerators, for a total of 245 research participants. This structure ensures that each area receives adequate representation so that variations in the implementation of SRP as well as conventional farming practices can be comprehensively captured in the study.

The respondents were then classified into two major groups, namely SRP Pilot respondents (n=120) and Non-Pilot SRP respondents (n=120). This categorization was used to compare changes in behavior, farming practices, technology adoption, and institutional dynamics between farmers or institutions that had been involved in the SRP program and those that had not. At the actor level, respondents included farmers/farmer groups, field extension workers, market players, rice millers (off-takers), village/sub-district governments, and the Regency Agriculture Office. This composition allows the study to capture a comprehensive value chain perspective from upstream (production) to downstream (marketing and governance) and to assess the readiness of the institutional ecosystem in supporting SRP expansion toward a broader scale of implementation.

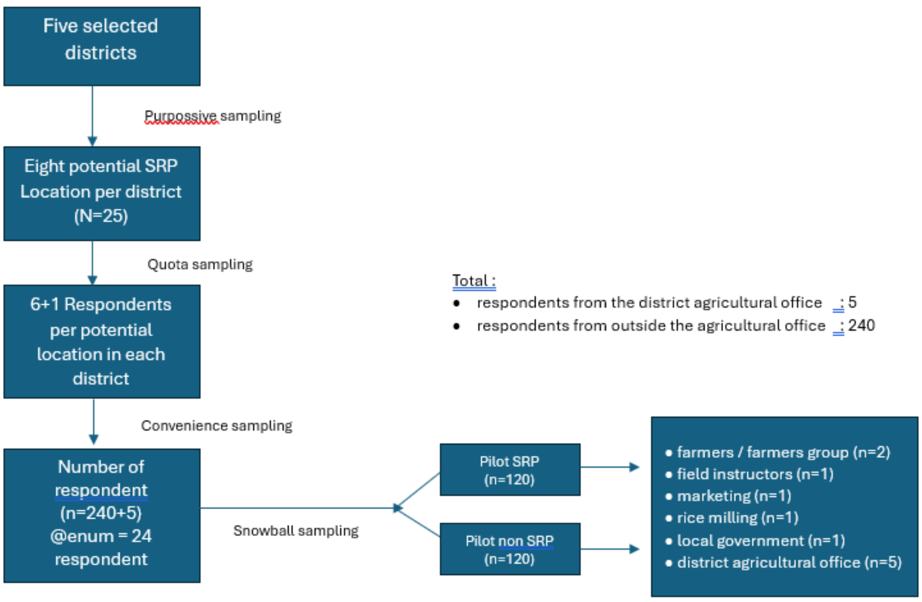

Figure 3.5. Data Collection and Sampling Techniques

3.6. Data Analysis Method

The data obtained was analyzed using various techniques to provide a comprehensive overview. Feasibility analysis was conducted on five main aspects: technical (input efficiency, productivity, GHG emissions), economic (cost-benefit analysis, potential carbon credits, premium price), social (farmer welfare, empowerment of marginalized groups), environmental (reduction of carbon footprint and water conservation), and institutional (capacity of farmer organizations). In addition, a SWOT analysis was conducted to map the strengths, weaknesses, opportunities, and threats in the development of SRP and low carbon rice in Indonesia. Descriptive statistical analysis was applied to survey data to obtain the distribution of farmer characteristics and production results. Meanwhile, qualitative data from interviews and FGDs were analyzed using narrative analysis techniques to identify the main themes emerging in the field. Furthermore, mapping between objectives and the scope of activities was carried out based on the analysis methods used. In general, the analysis methods can be seen in Table 3.1.

Table 3.1. Study Analysis Method Matrix

Hasil yang Diharapkan (Output)	Jenis Data	Sumber Data	Variabel	Instrumen	Indikator	Teknik Pengumpulan Data	Metode Analisis
1. Peta Kelayakan Wilayah dan Kelembagaan SRP	Kuantitatif & Kualitatif (spasial, kelembagaan)	Primer: Survei petani, FGD kelembagaan, wawancara lokal Sekunder: Data spasial BRIN, Statistik pertanian BPS, Dokumen kelembagaan Dinas	Luas lahan, kelembagaan, adopsi SRP	Kuesioner, citra satelit, FGD	Kelayakan agroklimat dan fisik, kelembagaan	Survei, FGD	Analisis Deskripti, Analisis AHP (IKW dan IKI)
2. Strategi Pengembangan & Lokasi SRP	Kuantitatif & Kualitatif (simulasi, strategi)	Primer: Lokakarya partisipatif, Wawancara ahli Sekunder: Statistik pertanian, peta agroekologi, RPJMN, dokumen Kementan	Lokasi, adopsi teknologi, skenario	Simulasi, konsultasi ahli	Analisis kesiapan lokasi, roadmap pengembangan	Survei dan Wawancara	Analisis SWOT dan Analisis Kebijakan

3.	**Global Market Access & Farmer Income**	Quantitative & Qualitative (exports, prices)	Primary: Exporter survey, farmer focus group discussions, *buyer interviews* . Secondary: UN Comtrade export data, Ministry of Trade, *specialty rice market reports.*	Price, margin, country reputation	Questionnaires, consumer surveys, forums	Export value, farmer margin	**Literature Review and Survey**	**Value chain, market intelligence**

As for the detailed explanation of the analysis methods for each output based on Table 3.1 above, it can be seen in the following explanation:

Output Analysis Method 1: Feasibility Analysis of the SRP Model

The quantitative analysis method in this study utilizes the Sustainable Rice Platform (SRP) framework, which employs 12 key performance indicators as objective measures to assess the sustainability of rice cultivation practices. These twelve indicators encompass three main dimensions—economic, social, and environmental—which comprehensively represent the quality of modern rice production systems. In the economic aspect, the indicators evaluate productivity, input use efficiency, yield stability, and the potential to increase farmers' income. In the environmental dimension, the indicators are used to measure water use efficiency, greenhouse gas emission reduction, crop residue management, and biodiversity conservation in rice fields.

In terms of the social dimension, the indicators assess farmers' occupational health and safety, gender inclusion, labor protection, and institutional participation. This SRP-based measurement framework allows for an analysis that not only evaluates the technical performance of cultivation but also examines farmers' commitment and readiness to implement internationally recognized sustainability principles. The use of SRP indicators in this study provides a methodological advantage because it can produce standardized measurements that are comparable across regions and relevant to global practices.

In addition, this approach supports a more in-depth analysis of the potential for productivity improvement and emission reduction, while also identifying implementation gaps that still need to be addressed through policy interventions, farmer capacity building, or improvements in institutional support. Thus, the use of SRP not only provides a quantitative overview of the sustainability level of rice cultivation but also serves as a diagnostic tool to formulate strategies for transforming rice farming systems to be lower in emissions, more efficient, and more socially inclusive. This can be seen in Table 3.2.

Table 3.2. Twelve Performance Indicators of the SRP Model Used in Analysis

No.	Performance Indicators	Practical Explanation	Indicator Size or Unit
1	**Profitability**	How much net profit do farmers earn from SRP rice production? Measuring the economic efficiency of farming.	Net margin (Rp/ha), Return on Investment (ROI), Net Profit Margin (%)
2	**Labor Productivity**	The productivity of labor used in rice production. Measures output per unit of labor.	Kg grain/labor/day, value added/labor
3	**Productivity**	Total production per unit of land. Assessing the effectiveness of inputs on crop yields.	Ton/ha/season, kg of grain/ha
4	**Water Productivity and Quality**	Efficiency of water use and the quality of water used in irrigation. Focus on reducing excess water use.	Kg rice/m³ water, water quality index (BOD, COD), AWD method (*Alternate Wetting and Drying*)
5	**Nitrogen-Use Efficiency**	The ratio of nitrogen fertilizer input to crop yield. Measuring the efficiency of N fertilizer use to prevent waste or pollution.	Kg grain/kg nitrogen, total N input vs rice output
6	**Phosphorus-Use Efficiency**	Like nitrogen, but specifically for phosphorus (P) fertilizers. Focus on reducing eutrophication pollution.	Kg grain/kg phosphorus, P-use efficiency ratio (%)
7	**Biodiversity**	Biodiversity in rice fields and their surroundings. Assessing the presence of flora and fauna that support the ecosystem.	Number of non-rice plant species, beneficial insect population, biodiversity index
8	**GHG Emission**	Total greenhouse gas emissions (CH_4, N_2O, CO_2) from rice production activities. Focus on reducing the carbon footprint of agriculture.	Kg CO_2e/ha/season, SRP GHG Calculator calculation results
9	**Food Safety**	Guaranteeing that the rice produced is safe for consumption and free from contaminants. Measuring food safety standards.	Pesticide residue content, aflatoxin, heavy metals, laboratory tests
10	**Health & Safety**	Protecting the occupational safety of farmers and workers in rice fields. Assessing the K3 (*Occupational Safety and Health*) aspects.	Number of work accidents, use of personal protective equipment, K3 training
11	**Child Labor & Youth Engagement**	Prevention of child labor in agriculture, as well as increasing the involvement of the younger generation in agriculture.	% young farmers, % child labor (target = 0%), youth farmer training program
12	**Women's Empowerment**	Women's participation in production processes, decision-making, and economic benefits of SRP agriculture.	% of women managing agricultural businesses, % of women cooperative members, *gender equality training*

Source: Author team (2025)

The analysis method used is the Regional Feasibility Index (IKW). This index aims to identify the potential for Sustainable Rice Platform (SRP) development using the Analytic Hierarchy Process (AHP) approach, a multi-criteria decision-making method that can systematically and measurably provide priority weights. This method was chosen because it is capable of accommodating the complexity of factors determining regional feasibility, while also capturing the subjective considerations of experts in a consistent mathematical structure. In the initial stage, the process begins with the determination of five main criteria considered most influential on regional feasibility for SRP implementation, namely water availability, greenhouse gas (GHG) emission potential, road access, soil texture suitability, and rainfall. These five criteria represent ecological, technical, and logistical aspects that directly impact the likelihood of success for sustainable rice cultivation based on SRP in a given area. With the selection of these criteria, the analysis becomes more focused and reflects the biophysical conditions as well as the infrastructure relevant to a low-emission rice production system.

Next, the stage of assessing priorities among criteria is carried out through the preparation of a pairwise comparison matrix. In this matrix, each criterion is compared one by one with the other criteria based on their level of importance to regional feasibility, using a scale of 1–9 according to Saaty's scale, where higher values indicate a higher level of significance.

This comparison process usually involves experts, extension workers, or technical analysts who understand the characteristics of the area and the dynamics of rice production. The results of this assessment are then processed to obtain the priority weights of each criterion, including testing the logical consistency of the assessment through the consistency ratio (CR). The final weight produced serves as the basis for calculating the feasibility score of each location, so that areas with the most favorable conditions, for example having stable water availability, high potential for emission reduction, good accessibility, as well as suitable soil texture and rainfall, will achieve a higher IKW score. Thus, AHP provides a robust analytical structure for determining priority areas for SRP development in an objective and accountable manner. The criteria used based on SRP principles are shown in Table 3.3:

Table 3.3. Criteria for the Development Potential of the SRP Model

Criteria	Water	Emission	Access	Texture	Rainfall
Water	1	3	5	4	2
Emission	1/3	1	3	2	1
Access	1/5	1/3	1	1	1/2
Soil Texture	1/4	1/2	1	1	1
Rainfall	1/2	1	2	1	1

After the pairwise comparison matrix is constructed, the next step is to perform normalization and calculate the criteria weights. This stage begins by summing the values in each column of the matrix, obtaining the total initial weight for each criterion. Next, normalization is carried out by dividing each matrix element by its column total so that all values are on a comparable scale. This normalization process is important to ensure that differences in the level of importance among criteria are proportionally reflected and can be consistently calculated. After all values are normalized, the next step is to take the average of each row, which represents the final weight of each criterion. These weights reflect the relative contribution of each factor to the feasibility of a region for implementing SRP, so criteria considered more important will have a greater weight in the final assessment.

The final stage in the AHP method is conducting a consistency test to ensure that the assessments given are not random or contradictory. This testing is carried out by calculating the Consistency Ratio (CR), which indicates how consistent the comparison matrix is. A matrix is considered consistent and valid if the CR is below 0.1, meaning that the experts' assessments are sufficiently stable and can be methodologically justified. The final result of this entire process is the standardized and consistent SRP criteria weights, which can be used for various spatial analyses such as regional suitability mapping, determining priority locations for interventions, and preparing SRP development potential maps based on agro-ecoregions. With these weights, regional suitability assessments become more objective, measurable, and aligned with the principles of multi-criteria decision-making.

The next stage is the preparation stage of the Institutional Preparedness Index (IKI) which is an important step in analyzing the ability of farm groups and institutional partners to adopt and implement the Sustainable Rice Platform (SRP) system effectively. This institutional approach emphasizes that the success of SRP depends not only on the biophysical and technical aspects, but also on the readiness of organisations, governance, human resource capacity, as well as the support of local networks and partnerships. In this framework, assessments are conducted through five main dimensions representing the pillars of institutional capacity, such as organizational structure, managerial ability, access to information and technology, the effectiveness of coordination with stakeholders, as well as the sustainability of supply chain partnerships. Each dimension is measured through a measured indicator given a score between 0 to 5, where a higher score indicates better readiness. This approach allows the measurement of institutional readiness to be done systematically and objectively, thus providing a real picture of the strengths and weaknesses of the institution in support of the adoption of SRP. This can be seen in Table 3.4.

Once all indicators are assessed and scores are collected, the total IKI score is then converted into an index of 0–100 scales to produce a more convenient size than between regions, peasants, or other institutional units. The index provides an analytical basis to determine which group is most ready to be the location of the SRP pilot or priority capacity building intervention. In addition, the index results can be used as a strategic planning tool for local governments, extensioners, and companion agencies to design more targeted institutional strengthening programs. Through this structured measurement, the research is able to identify institutional aspects that need to be improved so that SRP adoption can run sustainably, integrated and provide optimal impact for farmers and all agricultural ecosystems in the region.

Table 3.4. Dimensional Matrix and Indicators Used in SRP Institutional Analysis

Dimension	Indicator	Score (0–5)
Farmer Institutions	Active farmer groups, cooperative presence, and institutional legality	0–5
Market Access and Value Chains	Trade partnerships, presence of offtakers or marketing partners	0–5
SRP Training and Knowledge	Participation in SRP training, access to field extension workers	0–5
SRP Practice Adoption	Implementation of at least five of the eight SRP principles	0–5
Leadership & Innovation	Activities and innovations of group or cooperative leaders	0–5

Through this approach, farmers' institutional institutions can be mapped more accurately based on their social and institutional readiness levels in adopting the Sustainable Rice Platform (SRP) practice. Each peasant group and institutional unit are evaluated not only from aspects of the formality of the organizational structure, but also from internal dynamics such as leadership, member participation, decision-making mechanisms, and the ability to manage information and technology. Thus, the IKI drafting approach allows researchers to identify variations of readiness between groups, find latent institutional barriers, and assess the extent to which external support from both the extension, local government, and program partners contributes to institutional effectiveness in supporting the implementation of SRP. The mapping provides a holistic picture of the actual condition of the institution in the field and shows strategic areas that need to be strengthened to accelerate the adoption of SRP evenly.

The resulting index then serves as the foundation for the preparation of more directed and evidence-based recommendations. The index can be used to design institutional capacity strengthening strategies, ranging from group management training, continuous agronomic literacy improvement, to more transparent and accountable development of administrative and financial systems. In addition, institutional readiness index helps identify groups with greater potential for sustainable market access, including premium markets that require sustainable standards. At the regional policy level, IKI mapping results can be used as a basis in designing SRP institutional mentoring strategies, for example determining the priorities of interventions recipients, compiling institutional strengthening roadmaps, as well as improving cross-stakeholder synergy. Thus, the preparation of IKI is not only a measuring tool, but also a strategic instrument to accelerate the transformation of farmers' institutionalities towards a more sustainable and competitive rice production system.

Output Analysis Method 2: SRP Development Strategy in Indonesia and Its Development Locations

The analysis method for the second output in this study is designed to integrate internal data from field surveys with external information such as policies, development plans, and regional characteristics. Combining these two sources allows the analysis not only to depict empirical conditions at the farmer and institutional levels but also to place the findings within the broader framework of national and regional development. Internally, the study produces two important analytical instruments: the Regional Feasibility Index (RFI) and the Institutional Readiness Index (IRI). The RFI assesses the biophysical potential and agroecological suitability for SRP development, while the IRI measures the social–institutional capacity of farmer groups, mills, extension workers, and local partners in adopting SRP practices. Both indices reflect the real conditions in the field and provide a precise picture of the opportunities and obstacles for SRP implementation at the grassroots level.

The analysis is then strengthened by integrating external information, including government policy directions, regional development priorities, the availability of irrigation infrastructure, sustainable rice market dynamics, investment potential, and the regulatory framework related to the transition to low-carbon agriculture. This integration allows internal analysis—IKW and IKK—to be interpreted in a broader strategic context, so that SRP development is not solely based on technical readiness but also considers funding opportunities, policy support, supply chain readiness, and market absorption capacity. As a result, field data interpretation becomes more dynamic, providing a solid basis for identifying opportunities for adoption acceleration, implementation risks, and program synchronization among actors. Thus, the analysis does not stop at mapping conditions but evolves into a strategic tool that helps answer how SRP can be expanded systematically and sustainably.

The integration of these two sources of information is the basis for the preparation of SRP development roadmap, which includes: (1) priority location determination, namely areas with high IKW and IKK values and has adequate policy and infrastructure support; (2) the formulation of development models, such as cluster-based SRP models), partnership models with off-taker, cooperative models or milling-based models as the center of innovation; and (3) the preparation of gradual implementation roadmap, from intensive pilots, scaling-outs, to integration into regional and national programs (mainstreaming). The Roadmap also includes institutional strengthening strategies, increased farmers' technical capacity, incentive design to drive adoption, monitoring-evaluation mechanisms, and strengthening data governance to ensure the implementation of SRPs is running accountable. With this comprehensive approach, the SRP development roadmap is not only technical and descriptive, but also operational, measurable, and aligned with the policy dynamics and regional development needs, so it can be a strategic reference for governments, development partners, and business actors in accelerating SRP adoption to a scale of 1 million hectares.

Output Analysis Method 3: Increasing Opportunities for Access to Global Markets and Enhancing Farmers' Income

In this third output analysis, on a macro level, using the Gravity Model is an econometric approach that adapts Newton's law of gravity to explain the magnitude of bilateral trade interactions between two countries. In this theory, trade is analogized as a pull force influenced by the "economic mass" of the two countries, represented by their respective GDP sizes, and weakens as the distance or trade barriers between them increase. The larger the economic size of the two countries, the stronger the potential for interaction and trade volume; conversely, the greater the geographical distance or economic distance (such as logistical barriers, tariffs, and regulations), the lower the tendency for trade to occur.

In the context of this study, the Gravity approach is used to estimate the potential exports of Indonesian SRP rice to the global market by assessing the extent to which destination countries have economic attractiveness for sustainable and low-carbon rice products. Variables such as Indonesia's GDP as the exporter, the GDP of destination countries like Japan or the European Union, and the distance between countries are used to determine which markets have the greatest potential demand for SRP rice as a specialty and environmentally friendly commodity.

Mathematically, the Gravity model is represented in two common forms: the fractional form and the log-linear form. The basic representation of the model is explained through the equation $T_{ij} = G \times (GDP_i^{\alpha} \times GDP_j^{\beta}) / (Distance_{ij}^{\gamma})$, where the export value from country i to country j is influenced by the size of both countries' GDPs and is reduced by the distance between them.

For ease of econometric estimation, the equation is transformed into a log-linear form, becoming:

$$\ln T_{ij} = \ln G + \alpha \ln GDP_i + \beta \ln GDP_j - \gamma \ln Distance_{ij} + \delta Z_{ij} + \varepsilon_{ij}.$$

This transformation allows models to be estimated using multiple linear regression and provides a clearer interpretation of elasticity. Additional variables Z_ij can include institutional factors such as trade agreements, import tariffs, sustainability standards, or destination country consumer preferences towards eco-friendly products. Through this shortant, research can identify the most promising destination countries for SRP rice exports as well as measure demand sensitivity to economic factors and trade barriers, so that the analysis results can be used to formulate more directional and evidence-based export strategies.

To ensure that the findings are focused and based on field evidence, the analysis of the third output also integrates field findings obtained from farmer surveys, stakeholder interviews, cultivation practice observations, and institutional assessments in the five research districts. These field findings provide a very important empirical context because they show how farmers' readiness, land conditions, availability of irrigation infrastructure, production cost structures, and value chain dynamics interact in reality with the potential SRP rice exports estimated through the Gravity Model.

For example, regions with high IKW values but facing institutional or market barriers at the local level will require different intervention strategies compared to regions that are institutionally prepared but have limitations in biophysical conditions. Thus, integrating field findings allows the model to not only predict export potential on a macro scale but also link it to real conditions in the field that can either strengthen or limit the region's capacity to capture SRP export opportunities.

Field findings also help analyze how SRP standards are applied by farmers and milling, as well as how sustainable practices such as water efficiency, emission reduction, and post-capanent management contribute to the differentiation of SRP rice products in the global market. This empirical information enriches the interpretation of the output of the Gravity Model, so that the estimation of export potential is not only theoretical, but has considered sustainable production capacity, the quality of rice produced, as well as the readiness of local value chains to meet the demand for international markets that require sustainability and traceability. By combining the results of econometric models with field dynamics, analysis on the third output results in a more comprehensive and operational understanding, which then became a strong foundation for strategizing export, priority market mapping, and development of the roadmap of increasing the competitiveness of Indonesia’s SRP rice in the global market.

CHAPTER 4. FEASIBILITY ANALYSIS OF SRP DEVELOPMENT LOCATION AND INSTITUTIONS

CHAPTER 4. FEASIBILITY ANALYSIS OF LOCATION AND INSTITUTIONAL DEVELOPMENT OF SRP

4.1. Findings of twelve indicators of SRP development by location

Analysis of SRP development by location is seen first 12 SRP indicators. This can be seen in **Table 4.1.** The analysis is based on the findings of each indicator. In the analysis of the table is analyzed in 4 stages, which is based on 4 diklaster indikartor. In detail the analysis of the table that these 12 indicators of SRP development can be seen as follows:

Analysis of the first three Cluster indicators of SRP: profitability, labor productivity, and grain productivity.

In detail, this analysis begins with an analysis of profitability indicators. Where there are significant differences in the level of net income per hectare between districts, which reflects the variation in cost structure, productivity, and effectiveness of the implementation of cultivation practices. Madiun and Boyolali regencies recorded relatively higher levels of profitability compared to other regions, indicating better production efficiency, while Sragen showed low profitability which could indicate high input costs, unoptimized productivity, or limited market access. This pattern shows that the implementation of SRP has great potential to improve the economic efficiency of farmers, but its success is strongly influenced by the readiness of local institutions and the availability of technical support. This indicator also confirms the need for tailored interventions to address the profitability gap between regions, especially for districts that are still lagging behind.

From the aspect of labor productivity, the findings show that there is a significant inequality. Madiun emerged as the region with the highest productivity, followed by Ngawi, which indicates the capacity of farmers to produce higher economic value output with a relatively efficient workforce. In contrast, Klaten recorded lower numbers, showing that labor productivity can still be improved through agronomic training, farm management, and improved access to technology. This difference indicates that the effectiveness of the implementation of SRP is determined not only by biophysical factors, but also by the capacity of human resources and cultivation practices applied in the region. Increasing labor productivity can be one of the focuses of intervention strategies to reduce gaps between regions.

Table 4.1 Implementasi SRP Di 5 Lokasi Berdasarkan 12 Indikator SRP

No	Indicator	Final Variabel (Indicator)	Total	Boyolali	Klaten	Madiun	Ngawi	Sragen
1	Profitability	Profitability = Net Income/Ha/MT	Rp 14,087,101	Rp 38,449,933	Rp 15,079,696	Rp 30,444,590	Rp 17,370,089	Rp 5,254,630
2	Labor Productivity	Farmer Productivity = Net Income/Farmer/MT	Rp 21,459,938	Rp 17,903,250	Rp 8,680,250	Rp 30,425,563	Rp 25,696,875	Rp 21,281,250
3	Grain Yield	Land Productivity = Grain/Ha	3663.11	7556.38	6965.04	3871.17	5143.64	2120.83
4	Water Productivity	Average Irrigation = Irrigation/planting season/Farmer	13.75	12.81	3.50	14.44	21.56	16.44
		Harvested rice/rain-fed rice fields	17176.72	7556.38	76366.67	13755.56	12748.69	12725.00
		Harvested rice/irrigated rice fields	4656.06	5444,3	7664.04	5387.29	8622.52	2545.00
5	Nitrogen-Use Efficiency	Grain harvested/N usage kg	12.61	11.13	9.21	8.75	24.14	13.07
6	Phosporus-Use Efficiency	Grain harvested/use P kg	84.82	16.75	99.32	206.33	269.36	130.76
7	Biodiversity	Average Pesticide/Season	3.11	2.69	2.00	3.88	2.63	4.38
		% of Insect Presence in the Field	93.75%	100.00%	100.00%	93.75%	87.50%	75.00%
		% Presence of Other Plants in the Land	45.00%	93.75%	31.25%	37.50%	18.75%	31.25%
8	GHG Emissions	%Have attended training related to SRP	53.75%	87.50%	100.00%	25.00%	25.00%	31.25%
9	Food Safety	%Clean and Suitable Place for Grain Storage	95.00%	100.00%	100.00%	100.00%	100.00%	75.00%
		%Have you ever attended GAP training?	26.25%	56.25%	18.75%	12.50%	25.00%	18.75%
10	Health & Safety	%Use of PPE	88.75%	100.00%	75.00%	100.00%	87.50%	81.25%
		% Have Attended Safety Training	20.00%	31.25%	25.00%	12.50%	6.25%	25.00%
11	Child Labor	%No Child Labor	86.25%	75.00%	81.25%	93.75%	87.50%	93.75%
12	Women's Empowerment	% of Decisions with Women's Participation	52.50%	31.25%	87.50%	62.50%	43.75%	37.50%
		% of Women Who Have Attended Agricultural Training	40.00%	81.25%	75.00%	0.00%	12.50%	31.25%

Sumber: Hasil Survei Lapangan (2025)

indicators of grain productivity (grain yield) showed variations in production between districts, where Klaten and Ngawi showed higher performance than other locations. This illustrates that the region has a more optimal agroclimate suitability, irrigation system, and cultivation management. Districts with low yields such as Boyolali indicate the need for improvements in irrigation systems, fertilization, or access to high-yielding seeds. These findings reinforce the urgency of implementing efficiency-based SRP practices, as increasing productivity not only impacts on increasing farmers ' incomes, but also contributes to reducing emissions per unit of production, according to the principle of low-carbon agriculture

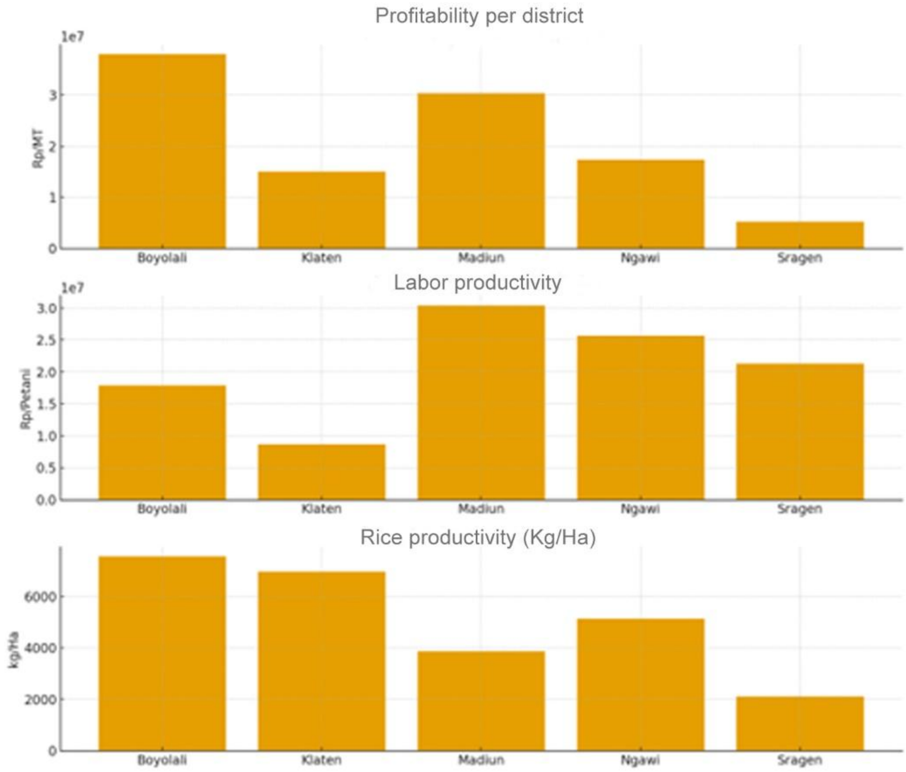

Figure 4.1 the first three Cluster indicators of SRP:*profitability*, *labor productivity*, and *grain productivity*.

Figure 4.1 above shows a comparison of the three main indicators of SRP profitability, labor productivity, and grain productivity in the five sample districts. It can be seen that Boyolali and Madiun consistently show superior economic performance, especially in terms of profitability and labor productivity. Madiun became the district with the highest labor productivity, reflecting the efficient use of Labor and the added value of a stronger agricultural business. In contrast, Klaten and Sragen showed lower economic performance in the first two indicators, indicating structural challenges such as access to technology, cultivation management, or limited capacity of farmers that need to be intervened in the SRP framework.

Meanwhile, on the indicators of grain productivity, Boyolali and Klaten appear to be superior, which indicates that agroclimate factors or land quality support higher grain yields. However, high grain productivity is not always directly proportional to profitability, as seen in Klaten, which despite having high yields but low profitability indicates high production costs, less efficient value chains, or uncompetitive selling prices. These findings underscore the importance of a holistic SRP approach: not only improving physical productivity, but also improving economic efficiency and farmer competitiveness. Overall, this graph shows the heterogeneity of conditions between districts that can be the basis for the preparation of intervention strategies and regional priorities in the SRP roadmap.

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Analysis of three indicators of the second cluster of SRP: *water use productivity, Nitrogen Use Efficiency and phosphorus*

From the perspective of water use efficiency, the data shows that Ngawi has the highest level of efficiency, reflecting the effectiveness of the irrigation system and the ability of farmers to manage water during the growing season. Klaten, on the other hand, recorded lower values, exposing challenges in water resource management or dependence on rainfed rice paddies. Water efficiency is one of the core indicators of SRP, so this variation provides a strong basis for developing strategies to increase farmers ' capacity in water management, including the adoption of water-efficient irrigation technology, structuring planting schedules, and coordinating farmer groups. Increasing water productivity will strengthen farmers ' resilience to climate change and fluctuations in water sources.

The use of nitrogen and phosphorus shows disparities that are relevant to sustainability aspects. Ngawi Regency appears to have a better level of fertilization efficiency than other districts, indicating a more optimal application of balanced fertilization. In contrast, districts such as Sragen and Klaten showed lower efficiency scores, illustrating the potential for overuse or underuse that could impact productivity and the environment. Inefficient nutrient management can increase production costs, degrade soil quality, and increase the riskof n_2o emissions, so SRP interventions need to focus on technical assistance and precision fertilization training in the region. These findings indicate that improved fertilization becomes one of the important leverage to raise the overall performance of SRP.

On social and institutional aspects, indicators of SRP training, PPE use, and women's involvement showed varying levels of participation among districts. Boyolali and Klaten showed a high level of participation in SRP training, indicating a stronger readiness to adopt sustainable practices. Meanwhile, districts with low Training figures indicate the need for institutional intervention and intensive capacity building. The involvement of women is also an important indicator in the SRP, where Madiun and Boyolali have relatively high participation rates, showing great potential for gender empowerment in the sustainable rice value chain. Inter-district variations indicate that strengthening institutional social capacity should be the main agenda in the SRP adoption roadmap.

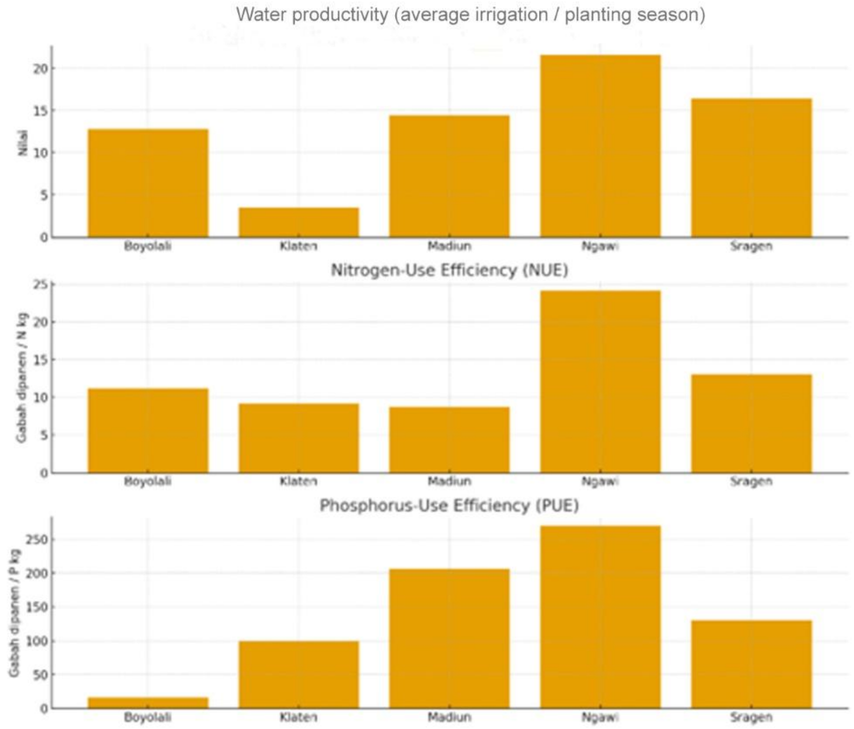


Figure 4.2 three indicators of the second cluster of SRP:*water productivity, Nitrogen-Use* dan *Efficiency, and phosphor-Use efficiency*

The comparative analysis of the three indicator clusters above (see Figure 4.2) shows that water productivity indicators show significant variations in water use efficiency between districts. Ngawi emerged as the region with the highest water productivity, indicating a more stable irrigation system, better water management practices, as well as the potential adoption of more developed water-saving technologies. In contrast, Klaten recorded the lowest value, which indicates the limited access to water, high dependence on rainfed rice fields, or weaknesses in irrigation management of farmer groups. This condition confirms that interventions on water management aspects need to be designed differently per region, especially with an SRP approach that emphasizes the efficient use of water resources.

In *the Nitrogen-Use Efficiency (NUE*) indicator, Ngawi again showed the highest performance, reflecting the effectiveness in the use of nitrogen fertilizers and the application of more optimal balanced fertilization. On the other hand, Madiun and Klaten recorded relatively low values, indicating the potential for overuse and underuse of nitrogen fertilizers that can have an impact on productivity, production costs, and the environment (including the riskof n_2o emissions). This difference shows that increasing the capacity of farmers in precision fertilization is one of the important pillars to strengthen production sustainability. SRP approach based on nutrient requirement analysis and directed fertilization can help improve this indicator significantly.

Phosphorus-Use Efficiency (PUE) showed a sharper contrast between districts. Ngawi and Madiun performed very well, indicating that the use of phosphorus fertilizers in both regions is relatively more efficient and provides a high crop output per unit of input P. In contrast, Boyolali showed the lowest performance, which may indicate inaccuracy of P dosage, soil quality that does not support nutrient absorption, or cultivation management that has not been optimal. This gap indicates that SRP intervention in Boyolali needs to be more focused on evaluating soil conditions,*site-specific nutrient management recommendations*, and technical assistance related to P fertilization. Overall, these three indicators emphasize that input efficiency is one of the main foundations of SRP success and should be a core part of the capacity building roadmap for farmers and institutions at the district level.

Analysis of Three Indicators of the Third SRP Cluster: Biodiversity, GHG Emission, and Food Safety

The findings on biodiversity indicators show that there are variations in the intensity of pesticide use between districts, which directly reflects the level of sustainability of rice cultivation practices implemented by farmers. Sragen recorded the highest values in pesticide use, indicating greater pressure on biodiversity in agricultural land. In contrast, Klaten and Boyolali showed relatively lower values, reflecting the potential for more environmentally friendly pest management practices or more controlled pesticide use. This variation gives an idea that the implementation of SRP principles related to biodiversity conservation still requires different interventions in each region, especially in districts with high levels of pesticide use to ensure long-term ecological risk reduction. This can be seen in Figure 4.3.

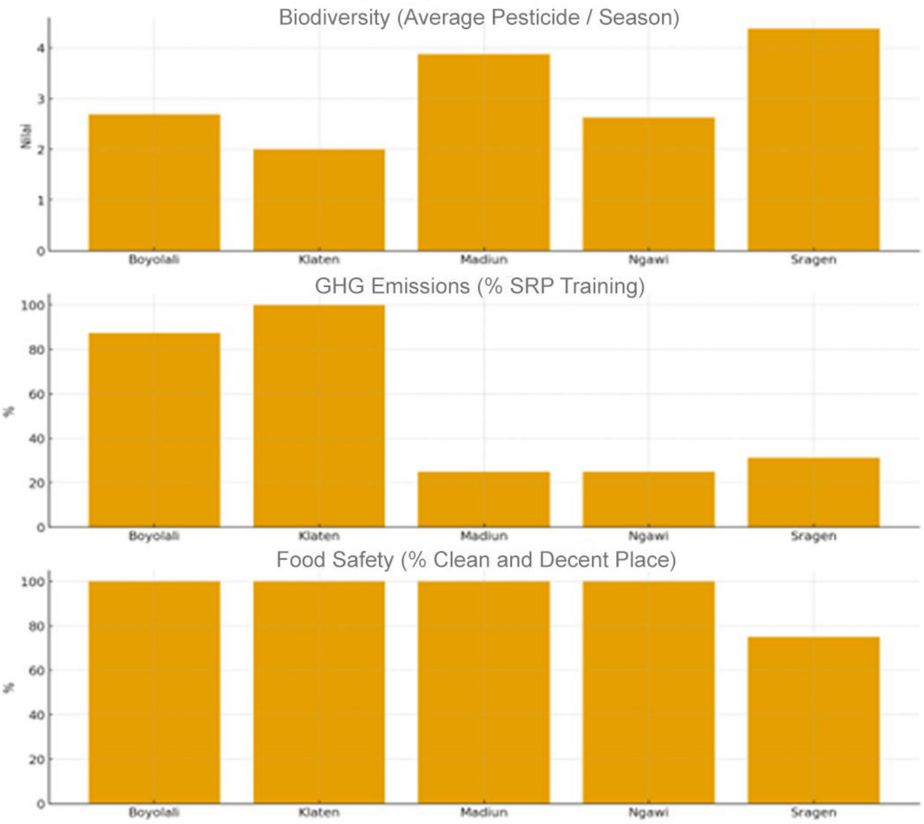


Figure 4.3 Three Indicators of the Third Cluster of SRP: Biodiversity, GHG Emission, and Food Safety.

In the GHG Emissions indicator, which is measured by the percentage of farmers who have attended SRP training, there is a significant capacity gap between districts. Klaten and Boyolali showed the highest levels of training participation, indicating stronger readiness in implementing low-emission practices such as water management, precision fertilization, and climate-friendly cultivation techniques. In contrast, Madiun, Ngawi, and Sragen had significantly lower participation rates, indicating the need for increased access to more intensive training and technical assistance. This Data shows that the success of emission reduction depends not only on technical factors in the field, but also on the knowledge capacity and involvement of farmers in the SRP program.

Food Safety indicators showed relatively strong results in four districts, namely Boyolali, Klaten, Madiun, and Ngawi, which all achieved 100% compliance with clean and proper grain storage standards. This shows the high awareness and application of post-harvest practices that support food quality and safety. However, Sragen recorded a lower value, which was 75%, indicating a gap in warehouse management standards or storage facilities. These differences indicate that food safety improvement interventions need to be focused specifically in Sragen to ensure consistency in rice quality and safety, especially if the region is geared to participate in the SRP rice value chain targeting premium markets.

Overall, the results of the analysis on biodiversity, GHG Emissions, and Food Safety indicators show that the level of implementation of sustainability practices in the five sample districts is still diverse and reflects uneven readiness to adopt SRP standards. In the aspect of biodiversity, variations in the intensity of pesticide use indicate a greater ecological risk in some areas, especially Sragen, which requires integrated pest management interventions to reduce environmental stress. Meanwhile, emission indicators show that the capacity of farmers to implement low-carbon practices is still limited in some areas, reflected in the low level of SRP training participation. This is a signal that the acceleration of training and capacity building is an urgent need so that emission mitigation targets in the rice sector can be achieved.

Analysis of Three Indicators of the Fourth SRP Cluster: Health and Safety, Child Labor, and Women's Empowerment

In this analysis seen from Figure 4.4. The findings in the figure, that health & Safety indicators show that most districts have achieved a fairly good level of compliance with SRP safety standards, especially in the use of personal protective equipment (PPE). Boyolali and Madiun achieved a perfect compliance level (100%), indicating a high awareness of occupational risks and well-established institutional support. Meanwhile, Ngawi and Sragen are at the middle level, indicating the need for increased socialization, provision of PPE, and supervision of the implementation of safety standards. Klaten became the district with the lowest score (75%), which indicates the need for more intensive intervention, especially in K3 training and the provision of safety facilities. This variation indicates that although the H&S standard has begun to be adopted, its consistency has not been evenly distributed throughout the research area.

Indikator *Child Labor indicators* in general show encouraging results because the entire district is in the range of high scores (75-94%). This indicates that farmers ' awareness of the importance of Child Protection has been quite good and most farmers have complied with the SRP principle which prohibits the involvement of children in agricultural production activities. Madiun and Sragen recorded the highest scores, indicating strong social governance and effective institutional support at the site level. While other districts such as Boyolali and Klaten still show good scores, they still require monitoring to ensure that regression does not occur. Although this indicator is relatively stable, its sustainability still requires strengthening the capacity of extension workers in providing social education and ensuring compliance with farmer groups in a sustainable manner.

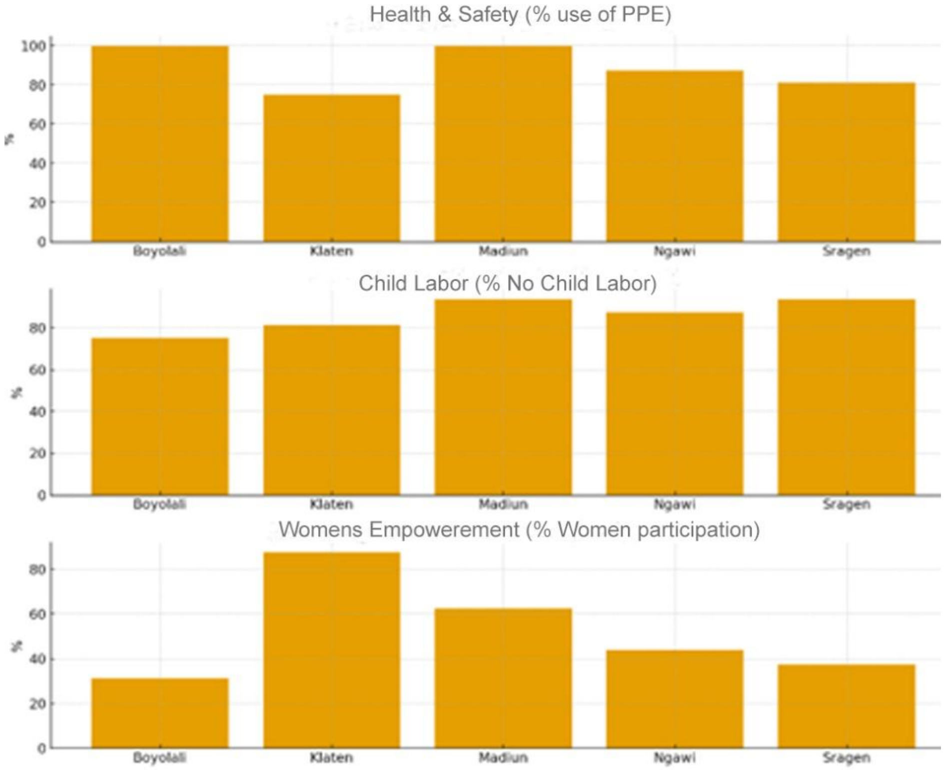


Figure 4.4 Three Indicators of the Fourth Cluster of SRP: Health and Safety, Child Labor, and Women's Empowerment

The next indicator, namely women empowerment, shows one of the biggest gaps between districts. Klaten emerged as the district with the highest female participation rate (87.5%), signifying institutional inclusiveness and strong involvement of women in decision-making, farmer group management, and training activities. In contrast, Boyolali, Ngawi, and Sragen still have low to medium scores, reflecting the limited space for women's participation in local institutional structures. This inequality shows that the gender dimension is one of the components of SRP that most needs systematic intervention, either through institutional approaches, capacity building, or changes in social norms related to the role of women in agriculture.

The correlation of these three social indicators shows that the sustainability of SRP implementation is not only determined by technical and agronomic aspects, but also strongly influenced by social and institutional dimensions. Districts with low scores on indicators of women's empowerment and Occupational Safety tend to have more limited capacity for SRP adoption. While relatively stable Child Labor indicators provide a good social Foundation, two other indicators show the need for capacity building, increased sustainability literacy, and more focused institutional interventions. This finding confirms that the SRP roadmap cannot be homogeneous, but must be adapted to the social characteristics of each district.

Overall, these three indicators show that the achievement of SRP in five districts has not been uniform—there are areas that are already strong such as Child Labor, but also aspects that are still challenging such as Health & Safety and especially women's Empowerment. This inequality underscores the importance of local-specific intervention strategies, as well as the need to strengthen the role of extension workers and farmer institutions in promoting inclusive and sustainable social practices. By prioritizing improvements in these three indicators, the implementation of the SRP can run more comprehensively, effectively, and sustainably, while strengthening Indonesia's position in the development of low-carbon rice and international standard rice.

4.2. Adequacy analysis of SRP development location

Overall, the adequacy level of locations in the five sampled districts indicates that the implementation of the SRP principles has been underway, but has not yet met optimal standards in several key aspects, particularly production efficiency, environmental sustainability, and institutional social inclusion. This is based on Table 4.2. Economic indicators such as profitability, labor productivity, and rice productivity provide an overview that most areas are still in the moderate performance category, which means the potential for improvement is still very high. Rice productivity below the national standard and thin profit margins signal that technological transformation and input efficiency are urgent needs for farmers to achieve a more stable level of economic sustainability.

In terms of the environmental aspect, indicators such as water efficiency, fertilization efficiency (NUE and PUE), biodiversity, and emission mitigation training show uneven achievements. Moderate water efficiency and suboptimal fertilizer usage indicate a high reliance on conventional practices that are less adaptive to climate change. Biodiversity, which is relatively pressured by pesticide intensity, along with low participation in emission mitigation training, poses major challenges in meeting SRP standards related to ecological sustainability. This indicates that the transformation of environmental practices requires a more intensive approach, including strengthening IPM, precision fertilization, as well as broad and consistent low-carbon agronomy training.

Meanwhile, the social aspects including Food Safety, Health & Safety, Child Labor, and Women's Empowerment show better performance, especially in food safety and child protection which have met SRP standards. The relatively high use of PPE also indicates an increased awareness of farmer safety. However, the aspect of women's empowerment remains uneven and inconsistent across regions, showing that the capacity for gender inclusion within agricultural institutions still needs to be strengthened. This disparity is important to note because women’s participation is one of the key indicators of successful long-term SRP adoption.

Based on all these indicators, it can be concluded that the adequacy level of the location is at a medium level: sufficiently suitable for SRP development, but requires targeted interventions in the environmental dimension, technical efficiency, and social capacity strengthening. Areas that have achieved higher scores in technical and social aspects can become champion areas for SRP development, while areas with lower scores require more intensive support, whether in outreach, technology provision, or institutional strengthening programs. Therefore, the SRP development roadmap must adopt an area-specific, evidence-based, and phased approach to bridge the readiness gap between districts.

From Table 4.2, it is also observed individually by indicator that the three main economic indicators—profitability, labor productivity, and rice productivity—show that the economic performance of farmers in the sample area is still in the moderate category. Thin profitability indicates that farmers' profit margins are not yet strong enough to support long-term financial resilience, especially in facing input price risks and market fluctuations. Relatively good labor productivity shows farmers' contribution to the added value of the agricultural sector, but it is not yet proportionate to the productivity potential that can be achieved through more efficient technology and agronomic practices.

Dari Table 4.2 juga secara individu indikator diperoleh bahwa tiga indikator ekonomi utama profitabilitas, produktivitas tenaga kerja, dan produktivitas gabah menunjukkan bahwa kinerja ekonomi petani di wilayah sampel masih berada pada kategori moderat. Profitabilitas yang tipis mengindikasikan bahwa margin keuntungan petani belum cukup kuat untuk menopang ketahanan finansial jang

Table 4.2 Adequacy Level of 12 SRP Indicators in All Sample Areas

No	SRP Indicator	Total Value	Descriptive Analysis	Economic/Social/Environmental Aspects
1	Profitability	Rp 14.087.101/Ha/MT	Farmer profit margins are moderate; a small margin over production costs.	This indicates that farmer welfare is not yet optimal; the risk of financial sustainability is high.
2	Labor Productivity	Rp 21.459.938/petani/MT	Labor productivity is quite good, but not yet on par with the non-agricultural sector.	This reflects that farmers' contribution to added value is still limited.
3	Grain Yield	3.663 kg/Ha	Below the national average (5.2 tons/ha).	Production efficiency and superior seeds are not yet optimal.
4	Water Productivity	13,75	Water efficiency is moderate; variation across districts is large.	Water efficiency is important for climate resilience and irrigation costs.
5	Nitrogen Use Efficiency (NUE)	12,61 kg grain/kg N	Nitrogen fertilizer use is quite efficient.	This reflects increasing awareness of rational fertilization.
6	Phosphorus Use Efficiency (PUE)	84,82 kg grain/kg P	P fertilizer use is very efficient.	This indicates that phosphate inputs are not excessive and are cost-effective.
7	Biodiversity	Pesticide 3,11 time/season; Insect 93,75%; othe plan 45%	The rice field ecosystem is still vibrant, but monoculture is dominant.	Biobalance is beginning to be established, but crop types are still limited.
8	GHG Emissions (Training SRP)	53,75% Farmers	Half of the farmers have participated in emission mitigation training.	Awareness of climate mitigation is growing.
9	Food Safety (GAP Practices)	95% Decent place; 26,25% GAP Training	Storage infrastructure is good, but GAP education is minimal.	Food safety is still experience-based, not standards-based.
10	Health & Safety	PPE 88,75%; Safety Training 20%	Awareness of PPE is high, training is low.	The occupational health and safety (K3) aspect of agriculture has not been institutionalized.
11	Child Labor	86,25% No Child Labor	Social practices are good; a small proportion still risks child involvement.	This reflects high social compliance and support for SDG 8 (Decent Work).
12	Women's Empowerment	52,5% ikut keputusan; 40% ikut pelatihan	Women's participation is increasing but not evenly distributed.	Gender equality is beginning to be realized, but access to training remains unequal.

Source: Field Survey Results (2025)

Water Productivity shows the level of water usage efficiency that is still moderate, with variations between districts that are quite wide. Water efficiency is a critical component in the face of climate change pressures and water resources limitations, especially in areas that rely on rainfall fields. Low water efficiency in some locations indicates the need for adoption of water management technologies such as Alternate Wetting and Drying (AWD) and more effective irrigation governance. This indicator is an important pillar in SRP because water efficiency not only lowers production costs, but also reduces methane emissions and improves farmers' resilience to climate variability.

Nitrogen-Use Efficiency (NUE) and Phosphorus-Use Efficiency (PUE) indicate rational fertilization awareness is beginning to increase, but the efficiency rate has not been evenly even between locations. Nitrogen fertilization is considered quite efficient, but phosphorus fertilization still needs special attention because there are indications of excess use in some districts. Low fertilization efficiency has the potential to increase production costs, lower soil quality, and increase N_2O emissions that contribute significantly to climate change. Therefore, the increase in the capacity of farmers through precision fertilizing training and strengthening the role of extension in monitoring fertilizing practices is a very important recommendation.

Biodiversity indicators show that the rice field ecosystem is still alive, but the dominance of monoculture and high intensity of pesticides limits biodiversity. Meanwhile, farmers' participation in emission mitigation training is still relatively low in some regions, reflecting the need for increased climate literacy and low carbon agronomy. Both are important elements of interconnected SRP: high pesticide intensity can disrupt the balance of agroecosystems, while low emission mitigation training slows the adoption of climate-friendly agronomic practices. Thus, an integrative approach is needed to drive ecological transformation, through reducing chemical inputs and increasing climate mitigation capacity at the farmer level.

Food Safety and Health & Safety show that the safety and protection aspects of workers are in good categories, although not yet fully consistent between regions. The high feasibility of grain storage is a positive indication of the readiness of the region in meeting premium rice standards. Meanwhile, the use of APD high enough reflects increased awareness of employment risks, but some districts still require strengthening advocacy and providing safety facilities. Both indicators are important to ensure the social sustainability of SRP, as the post-capanent quality and safety of farmers are the main prerequisites in the sustainable rice value chain.

Child Labor social indicators show a very high level of compliance, in line with the principles of SRP and SDG related to child protection. Women's

Empowerment has shown progress but still lame between regions, reflecting the inequality of women’s access to training, decision-making and leadership roles of peasant groups. Women’s participation is an important element in strengthening local institutionalities because it affects the diffusion of innovation, group stability, and quality of farm business management. Therefore, the increase in women’s empowerment should be an integral part of the SRP strategy through directional training, incentive mechanisms, and integration of women’s role in agricultural institutional structures.

4.3. Analysis of SRP Development Location Feasibility

Analysis of the viability of this location based on Table 4.3, which explains the degree of location eligibility for SRP development is seen based on cluster I, i.e. high performance and relatively balanced areas. The findings are that Madiun and Ngawi Regency show a profile of eligibility that is mixed performance, which has a number of superior indicators but also significant weaknesses in other indicators. Madiun stands out in labor productivity and profitability, demonstrating strong farming economic capabilities. However, the productivity of grain is relatively low and the participation of GHG training is very limited (25%), which indicates the adoption gap of sustainable cultivation technology. On the social side, the safety aspects of work are good, but women’s empowerment is still not optimal. Ngawi has the advantage of water efficiency and very high nitrogen efficiency, reflecting relatively efficient and adaptive management of inputs to climate pressure.

However, low biodiversity value and SRP training related to emission mitigation are also low, showing ecological risk and institutional capacity limitations. Both districts can be categorized as transitional potential areas, which require bridging strategies: utilizing existing technical-economic advantages, while accelerating the increase in environmental and institutional capacity to achieve SRP standards in full.

Next, looking at cluster II, which is a potential area with disparities among indicators, it was found that Madiun and Ngawi Regencies show a mixed performance feasibility profile, meaning they have a number of strong indicators but also significant weaknesses in other indicators. Madiun stands out in labor productivity and profitability, indicating strong economic capabilities in farming enterprises. However, rice productivity is relatively low and participation in GHG training is very limited (25%), indicating a gap in the adoption of sustainable cultivation technology. On the social side, occupational safety is good, but women's empowerment is still not optimal.

Ngawi has advantages in water efficiency and very high nitrogen efficiency, reflecting relatively efficient input management and adaptability to climate pressures. However, biodiversity values are low and SRP training related to emission mitigation is also low, indicating ecological risks and limited institutional capacity. Both regencies can be categorized as potential transitional areas, requiring bridging strategies: leveraging existing technical-economic strengths while accelerating the enhancement of environmental and institutional capacity to fully meet SRP standards.

As for cluster III, where low performance regions and intensive intervention needs, it is shown that Sragen County forms its own cluster as a region with relatively low feasibility rates in many key indicators of SRP. The profitability and productivity of the grain are the lowest among all samples, indicating fundamental limitations on the efficiency of the farm business and production quality. In addition, some environmental and social indicators such as biodiversity, GHG training participation, food safety and female empowerment show low to moderate achievements. This combination suggests that Sragen is not yet in a ready position for full-scale adoption of SRP.

However, Sragen has some relatively good social indicators, such as child labor and basic health, which provide initial capital for transformational interventions. In other words, Sragen is more appropriately positioned as a basic construction priority (SRP entry-level area), where the initial focus should be directed towards improvements in basic productivity, strengthening of farmers' institutional, increased extension capacity, and improvement of post-capital infrastructure before entering the SRP certification or expansion phase.

Overall, the eligibility level of the Sustainable Rice Platform (SRP) development area in five sample districts forms three different readiness clusters, reflecting the heterogeneity of technical, environmental and social conditions at the site level. Boyolali and Klaten regencies are in a relatively high readiness region cluster because it shows strong performance in most indicators of economic, environmental and social governance, so it is worth positioning as a pilot area and leveraging SRP expansion. Madiun and Ngawi regencies are in a transitional region cluster with a number of technical advantages such as labor productivity and input efficiency but still face limitations on mitigation aspects of emissions, biodiversity and institutional strengthening, thus requiring selective intervention to drive transition to a more intact SRP standard. Meanwhile, Sragen Regency is in a low readiness region cluster, characterized by weak productivity indicators, profitability and SRP training participation, so that the necessary development approach is fundamental and gradual before being directed towards full-scale adoption of SRP. The findings confirms that SRP development needs to be done through cluster-based and region-specific approaches, so that policy, mentoring and investment interventions can be more targeted and sustainable.

The strategic implication of this cluster analysis is that the SRP development roadmap should be structured in tiers and based on clusters. Cluster I areas can be directed as demonstration sites and levers for SRP expansion into premium markets and exports. Cluster II requires intervention designs focused on enhancing environmental capacity (GHG, biodiversity) and strengthening institutions to support the transition to a ready cluster. Meanwhile, Cluster III needs a foundational development approach, including increasing productivity, intensive mentoring, and institutional investment before being directed toward full SRP standards. With this cluster approach, SRP development becomes more realistic, efficient, and sustainable, as it aligns with the actual conditions of each area and can maximize the impact of policy and funding interventions available.

Thus, the findings on district feasibility levels indicate that the opportunities for developing a Sustainable Rice Platform (SRP) largely depend on the readiness level of each cluster, where areas with high readiness such as Boyolali and Klaten have the greatest and quickest potential to be developed as core SRP locations, certified sustainable rice production, and entry points to premium and export markets. Transitional areas like Madiun and Ngawi offer medium-term development opportunities through targeted capacity-building interventions focusing on environmental and institutional aspects, thus potentially upgrading to SRP-ready regions. Meanwhile, areas with low readiness such as Sragen are more appropriately positioned as targets for long-term development based on strengthening productivity and institutional foundations.

Table 4.3 Level of Feasibility of All Sample Areas According to twelve SRP Indicators

Indikator SRP	Kab. Boyolali	Kab. Klaten	Kab. Madiun	Kab. Ngawi	Kab. Sragen
1. Profitability (Rp/Ha/MT)	38,449,933	15,079,696	30,444,590	17,370,089	5,254,630
2. Labor Productivity (Rp/petani/MT)	17,903,250	8,680,250	30,425,563	25,696,875	21,281,250
3. Grain Yield (kg/Ha)	7,556	6,965	3,871	5,144	2,120
4. Water Productivity (Indeks)	12.81	3.50	14.44	21.56	16.44
5. Nitrogen-Use Efficiency (kg gabah/kg N)	11.13	9.21	8.75	24.14	13.07
6. Phosphorus-Use Efficiency (kg gabah/kg P)	16.75	99.32	206.33	269.36	130.76
7. Biodiversity (% serangga di lahan)	100%	100%	93.75%	87.50%	75%
8. GHG Emissions (% ikut pelatihan SRP)	87.50%	100%	25%	25%	31.25%
9. Food Safety (% tempat bersih & GAP)	100%; 56.25%	100%; 18.75%	100%; 12.5%	100%; 25%	75%; 18.75%
10. Health & Safety (APD & pelatihan)	100%; 31.25%	75%; 25%	100%; 12.5%	87.5%; 6.25%	81.25%; 25%
11. Child Labor (% tidak ada pekerja anak)	75%	81.25%	93.75%	87.5%	93.75%
12. Women's Empowerment (% partisipasi keputusan & pelatihan)	31.25%; 81.25%	87.5%; 75%	62.5%; 0%	43.75%; 12.5%	37.5%; 31.25%

Sumber: Field Survey Result (2025)

Achievement categories (low, medium, high) use the performance classification system:

High (≥75%)

Midle (40–74%)

Lower (<40%)

4.4. Analysis of SRP Development Opportunities

Based on Table 4.4 SRP Development Opportunities According to Dimensional Indicator Cluster, and are directly associated with findings in Table 4.2 and Table 4.3, can be drawn integrated analysis as follows. In the economic dimension, the average achievement still in the moderate category (about 60%) is consistent with previous findings showing the relatively thin margin of farmers' profit, below the national average, and unoptimal labor productivity across the sample area. The findings in Table 4.3 show that only high readiness clusters such as Boyolali and Klaten are able to show relatively better economic performance, while Madiun and Ngawi are still transitional and Sragen are left behind. This confirms that the main economic challenge in the development of SRP is not in the absence of production potential, but in technical efficiency, improvement input quality, and added value integration. Thus, the opportunities for development of SRP in the economic dimension depend heavily on the success of increased productivity interventions and cost efficiency at the site level.

In the environmental dimension, achievements categorized as fairly good (around 70%) reflect initial progress in sustainable agricultural practices, such as efficient use of water and fertilizers (NUE and PUE) as well as the sustainability of basic biodiversity. These findings align with the clustering results in Table 4.3, which show relative advantages in input efficiency in certain regions, particularly Ngawi and parts of Madiun. However, the adoption rate of these environmental practices is still not widespread and has not been fully internalized into cultivation systems, as reflected by the low participation in SRP emission mitigation training in several districts. This indicates that the development opportunities for SRP in the environmental dimension are in a transitional phase, where future success largely depends on the expansion of training, technical assistance, and incentives for adopting low-carbon practices.

Meanwhile, the social dimension showed the highest achievement (about 80%), consistent with the findings in the previous table regarding the strong food safety, health and safety indicators, and child labor protection in almost all samples. This shows that social capital and normative awareness of farmers are relatively better prepared than economic and environmental aspects. However, findings related to empowering women who are still lame between regions indicate that institutional quality is not yet fully inclusive and sustainable. Therefore, although the social dimension is a strong foundation for SRP development, optimal development opportunities still require the strengthening of farmers' institutional, expanding training access, and integration of gender roles in decision-making structures. Overall, the intertable interconnectedness confirms that the opportunities for development of SRP in Indonesia are gradual and multi-story, with social dimensions as foundations, environmental dimensions as transition leverages, and economic dimensions as key challenges that must be solved to achieve a sustainable scale of development.

Table 4.4. SRP Development Opportunities According to SRP Dimension Clusters

SRP Dimention	Related SRP Indicator / Cluster	Total Achievement	Total Achievement
Economy	Profitability, Labor Productivity, Grain Yield	Moderate (around 60%)	Income and labor efficiency are not yet sufficient to support well-being.
Environtment	Water Prod., NUE, PUE, Biodiversity, GHG	Quite Good (around 70%)	Environmentally friendly practices are beginning to take hold, but are not yet widespread.
Social	Food Safety, Health & Safety, Child Labor, Gender	Good (around 80%)	Social and gender awareness are high; institutionalization and training still need to be expanded.

Source: Field Survey (2025)

Overall, the implications of these findings emphasize that the success of SRP development is not sufficient solely based on compliance with technical indicators, but must be supported by a cross-dimensional policy design that is aligned, region-cluster based, and oriented towards real economic incentives. This approach will ensure that SRP is not only technically and socially feasible, but also economically sustainable and capable of progressing towards large-scale rice land management targets.

4.5. Readiness Analysis for SRP Development

The level of readiness for implementing the Sustainable Rice Platform (SRP) across regions is not homogeneous and is largely determined by the balance of achievements in the economic, environmental, and social dimensions. Boyolali Regency falls into the High SRP Readiness category with strong performance across all three dimensions, reflecting structural and operational readiness for advanced SRP development. This situation directly presents a significant opportunity for Boyolali to be established as a central location for SRP development, whether as a demonstration site, a learning hub, or an entry point for certification and integration into the sustainable rice market. This high readiness indicates that the transition cost towards full SRP standards is relatively low and the implementation risks can be well managed. This can be seen in Table 4.5.

Klaten and Ngawi regencies fall into the Medium SRP Readiness category, with their main strengths in social and environmental dimensions, but still facing limitations in economic aspects and consistency of performance across indicators. This condition indicates that the opportunities for SRP development in both regions are transitional, requiring selective interventions to strengthen areas in order to advance to SRP-ready status. Development opportunities can be focused on increasing production efficiency, enhancing added value, and better aligning cultivation practices with SRP standards. In this context, Klaten and Ngawi have strong potential to become second-stage SRP expansion areas, especially if supported by incentive policies, financing, and capacity building for farmer institutions.

Madiun Regency occupies a strategic position as an area with Above Average readiness, marked by high achievements in economic and environmental dimensions, while the social aspect is still in the moderate category. This characteristic indicates that the potential for SRP development in Madiun is relatively large in terms of productivity and farming efficiency, but its long-term sustainability depends on strengthening social aspects, such as workplace safety, training, and women's empowerment. With a more systematic social assistance approach, Madiun has the potential to become an SRP accelerator area that bridges development from core locations to transitional areas..

Table 4.5. Readiness Level of Sample Areas in SRP Implementation Based on SRP Indicator Dimensions

District	Economy (Profit, Labor, Yield)	Environment (Water, Fertilizer, GHG, Biodiversity)	Social (Food Safety, K3, Child, Gender)	General Category SRP
Boyolali	High	High	High	⭐ Very Good (High SRP Readiness)
Klaten	Medium	Medium	High	Fairly Good (Medium SRP)
Madiun	High	High	Medium	Good (Above Average)
Ngawi	Medium	High	Medium	Fairly Good (Medium SRP)
Sragen	Low	Medium	Medium	⚠️ Needs Improvement (Low SRP)

Source: Field Survey (2025)

Meanwhile, Sragen Regency falls into the Low SRP Readiness category, indicating that the opportunities for SRP development in this area are still limited in the short term. The low economic readiness, along with moderate environmental and social achievements, suggests that the approach required is fundamental and gradual. Opportunities for certification-based and premium market SRP development are not yet relevant for Sragen in the near future; however, the region still holds long-term potential through basic productivity improvement programs, strengthening farmer institutions, and integration with local government programs. With the right foundational development strategy, Sragen can be prepared as a candidate for advanced-stage SRP development once readiness gaps are reduced.

The main implication of the findings on regional readiness levels is that farmer institutions and supporting institutions become determining factors for the successful adoption and sustainability of SRP. Regions with high readiness, such as Boyolali, show that the presence of relatively strong farmer groups, active involvement of extension workers, as well as support from local governments and supply chain partners, has created an institutional ecosystem capable of integrating economic, environmental, and social aspects simultaneously. This condition provides significant opportunities for local institutions to act as SRP implementing agents, while also serving as nodes for learning and replicating best practices to other regions.

Overall, the relationship between regional readiness levels and institutional capacity confirms that SRP can only develop sustainably if supported by adaptive, inclusive, and functional institutions. Differences in readiness between regions reflect differences in institutional maturity, so the SRP development strategy must place institutional strengthening as a core element in the roadmap, whether through continuous mentoring, enhanced cross-actor coordination, or the integration of farmer institutions into the sustainable rice value chain ecosystem. Therefore, it is necessary to analyze the feasibility of these institutions.

4.6. Analysis of Institutional Readiness Mapping for SRP Development

Overall, the AHP structure in Table 4.7 shows that the institutional readiness for SRP development is built on a combination of basic physical factors and sustainability orientation, with water availability and emission aspects as the main pillars. This reinforces previous findings that areas with high SRP readiness are not only economically superior but also have the resource and institutional foundations that allow sustainable practices to be implemented consistently. Thus, these AHP results provide a rational and measurable basis for determining priority areas for SRP development as well as for preparing a roadmap based on agro-ecoregions and institutional readiness.

Table 4.7. Composite Index for Institutional Analysis with AHP

	Water Availability	GHG	Road Access	Soil Texture	Rainfall
Water Availability	1.000	4.173	4.204	4.848	4.647
GHG	0.240	1.000	3.043	2.956	2.770
Road Access	0.238	0.329	1.000	1.678	2.278
Soil Texture	0.206	0.338	0.596	1.000	1.828
Rainfall	0.215	0.361	0.439	0.547	1.000

Table 4.6. Readiness Level of Sample Regions in Implementing SRP Based on Long-Term Development Opportunities Based on SRP Indicator Dimensions

District	Economics (Profit, Productivity, Yield)	Environment (Water, Fertilizer, Biodiversity, Emissions)	Social and Institutional (Food Safety, K3, Gender)	SRP Readiness Score (0–100)	Readiness Category	Reasons for Regional Readiness
Boyolali	85	80	90	85	High Readiness	It meets almost all SRP principles: high profits, good input efficiency, and strong social and gender awareness. Suitable as a full SRP pilot project.
Klaten	70	65	80	72	Ready	Productivity is high and GAP implementation is good, but water and fertilizer efficiency are inconsistent. Great potential if training is expanded.
Madiun	78	82	65	75	Moderately Ready	Phosphate fertilizer and water efficiency are very good, but social and institutional capacity (training and gender) is still limited.
Ngawi	65	80	60	68	Partially Ready	Technically ready (high fertilizer efficiency), but institutional and social readiness are not yet there—low SRP training and gender awareness.
Sragen	50	60	55	55	Low Readiness	Productivity is low, input efficiency is suboptimal, and social awareness is weak. Intensive mentoring and capacity building for farmers are needed.

Source: Field Survey (2025)

Based on Table 4.7, it shows the relative importance structure among location criteria used in the AHP analysis, and implicitly reflects the institutional and spatial logic in determining the readiness of areas for SRP development. Water availability occupies the most dominant position, reflected in the high comparison scores against all other criteria. This emphasizes that in institutional decision-making, the sustainability of irrigation systems and water availability are key prerequisites, as they directly affect production stability, input efficiency, and the potential for implementing low-carbon practices such as alternate wetting and drying. The dominance of this criterion is also consistent with previous findings that areas with good water availability tend to have higher SRP readiness.

Greenhouse gas (GHG) emission criteria rank second in priority, indicating that climate mitigation aspects have been seriously considered in institutional assessments, although they still fall below fundamental technical aspects such as water. The high comparative value of GHGs relative to road access, soil texture, and rainfall suggests that SRP development is viewed not merely as a production issue, but also as part of a low-carbon agriculture agenda and sustainability commitment. This aligns with the achievements in SRP training and GHG indicators in the previous tables, showing that areas with a stronger climate mitigation orientation have a greater chance of being developed as priority SRP locations.

Road access and soil texture are of medium importance, reflecting their roles as supporting factors for institutional and logistical aspects. Road access is directly related to the efficiency of input distribution, mobility of extension workers, and market connectivity, thereby supporting the operational sustainability of the SRP. Meanwhile, soil texture reflects long-term agroecological suitability, which, although important, can be managed through technical interventions if major factors such as water and institutional support are strong. Rainfall is of relatively lower priority, indicating that within the SRP framework, rainfall variability is considered manageable through good irrigation and water management systems.

The results in Table 4.8 indicate that the institutional composite index value of 0.667 is primarily driven by the dominance of the water availability aspect, which has a high score (84.38%) and the largest weight in AHP (49.30%), thus contributing the most significant index (0.416). This finding is consistent with the results in Table 4.7, which position water availability as the most decisive criterion in regional readiness, and aligns with Table 4.6, which shows that regions with high SRP readiness generally have good irrigation conditions and water management. This confirms that a physical–institutional foundation in water resource management is a key prerequisite for SRP implementation, as well as a leverage factor for the adoption of low-carbon practices and rice production stability.

However, even though the physical foundation is considered strong, the contribution of potential GHG emissions and market/institutional/transportation access aspects is still relatively limited, each contributing only 0.083 and 0.074 to the index value. This condition explains why in Tables 4.5 and 4.6 there are still regions with medium to low readiness, despite having adequate technical potential. The low contribution of GHGs reflects that climate mitigation orientation and institutional support capacity for SRP, such as training, mentoring, and recording mechanisms, have not been fully internalized. Similarly, suboptimal market access and logistics infrastructure limit the conversion of technical achievements into sustainable economic benefits..

Table 4.8. AHP Composite Index Score for Institutions

Aspek AHP	SRP Performace Score	AHP Weight	Final IKW Index Score
Water Availability	84.38%	49.30%	0.416
GHG	37.50%	22.10%	0.083
Road Access	59.38%	12.40%	0.074
Soil Texture	59.38%	9.30%	0.055
Rainfall	56.25%	7.00%	0.039
Final IKW Index Score			0.667

Soil texture and rainfall aspects are at the lowest level of contribution to the composite index, indicating that basic agroecological factors can relatively be managed through technical interventions if institutional strength and production management are already strong. This reinforces the conclusion from previous cluster analysis that the main constraints to SRP development are not merely biophysical aspects, but rather the quality of institutions in managing resources, adopting sustainable practices, and connecting production with markets. Thus, the interlinkages across tables consistently indicate that improving SRP readiness in the future should focus on strengthening the institutional dimension, particularly low-carbon orientation, market integration, and mentoring systems so that regions with technically adequate potential can be transformed into sustainable and large-scale SRP development.

Based on the results of the Analytic Hierarchy Process (AHP) summarized in Table 4.9, it can be seen that the correlation between the Regional Feasibility Index (IKW) and the Institutional Readiness Index (IKI) shows a fairly clear variation among regencies, reflecting differences in biophysical conditions and institutional capacity in supporting the development of the Sustainable Rice Platform (SRP). Boyolali Regency holds the strongest position with an IKW value of 66.71% and an IKI of 68.75%, both falling into the medium category. This indicates that Boyolali has a relatively balanced alignment between regional suitability and institutional readiness, making it more prepared than other regencies for further SRP development interventions.

Table 4.9. IKW and IKI Scores for Institutions by Location

Regencies	IKW (%)	Categories	IKI (%)	Categories
Boyolali	66.71	Medium	68.75	Medium
Klaten	55.29	Need intervention	62.50	Medium
Madiun	53.48	Need intervention	59.38	Medium
Ngawi	46.48	Need intervention	53.75	Medium
Sragen	43.97	Need intervention	43.13	Need intervention

Source: Field Survey(2025)

Klaten, Madiun, and Ngawi regencies show a relatively similar pattern, where the IKW values fall into the low category (46–55%), while the IKI values are in the medium category (53–63%). This condition indicates that although the institutions of farmers and supporting actors have been relatively established and are functioning, limitations in biophysical and spatial aspects—such as water availability, infrastructure access, or land suitability—still remain major constraints for the optimal development of SRP. These findings affirm that strengthening institutions alone is not enough; technical interventions and investments in improving regional conditions are still required for the SRP potential to be effectively realized.

Meanwhile, Sragen Regency is in the lowest position with an IKW score of 43.97% and an IKI score of 43.13%, both in the low category. These results indicate that limitations occur simultaneously in both territorial suitability and institutional readiness, making SRP development in this area face more complex structural challenges. Consequently, the SRP development approach in Sragen needs to be directed at strengthening the basic foundation stage, such as improving land productivity, providing intensive support for farmer institutions, as well as enhancing governance and infrastructure support. Overall, these AHP results provide a strong basis for determining regional priorities and adjusting SRP intervention strategies to be more contextual and sustainable.

4.7. Feasibility Analysis and Institutional Readiness for SRP Development: A Case Study in Boyolali Regency

Boyolali can be categorized as a regency with a high level of institutional readiness and feasibility in the development of SRP. The combination of technical readiness (water and land), institutional support, and the potential to strengthen environmental aspects makes Boyolali very suitable to be used as a pilot project location or an initial SRP acceleration hub. This advantage allows SRP implementation to be not only effective at the field level but also to serve as a replication model for other regions that are still at medium or low readiness levels. With targeted policy interventions, especially in strengthening emission mitigation, access to sustainable rice markets, and the institutional capacity of Boyolali farmers, the region has the potential to become a key anchor for SRP development towards national-scale targets, including achieving the 1 million hectare roadmap.

Table 4.10. Feasibility and Readiness Index of Institutional Models in Accelerating the Development of SRP Implementation: The Case of Boyolali as a Location with a High Level of Readiness

No	Aspect AHP	Score (IKW)	Value AHP	Index Value (IKK per factor)	Contribution (%) to IKK
1	Water Availability	84,38%	49,30%	0,416	41,6%
2	GHG Emissions (Potential)	37,50%	22,10%	0,083	8,3%
3	Market Access / Institutions / Transportation	59,38%	12,40%	0,074	7,4%
4	Soil Texture (Soil Quality)	59,38%	9,30%	0,055	5,5%
5	Rainfall (Dependence / Resilience)	56,25%	7,00%	0,039	3,9%

Source: Field Survey(2025)

Based on Table 4.10, the level of readiness and feasibility of institutional development of SRP by location shows a clear differentiation between regions, with Boyolali occupying the most advanced position compared to other locations. AHP analysis shows that water availability is the main determinant of regional readiness, with the highest weight of 49.30% and an IKW score of 84.38%. The contribution of this factor to the Institutional Readiness Index (IKK) reaches 41.6%, indicating that the presence of a relatively reliable irrigation system and stable water management is a key foundation for the successful implementation of SRP. This condition also reflects the technical readiness of the region to ensure the sustainability of low-carbon rice production.

In addition to water availability, environmental factors and other institutional support also shape the feasibility level of a region. GHG emissions have a fairly significant weight (22.10%), but a relatively lower IKW score (37.50%) indicates that although there is potential for emission mitigation, management practices still need to be strengthened through wider adoption of technology and SRP training. Market access, institutions, and transportation (weight 12.40%) as well as soil texture quality (9.30%) are at a moderate level, suggesting that Boyolali already has adequate market connectivity and land resource base, although there is still room for improving supply chain efficiency and sustainable land management. Rainfall factors contribute the least (3.9%), confirming that dependence on the climate can relatively be mitigated with strong water infrastructure support.

The implication of the findings regarding institutional readiness and feasibility is the need to establish a tiered and location-based SRP development strategy. Boyolali, with the highest level of readiness and feasibility, is very suitable to be positioned as an anchor area or pilot core in SRP development. The implementation of SRP in Boyolali can focus on accelerating scale, standardizing low-carbon cultivation practices, and strengthening upstream–downstream integration, thereby producing a credible proof of concept from technical, institutional, and market perspectives. Success in this area will send a positive signal to investors, policymakers, and market partners regarding the feasibility of developing SRP on a larger scale.

The next policy implication is the need to strengthen institutional capacity and adaptive capacity in regions with medium and low readiness, with Boyolali serving as a learning hub. Knowledge transfer, institutional mentoring, and replication of water governance models, farmer institutions, and market partnerships from Boyolali to other regencies are key to closing the readiness gap. This approach allows SRP development to be not one-size-fits-all, but rather to adjust the entry points of intervention according to the characteristics and capacity of each region.

Strategically, the medium-term implication of this finding is the need to integrate SRP into regional and national agricultural development planning, particularly within the framework of low-carbon agriculture, food security, and regional economic development. Areas with high readiness, such as Boyolali, can serve as a primary base for developing incentive schemes, whether fiscal, non-fiscal, or carbon market-based, while other areas should focus on capacity building and improving basic prerequisites. In this way, SRP will not only grow as a technical standard but also as an effective, measurable, and sustainable development policy instrument.

Table 4.11. Institutional Readiness Mapping Analysis by Location

Distrcit	Institutional Position	Readiness Recommendations
Boyolali	Highest: active coordination, relatively ready market; gaps in MRV emissions and audit standardization	Establish an SRP lighthouse: annual audits, AWD carbon plots, dashboards, retail offtaker contracts; local SRP rice exports.
Klaten	Medium: strong social; fluctuating water/fertilizer technical aspects	Mass GAP+AWD packages, MRV training, SRP cooperatives for stable contracts; 50% gender quota.
Madiun	Medium: efficient technical aspects, moderate social institutions	Green KUR scheme + SRP warehouses; K3 standardization; expansion of Bulog and milling contracts.
Ngawi	Medium: good technical aspects, weak social aspects (low training and gender)	Bootcamp for female extension workers + community trainers; establish SRP cooperatives; start a simple dashboard.
Sragen	Lowest: low profit and technical capacity; minimal gender and training	12-month basic program: subsidized superior seeds + soil testing, micro-irrigation, core training, SRP cooperative formation, and Bulog minimum contracts.

Source: Field Survey(2025)

Table 4.11 above shows that the mapping of institutional readiness indicates a gradient of institutional capacity among districts in supporting the implementation of SRP, ranging from areas with very high readiness to those that still require basic interventions. Boyolali occupies the highest position with relatively mature institutional characteristics, marked by active actor coordination, good market readiness, and technical gaps that are already specific and measurable, particularly in the aspects of emission MRV and audit standardization. This position is consistent with previous analysis results that placed Boyolali as a region with the highest readiness and feasibility scores in both the Regional Feasibility Index (IKW) and the Institutional Readiness Index (IKI). Thus, Boyolali has institutional readiness that is not only administrative but is approaching operational readiness for large-scale SRP.

When examined more deeply, the institutional readiness of Boyolali reflects a strong combination of biophysical, social, and governance factors. The predominance of water availability, relatively established market access, and the capacity of farmers' institutions accustomed to GAP practices and cooperative collectivity provide a solid foundation for SRP development. This distinguishes Boyolali from other regencies which, although having good technical aspects (such as water or fertilizer efficiency), are still weak in social, gender, or market contract mechanisms. In other words, Boyolali is not only technically "feasible" but also institutionally "ready" to enter the SRP acceleration phase.

The implications of developing a strategic plan framework from these findings highlight the need to position Boyolali as an SRP lighthouse in medium-term planning. Emerging recommendations, such as annual SRP audits, development of AWD carbon plots, data-based monitoring dashboards, and contracts with retail offtakers, indicate that interventions in Boyolali can now focus on system strengthening and scale expansion, rather than on laying the basic foundation. Boyolali has strong potential to become a learning and replication hub, a site for piloting MRV mechanisms, carbon incentive schemes, and upstream–downstream partnership models that can later be replicated in areas with medium readiness, such as Klaten and Madiun.

Within the framework of the medium-term SRP development roadmap, these findings underscore the importance of a gradual, regionally differentiated approach. Boyolali is placed in the scaling and integration phase (years 1–3), with a focus on standardization, market integration, and sustainability incentives. Regencies with medium readiness (Klaten, Madiun, Ngawi) are directed toward the capacity consolidation phase, through MRV training packages, strengthening SRP cooperatives, and contract stabilization. Meanwhile, areas with low readiness, such as Sragen, enter the foundation building phase, which involves enhancing basic productivity, forming farmer institutions, and providing intensive assistance. With a roadmap structure like this, SRP not only grows rapidly in ready locations but also develops inclusively and sustainably toward the long-term SRP development target of up to 1 million hectares.

Thus, institutions are the key to accelerating the implementation of SRP, because the sustainability of the system is not determined solely by technical adoption at the field level, but by the institution's ability to coordinate actors, manage incentives, and maintain standard consistency. Without a strong institutional framework, SRP practices risk being fragmented into standalone pilot activities, difficult to replicate, and lacking market or financing certainty. The formation of an SRP Task Force across ministries and regions becomes crucial to unite the roles of central government, local governments, extension workers, cooperatives, offtakers, and financial institutions within a coordinated and sustainable governance structure.

CHAPTER 5. STRATEGY AND DEVELOPMENT OF A ROADMAP FOR ACCELERATION OF SRP DEVELOPMENT TOWARDS 1 MILLION HECTARES OF LAND IN INDONESIA

CHAPTER 5. STRATEGY AND DEVELOPMENT OF A ROADMAP FOR ACCELERATION OF SRP DEVELOPMENT TOWARDS 1 MILLION HECTARES OF LAND IN INDONESIA

5.1. SRP Development Strategy Formulation: SWOT Analysis

The strategy formulation for developing the Sustainable Rice Platform (SRP) in Indonesia in this study was developed using a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis framework as a strategic approach to comprehensively understand the SRP's position. SWOT analysis was chosen because it systematically integrates internal and external dynamics, ensuring that the resulting strategy is not only responsive to technical conditions on the ground but also aligned with the broader context of policy, market, and structural challenges in sustainable agricultural development.

In its implementation, the SWOT analysis is built through two main frameworks: internal factor analysis and external factor analysis. The internal framework is formulated in the form of an Internal Factor Evaluation (IFE), which evaluates the strengths and weaknesses of SRP development, covering aspects of agroecology, production efficiency, social compliance, readiness of priority areas, institutions, economic incentives, and MRV capacity. Meanwhile, the external framework is formulated through an External Factor Evaluation (EFE), which captures opportunities and threats, such as increasing market demand for sustainable rice, the global low-carbon agenda, and the availability of green financing, as well as the risks of climate change, price volatility, and cross-sectoral policy fragmentation.

By building on these two analytical frameworks, the SRP strategy is not formulated normatively but rather based on an objective mapping of the internal and external conditions facing Indonesia. This approach allows for the explicit formulation of SO, WO, ST, and WT strategies while also providing a strong foundation for developing a realistic and measurable roadmap for accelerating SRP development toward 1 million hectares.

The Internal Factor Evaluation (IFE) matrix shown in Table 5.1 provides a comprehensive overview of the internal position of the Sustainable Rice Platform (SRP) development in Indonesia toward the 1 million hectare target. The total weighted score of 2.72 indicates that overall internal conditions are in the fairly strong category, although not yet optimal. This means that Indonesia has a relatively adequate initial foundation for accelerating the

SRP but still requires institutional strengthening, incentives, and policy integration for the transformation to take place systematically and sustainably.

Table 5.1. *IFE (Internal Factor Evaluation*) Matrix for SRP Development in Indonesia Towards 1 Million Hectares of Land

No	Main Internal Factors	Weight	Rating	Weighted Score	Justification
Strengths (S)					
1	Agroecological suitability and irrigation infrastructure	0.12	4	0.48	SRP's technical base is strong in the barn region
2	Practice input efficiency (water, N, P) is starting to improve	0.10	3	0.30	Supporting low-carbon rice
3	Compliance with high social standards (food safety, child labor)	0.08	3	0.24	Support SRP global standard
4	Confession: International SRP standards	0.07	4	0.28	Potential market access & financing
5	priority area (Boyolali) is ready as a pilot	0.08	4	0.32	National SRP Lighthouse
Weaknesses (W)					
6	SRP institution has not yet integrated the national	0.15	2	0.30	Still based project
7	SRP farmers' economic incentives are limited	0.14	2	0.28	Profitability is moderate.
8	MRV capacity & digitalization low	0.10	2	0.20	Obstacle: Carbon & ESG
9	The gap capacity inter- regional	0.08	2	0.16	Risk inequality adoption
10	Coordination chain weak SRP supply	0.08	2	0.16	Offtaker Not yet bound strong
Total		**1,00**		**2,72**	Internal conditions are sufficiently strong

Source: Results of the Author Team's Calculations (2025)

From the side strengths, factors with the highest contribution originate from suitable agroecology and infrastructure irrigation (score weighted 0.48), which reflects superior structural Indonesian rice farming as the main base of SRP adoption. The implementation of input efficiency practices (water, nitrogen, and phosphorus) is also a crucial factor in promoting low-emission rice production. Furthermore, the relatively high level of social compliance in food safety and child labor aspects strengthens Indonesia's readiness to meet global SRP standards, particularly for access to international markets and premium markets sensitive to sustainability issues.

Another significant strength is the international recognition of SRP standards and the existence of leading regions, such as Boyolali, that are ready to be piloted. A high score on this factor reflects that SRP is not starting from scratch but rather has early success stories (*lighthouse projects*) that can be replicated and scaled. Strategically, the existence of these pilot regions minimizes implementation risks, strengthens policy legitimacy, and serves as an initial anchor for the formation of a national SRP ecosystem.

However, the IFE matrix also highlights a number of structural weaknesses that are holding back acceleration. The SRP institutional framework, which has not yet been integrated into the national system, received a relatively high weighting and score, indicating that the SRP is still treated as a sectoral project, not a cross-system policy. Limited economic incentives for farmers, reflected in moderate profitability, are a major obstacle to expanding adoption at the grassroots level, particularly for smallholder farmers who are highly sensitive to income risk.

Another critical weakness is the low capacity for MRV (monitoring, reporting, and verification) and digitalization, coupled with capacity gaps between regions and weak supply chain coordination. These factors reduce the leverage of SRP, especially within the framework of green finance, carbon markets, and long-term contracts with offtakers. Therefore, the main interpretation of this IFE matrix is that SRP development in Indonesia has quite strong technical and social capital, but success in achieving the 1 million hectare target depends heavily on institutional reform, strengthening economic incentives, and integrating SRP into national financing systems, markets, and policies as a systemic transformation, not simply a technical intervention.

The external environmental influences are reflected in the EFE matrix. The External Factor Evaluation (EFE) matrix in Table 5.2 provides an overview of the external environment influencing the development of the Sustainable Rice Platform (SRP) in Indonesia toward the 1 million hectare target. A total score of 2.73 indicates that the external environment is quite conducive, meaning that the available opportunities are relatively greater than the threats faced. Strategically, this condition indicates that the current external momentum supports the acceleration of the SRP, especially if it can be responded to with institutional strengthening and appropriate policies.

In terms of opportunities, the factors with the highest contributions are the existence of the national FOLU Net Sink agenda and low-carbon agriculture, with a weighted score of 0.60. This confirms that the SRP has a very high level of alignment with the direction of national policies on climate change mitigation and reducing emissions in the agricultural sector. Furthermore, the increasing global demand for sustainable rice and the development of green financing and carbon finance schemes provide significant room for SRP to enter the premium market and utilize innovative financing instruments such as blended finance, green loans, and emissions-performance-based payments.

Table 5.2. *External Factor Evaluation (EFE)* Matrix for SRP Development in Indonesia Towards 1 Million Hectares of Land

No	Faktor Internal Utama	Bobot	Rating	Skor Tertimbang	Jastifikasi
Opportunity (O)					
1	FOLU Net Sink & agriculture national agenda low carbon	0.15	4	0.60	Strong alignment with SRP
2	Global demand for rice is sustainable	0.12	3	0.36	Premium market potential
3	Scheme financing green & carbon finance	0.14	3	0.42	The potential of blended finance
4	ESG donor & partner support	0.10	3	0.30	Early scale-up accelerator
5	Digital agriculture & MRV tools are developing	0.07	3	0.21	Efficiency implementation
Threats (T)					
6	Volatility of output and input prices	0.12	2	0.24	Risk for farmer adoption
7	Risk climate extreme	0.10	2	0.20	Threat productivity
8	Fragmentation of central–regional policies	0.10	2	0.20	Obstacle integration
9	Farmer resistance to additional standards	0.06	2	0.12	Need incentive economy
10	SRP risks being trapped in a pilot project	0.04	2	0.08	Institutional threat
Total		**1,00**		**2,73**	**Environment external conducive**

Other significant opportunities include support from ESG-based donors and partners, as well as the development of digital agricultural technology and MRV tools. While relatively smaller, these factors play a strategic role as initial *scaling enablers*, particularly in accelerating the adoption of SRP standards in pilot areas and strengthening accountability through data-driven tracking and reporting systems. Within the context of the roadmap, these opportunity factors can be leveraged in the early and mid-phases to accelerate the expansion of SRP from priority areas to transition areas.

On the other hand, the EFE matrix also indicates the presence of several threats that require serious mitigation. Volatility in agricultural product and input prices, as well as the risk of extreme climate change, are weighted relatively high, reflecting farmers' vulnerability to external shocks that could hinder SRP adoption. Furthermore, the fragmentation of central-regional policies and farmer resistance to additional standards indicate that without the right institutional approach and economic incentives, SRP risks slowing or even being rejected at the grassroots level.

Structural strategic threats are reflected in the risk of the SRP remaining a pilot project without institutional sustainability. This factor, while small, has serious long-term implications for achieving the 1 million hectare target. Therefore, the primary interpretation of this EFE matrix is that the success of SRP development is largely determined by the ability of the government and stakeholders to translate external opportunities from climate policy, markets, and green financing into tangible instruments that provide risk protection, incentive certainty, and institutional support for farmers, thereby managing external threats and preventing them from hindering the transformation of a sustainable rice farming system in Indonesia.

Based on the results of the IFE Matrix (score 2.72) and EFE Matrix (score 2.73), the main implication for the development of the Sustainable Rice Platform (SRP) in Indonesia is that the SRP is in a relatively advantageous strategic position but is not yet strong enough to develop automatically without targeted policy and institutional intervention. The combination of fairly solid internal strengths and a conducive external environment places the SRP in the *early scaling phase*, where acceleration still depends heavily on the quality of strategy design and cross-actor coordination.

Internally, the above-average IFE score indicates that Indonesia has adequate capital, particularly in agroecology, irrigation infrastructure, social compliance, pilot area readiness, and global recognition of SRP standards. However, key weaknesses include the lack of integration of SRP institutions into the national system, limited economic incentives for farmers, low MRV and digitalization capacity, and weak supply chain coordination, making SRP vulnerable if driven solely through a technical project approach. Consequently, SRP development cannot rely solely on the adoption of cultivation practices but must be accompanied by reforms in governance and economic instruments.

Externally, the relatively high EFE score confirms that policy and market momentum is in favor of the SRP. The FOLU Net Sink agenda, growing global demand for sustainable rice, the availability of green and carbon finance, and donor and ESG support create a strong window of opportunity for expansion. However, threats such as price volatility, extreme climate risks, fragmentation of central-regional policies, and farmer resistance to additional standards indicate that without risk protection and certainty of incentives, these opportunities may fail to be monetized at the farm level.

The strategic implication of this IFE-EFE combination is that Indonesia's SRP should be positioned on an aggressive-controlled (selective growth) strategy. This means that expansion needs to be focused first on areas with high readiness as *lighthouses* while simultaneously building national institutional systems such as *the SRP Task Force*, integration into green financing, a national MRV system, and market contracts with offtakers that can reduce risks and increase economic benefits for farmers. With this approach, internal strengths can be maximized to capture external opportunities while simultaneously closing weaknesses and mitigating threats.

Overall, the results of the IFE and EFE matrices suggest that the greatest challenge to developing SRP in Indonesia lies not in the absence of potential, but rather in the pace of institutional transformation. Without immediate institutional and economic instrument reforms, SRP risks remaining a pilot project. Conversely, with the right policy responses, SRP has a significant opportunity to develop into a national platform for sustainable, inclusive, low-carbon rice farming, capable of achieving the target of 1 million hectares of land development in a gradual and credible manner.

5.2. SRP Development Strategy Towards 1 Million Hectares of Land

One of the findings from the IFE and EFE matrix analysis above is that institutions are the key to accelerating SRP implementation, because the sustainability of the system is not determined solely by technical adoption at the field level, but rather by the ability of institutions to coordinate actors, manage incentives, and maintain consistent standards. Without a strong institutional framework, SRP practices risk fragmenting into stand-alone pilot activities, difficult to replicate and lacking market or financing certainty. The formation of a cross-ministerial and regional SRP Task Force is crucial to unite the roles of the central government, local governments, extension workers, cooperatives, offtakers, and financing institutions within a coordinated and sustainable governance architecture.

The following is the formulation of the SRP development strategy in Indonesia with an explicit SO–WO–ST–WT strategy to accelerate the development of the Sustainable Rice Platform (SRP) towards 1 million hectares in Indonesia, derived directly from the IFE–EFE Matrix and consistent with the findings of regional readiness–feasibility and institutional roles. The results of this strategy analysis are simplified in Matrix 5.3. The detailed formulation results are as follows:

1. **SO Strategy (Strength–Opportunity)**

   Leveraging internal strengths to capture external opportunities

   1. Establishing the ready region (Boyolali) as a national SRP lighthouse. This aims to leverage existing agroecological readiness, infrastructure, and strong institutions to access global market opportunities for sustainable rice, carbon markets, and green financing. Boyolali can be focused on becoming a center for large-scale SRP demonstrations, certification, and integration into premium value chains.
   2. Integrating the SRP with the national low-carbon agriculture (FOLU Net Sink) agenda, the strengths of water and fertilizer efficiency practices are geared toward supporting national climate policy while simultaneously accessing results-based payment opportunities and climate donor support.
   3. Developing the SRP as a tool for meeting ESG standards in the food sector. Global recognition of the SRP provides strategic leverage to attract offtakers, modern retailers, and the food industry, which require a supply of certified sustainable rice.

2. **WO Strategy (Weakness–Opportunity)**

   Overcoming internal weaknesses by taking advantage of external opportunities

   1. Establish a National SRP Task Force across ministries/agencies. To address institutional weaknesses, the SRP needs to be institutionalized within a coordinated national structure (Ministry of Agriculture, Ministry of Finance, Bappenas, Ministry of Environment and Forestry, and Financial Services Authority), leveraging opportunities for integration into green financing and low-carbon development policies.
   2. Linking the SRP to green financing schemes and economic incentives for farmers. Weaknesses in farmer profitability are addressed by leveraging opportunities such as Green KUR (People's Business Credit), blended finance, regional green bonds, and premium price or carbon payment schemes to ensure the SRP provides tangible incentives.
   3. Accelerate the development of MRV systems and the digitalization of
   4. The SRP. Limitations in data and emissions measurement are addressed through the adoption of digital agriculture technology and satellite/app-based MRV, enabling the SRP to be connected to carbon and ESG schemes.

3. ST Strategy (Strength–Threat)

Using internal strengths to mitigate external threats

1. Leveraging irrigation readiness and input efficiency to mitigate climate risks. AWD practices, water efficiency, and nutrient management are being used to mitigate the impacts of climate change and extreme weather on rice production.
2. Strengthening SRP social compliance to maintain legitimacy amidst farmer resistance. High levels of food safety and labor protection compliance are the foundation for building trust that SRP is not an additional burden but rather improves the quality of farming.
3. Using priority regions as a buffer against policy fragmentation. The success of the SRP in pilot regions is used as empirical evidence to align central and regional policies and reduce the risk of sectoral ego.

4. WT Strategy (Weakness–Threat)

Minimize internal weaknesses and avoid external threats

1. Avoid premature spatial expansion before institutional readiness. To prevent the SRP from becoming a failed project, a phased scheme, such as a mainstreaming pilot, is needed, based on regional and institutional readiness.
2. Simplify SRP standards for the initial phase of adoption. To avoid triggering farmer resistance, the SRP can be divided into *entry-level, intermediate, and advanced levels* so that the compliance burden increases in line with the incentives received.
3. Synergizing the SRP with existing programs (subsidies, counseling, and People's Business Credit). This is done to reduce the risk of overlapping policies by making the SRP an *integrative platform*, not a separate program.

The implications of the SO–WO–ST–WT Strategy Matrix indicate that accelerating the development of the Sustainable Rice Platform (SRP) towards 1 million hectares must be positioned as a systemic transformation, not simply a technical expansion of cultivation. However, the main implication of the SO–WO–ST–WT matrix is that the success of the SRP towards 1 million hectares is largely determined by the country's capacity to orchestrate institutions, economic incentives, and markets. The SRP will only develop rapidly if an aggressive strategy (SO–WO) is implemented in conjunction with a risk management strategy (ST–WT). With this approach, the SRP can be consolidated as a national platform for low-carbon rice farming that is sustainable, inclusive, and economically viable for farmers.

Table 5.3. SO–WO–ST–WT Strategy Matrix for SRP Development in Indonesia Towards 1 Million Hectares of Land

SWOT Strategy Analysis	**Opportunities (O)** • Agricultural agenda low carbon • Sustainable global and domestic rice markets • Green financing • ESG and Donor Support	**Threats (T)** • Price volatility • Climate risks • Policy fragmentation • Farmer resistance
Strengths (S) • Agroecology & irrigation basis strong • Practice input efficiency starts walk • Compliance social tall • Featured areas ready (Boyolali) • SRP standards are globally recognized	**SO Strategy** 1. Establishing Boyolali as an *SRP lighthouse* nationally for certification and premium market. 2. Integrating SRP into the FOLU Net Sink agenda and national low-carbon agriculture program. 3. Developing SRP as an ESG standard for the food sector to attract green offtakers and investors.	**ST Strategy** 1. Using irrigation advantages and input efficiency to mitigate climate risks (AWD, nutrient management) 2. Leveraging SRP social compliance to build legitimacy and reduce farmer resistance. 3. Making the success of pilot areas a tool for harmonizing central-regional policies.
Weaknesses (W) • Institutional: Not yet integrated • Incentive economy farmer limited • MRV capacity & digitalization low • The gap readiness interregional	**WO Strategy** 1. Forming **a national SRP task force across ministries and institutions as the** driving force for the main scale-up. 2. Linking SRP with **green financing** (Green KUR, blended finance, carbon payment). 3. Leveraging technological advances to accelerate MRV systems and SRP digitalization.	**WT Strategy** 1. Apply SRP expansion in gradually based regional readiness (pilot–scale up–mainstreaming). 2. Simplifying SRP standards in the adoption stage so as not to burden farmers. 3. Synergize SRP with existing programs (subsidies, counseling, KUR) to avoid overlapping policies.

5.3. Pillars of the SRP Development Strategy Towards 1 Million Hectares of Land

Based on the findings of the SO–WO–ST–WT Strategy Matrix, before developing an operational roadmap, the acceleration of the development and implementation of the Sustainable Rice Platform (SRP) in Indonesia needs to be placed on strategic pillars that serve as a framework for medium- to long-term policy direction. These pillars summarize the synthesis of strengths and opportunities that must be maximized, as well as weaknesses and threats that need to be systematically managed. The following are the National SRP Strategic Pillars derived directly from the results of the SO–WO–ST–WT analysis.

These pillars serve as a transition bridge from strategic analysis to a national SRP implementation roadmap. The subsequent roadmap no longer asks *whether SRP is feasible* but rather *how, where, and with what instruments SRP can be* credibly accelerated to 1 million hectares. If desired, I can immediately downgrade these pillars into a long-term timeframe roadmap (2025–2035), complete with actors, policy instruments, and area targets for each phase. These strategic pillars are derived from the findings in the previous strategy matrix. These are more clearly presented in Matrix 5.4.

Pillar 1: Strengthening National Institutions and Governance of SRP

This pillar is a direct implication of the WO and WT strategies, as well as the main foundation for all SRP acceleration. SRP development must be supported by the establishment of a National SRP Task Force across ministries/agencies, which functions as an orchestrator of policies, standards, and financing. Integrating the SRP into the national planning system, climate policy (FOLU Net Sink), and agricultural governance is key to ensuring the SRP does not become a separate project. This pillar emphasizes that institutions are an absolute requirement for systemic transformation, not merely a technical facilitator.

Pillar 2: Regional and Gradual Differentiation-Based Readiness

This pillar emerged from the combination of the ST and WT strategies, emphasizing the need for selective and adaptive SRP expansion. SRP development should utilize a regional readiness cluster approach: high-readiness areas (lighthouses) are accelerated toward certification and premium markets, transitional areas are focused on capacity building, and low-readiness areas are targeted toward productivity and institutional foundations. This pillar ensures that the 1 million hectare target is achieved through realistic, low-risk, gradual escalation.

Pillar 3: Economic Incentives and Green Finance Integration

This pillar is a key response to the SO and WO strategies, which emphasize converting external opportunities into tangible economic benefits for farmers. SRP must be integrated with financing. green national, such as green KUR, blended finance, carbon payments, and incentives based on performance-based incentives. Without clear economicincentive , adoption of SRP will stagnate. This pillar ensures that SRP becomes a strategy for improving farmers's welfare, not just sustainability standard obligations.

Pillar 4: Strengthening the Supply Chain and Market Certainty for SRP Rice

This pillar stems from the SO and ST strategies, focusing on leveraging sustainable rice markets to reduce production and price risks. Strengthening partnerships with offtakers, millers, state-owned food enterprises, and exporters is a prerequisite for farmers to obtain certainty about uptake and pricing. This pillar positions SRP as part of the national and global rice value chain, not just cultivation practices at the farm level.

Pillar 5: MRV System, Digitalization, and Emissions Accountability

This pillar is derived from the WO and ST strategies, which emphasize the need for SRP credibility in the context of climate and ESG. The development of a standardized, digital-based Monitoring, Reporting, and Verification (MRV) system connected to national systems is key to proving environmental performance, carbon claims, and supply chain transparency. This pillar ensures that SRP is recognized by the market, investors, and green financing schemes sustainably.

Pillar 6: Strengthening Human Resources Capacity, Counseling, and Social Inclusion

This pillar reflects a cross-WO–WT strategy, with an emphasis on mitigating farmer resistance and capacity gaps. SRP development must be accompanied by significant investment in extension services, GAP-SRP training, gender mainstreaming, and labor protection. This pillar ensures that SRP develops as an inclusive, equitable, and socially acceptable system.

Table 5.4. Strategic Pillar Matrix for Accelerating the Development and Implementation of SRP in Indonesia Towards 1 Million Hectares of Land

No	Strategic Pillars	Roots of Strategy (SO–WO–ST–WT)	Main Focus	Implications, Policies & Programs
1	Strengthening National SRP Institutions & Governance	WO – WT	SRP integration into the national	• Formation of the National SRP Task Force across Ministries/Institutions • Integration of SRP into RPJMN, FOLU Net Sink, and food & climate policy • SRP is no longer project-based but is part of GMA in Indonesia
2	Approach Gradual & Regional Differentiation Based Readiness	ST – WT	Expansion selective and adaptive	• Determination of regional cluster (lighthouse–transition–foundation) • • There is no uniform target • Mitigation risk failure adoption
3	Economic Incentives & Green Finance Integration	SO – WO	Increasing the attractiveness of SRP for farmers	• Integration of SRP with Green KUR, blended finance, carbon payment, and result-based financing • SRP increases farmer
4	Strengthening Chain Supply & Market Assurance SRP	SO – ST	Offtake & price certainty	• Contract Offtaker—farmers; the role of state-owned food companies and the private sector • Positioning SRP as premium/export rice • Initiate SRP certificate
5	MRV System, Digitalization & Performance Accountability	WO – ST	SRP's credibility towards the market & climate	• National MRV development digital-based • Standardized emissions, productivity, and social reporting • ESG Readiness
6	Strengthening, Counseling & Social Inclusivity	WO – WT	Acceptability and social	• Mass GAP–SRP training • Strengthening of extension workers • Gender mainstreaming & labor protection

5.4. *Roadmap* for Accelerating and Developing SRP in Indonesia Towards 1 Million Hectares of Land

The roadmap covers two main timeframes: the medium and long term, which are strategically interconnected. In the medium term (approximately five years), the primary focus is on building the foundations of the SRP system, consolidating institutions, and ensuring integration with green finance and domestic markets. Meanwhile, the long-term roadmap (10–20 years) aims to mainstream the SRP nationally, establishing it as a standard for sustainable rice production linked to climate policy, global markets, and long-term food security. Thus, this roadmap ensures the SRP evolves from an initial phase focused on readiness and consolidation to a sustainable and integrated national agricultural system.

The long-term roadmap represents ***the full mainstreaming*** *phase*, where the SRP serves as the gold standard for sustainable rice production in Indonesia. During this period, the SRP no longer requires special status as a program or project but instead serves as **the primary reference** for food policy, fiscal incentives, agricultural financing, and regional planning. The scale of implementation is increasing significantly, including outside Java, leveraging lessons learned from the medium-term phase to expand the SRP to large areas in an efficient and climate-resilient manner.

In the long term, the policy focus is shifting from accelerating adoption to maintaining quality, innovation, and system resilience. The national MRV system has matured and is connected to carbon markets, ESG, and international trade. Farmers' institutions have evolved from program recipients to key actors in the value chain, capable of negotiating prices, managing climate risks, and adopting new technologies. At this point, the 1 million hectare target is not simply a figure but an indicator of the success of Indonesia's rice farming transformation toward a low-carbon, inclusive, and sustainable system. This is presented in Table 5.5.

The medium-term roadmap serves as a critical transition phase that determines whether the SRP will cease to be a pilot project or transform into a national system. The main focus during this period is institutional strengthening, consolidation of the implementation model, and integration of the SRP into the financing system and markets. In the initial medium-term phase, the SRP is prioritized in high-readiness areas (*lighthouses*) to validate the institutional model, MRV system, and market linkages in real-world settings. Furthermore, in the scale-up phase, the SRP is expanded to transitional areas through model replication, accompanied by the implementation of economic incentives to ensure adoption does not increase the burden on farmers. At the end of the medium-term period, the SRP begins to be integrated into national agricultural and climate policies while still maintaining a phased approach based on regional readiness.

Strategically, the success of the medium-term roadmap is measured not only by area expansion but also by the functioning of the core components of the SRP system: an effective national task force, operational green financing, a credible MRV system, and market contracts that guarantee economic incentives. If these elements are not consolidated by the end of the medium-term period, national expansion will face significant risks. Therefore, the medium-term period represents the institutional lock-in phase, where the SRP is permanently integrated into national agricultural governance. The medium-term roadmap is presented in Table 5.6.

A medium-term roadmap is the absolute foundation for a long-term roadmap. Without institutional financing and market consolidation in the medium term, long-term mainstreaming will be fragile and risk failure. Conversely, a long-term roadmap acts as a *north star*, providing strategic direction from the outset, ensuring that every medium-term step moves toward a single ultimate goal: the SRP as a national system, not a temporary project.

In addition, a spatial-based roadmap is presented, covering Java and Outside Java. The Java and Outside Java-based SRP roadmap is derived from the 3-Phase Roadmap (*Pilot–Scale-up–Mainstreaming*) with agroecological, institutional, and logistical differentiation approaches. This format is ready to be placed as a sub-chapter of the spatial roadmap. This spatial roadmap emphasizes that the 1 million hectare target is only realistic if Java and Outside Java play different but complementary roles: Java as a rapid lever with high readiness and Outside Java as a sustainable large-scale growth space. This approach reduces the risk of expansion failure and ensures that SRP develops as a national system, not a regional project.

Roadmap Long-Term Development: Indonesia's *Sustainable Rice Platform (SRP)* aims to reach 1 million hectares by 2025-2045.

The long-term roadmap for the development of *the Sustainable Rice Platform (SRP)* towards 1 million hectares from 2025–2045 demonstrates a phased approach that is relatively consistent with the principles of institutional economics, sustainability transitions, and policy learning. By design, this roadmap does not position the SRP as a mere technical project but rather as a sustainable rice agricultural governance system internalized into public policy, market mechanisms, and national and global financing architectures. The division into four stages—national consolidation, policy and market mainstreaming, global and carbon integration, and food system resilience and innovation—reflects the understanding that agricultural transformation requires a long time, institutional consistency, and increasingly mature incentive escalation.

phase *(2025–2030)* serves as a crucial institutional foundation. The establishment of the SRP as the national reference standard for sustainable rice farming through formal regulations (Presidential/Ministerial Regulations) confirms the shift from a project approach to structural policy. Harmonizing the SRP with food, climate, and financing policies closes the policy fragmentation that has been a major obstacle to the adoption of sustainable practices. From an institutional economic perspective, the establishment of a permanent task force and integration into the RPJMN/RKP are crucial to reduce coordination costs and create policy certainty, thus providing farmers and business actors with more stable medium-term expectations.

phase *(2031–2033)* marked a shift from a supply-driven to a demand-anchored system, where the SRP began to be explicitly linked to fiscal incentives, access to financing, and market mechanisms. Establishing the SRP as a prerequisite for green KUR and green fiscal incentives are effective economic instruments for internalizing environmental externalities without a coercive approach. Expansion outside Java on a large scale is also crucial to avoid the spatial bias of agricultural development, which has historically been too Java-centric. Furthermore, long-term market contracts with offtakers strengthen the downstream side, reduce price risk, and increase the economic viability of the SRP for smallholder farmers.

Phase *2033–2040* is a critical phase for integrating the SRP into the global carbon- and ESG-based economic regime. The SRP's connectivity with carbon markets through internationally interoperable national MRV standards demonstrates that this roadmap positions environmental value as an additional source of income, not simply an obligation. Economically, this opens up opportunities for income diversification for farmers and supply chain actors through carbon credits, results-based finance, and global market preferences. Global certification and international cooperation also enhance the reputation of Indonesian rice, positioning it as a superior product with high added value in export markets.

However, the success of this global integration depends heavily on the credibility of the MRV system, data governance, and the country's ability to maintain environmental integrity. Without a robust and independent MRV design, the economic value of carbon risks being reduced to symbolic claims. Furthermore, care must be taken to ensure that the expansion of carbon-based SRP does not create exclusion for smallholder farmers due to high certification and compliance costs. Therefore, the role of the state as a facilitator, not merely a regulator, becomes increasingly strategic in this phase.

phase *(2040–2045)* moves the SRP toward long-term food system resilience through innovation and climate adaptation. The integration of artificial intelligence, precision agriculture, and next-generation digital MRV reflects the roadmap's adaptive orientation to extreme climate risks and global food market volatility. From a development economics perspective, this phase emphasizes that sustainability does not stop at scale but rather at the system's ability to survive, innovate, and maintain farmer productivity and incomes over the long term. Placing farmers as key institutional actors is a crucial correction to top-down models that often undermine social sustainability.

Thus, the SRP's long-term roadmap is consistently and robustly conceptualized stage-by-stage, with a logical progression from institutions, markets, and global finance to systemic innovation. The main challenges lie in disciplined implementation across governments, political continuity, and the ability to maintain a balance between area targets and the quality of standard implementation. If implemented consistently, the SRP has the potential to become a strategic instrument not only for achieving 1 million hectares but also for transforming Indonesia's rice economy toward a more productive, inclusive, low-emission, and resilient system in the long term. More details can be seen in Table 5.5.

Medium-Term *Roadmap for the Development of the Sustainable Rice Platform (SRP)* in Indonesia Towards 1 Million Ha from 2025 to 2030

The medium-term roadmap for the development of the Sustainable Rice Platform (SRP) for the 2025–2030 period plays a strategic role as a bridge between the initial preparation phase and the national mainstreaming phase. This is presented in Table 5.6. The stages of this roadmap are designed not simply to rapidly expand the area but to ensure that the SRP expansion takes place on a solid foundation of institutions, technical standards, and economic incentives. From a development economics perspective, this approach is appropriate because the transition to sustainable agriculture requires critical mass adoption while strengthening the supply side (farmer capacity and production systems) and demand (market access and financing).

Phase *(2025–2027)* focuses on model and institutional consolidation as an absolute prerequisite for scaling up. Building a "system foundation" through strengthening a cross-ministerial/institutional task force, establishing tiered national SRP standards, and initiating national certification and MRV reflects an institutional deepening approach. Tiered standards (entry–intermediate–advanced) are crucial for lowering entry barriers for smallholder farmers, ensuring non-exclusive adoption. Economically, this reduces the risk of adverse selection and increases the probability of successful early adoption.

The designation of lighthouse areas, such as Boyolali and other pilot areas, also has strong policy logic. Lighthouses function as a proof of concept that can reduce uncertainty for government regions, financial institutions, and market players. In theory, diffusion innovation and pilot areas accelerate the learning-by-doing process and facilitate replication policy based onevidence , not assumption. With a target area of 100–150 thousand hectares, stages first emphasize quality systems rather than quantity solely.

Stage *two (2028–2029)* marks the coordinated scale-up phase with emphasis on incentive economics and integration financing. Replication of SRP to transitional areas, both in and outside Java, shows a shift from the experimental model to targeted expansion. The integration of SRP with Green KUR, blended finance, and carbon payments is a key economic instrument for internalizing environmental benefits into farmers' cash flows. In theory, this is a relatively efficient mechanism for internalizing positive externalities compared to conventional subsidies.

Expanding contracts with offtakers and involving state-owned food enterprises strengthens the downstream sector and reduces market risks, which have been a major disincentive to adopting sustainable practices. With market and price certainty, the SRP is no longer perceived as a compliance burden but rather as a medium-term revenue-boosting strategy. At this stage, the SRP is beginning to function as an integrated production-market system, as reflected in key outputs and a significant increase in adoption to 400,000–600,000 hectares.

However, this scale-up phase also carries implementation risks that must be anticipated. Increasing MRV and outreach capacity is crucial to ensure that expansion does not compromise the quality of standard implementation. Without serious investment in mentoring and data systems, there is a risk of moral hazard and greenwashing at the field level. Therefore, support from thematic state and regional budgets and official market partnerships must be accompanied by credible oversight governance.

phase *(2030)* focuses on initial national consolidation in preparation for full mainstreaming. Integrating the SRP into national food and climate policies is a strategic step to ensure sustainability beyond the project phase. The full operation of the national MRV system and the standardization of quality and regional compliance demonstrate that the SRP has transformed from a specific program into an integral part of the public policy architecture.

The institutional consolidation of SRP farmers at this stage also has significant distributional implications. By strengthening farmers' positions in the value chain, SRP has the potential to reduce inequalities in access to premium markets and green financing. This aligns with an inclusive development approach, where green transformation pursues not only environmental efficiency but also economic and social equity at the producer level.

Therefore, the SRP medium-term roadmap for the 2025–2030 period demonstrates a long-term, comprehensive, and realistic design for bridging the transition to 1 million hectares. Its main strengths lie in clear stages, integrated financing, and institutional strengthening. The main challenge is ensuring inclusiveness, cross-sectoral consistency, and implementation capacity at the regional level. If this intermediate stage is successfully implemented with policy discipline and adequate fiscal support, the SRP has a significant opportunity to transform from a policy initiative into the foundation of a national sustainable rice food system.

Medium-Term *Roadmap for the Development of the Sustainable Rice Platform (SRP)* in Indonesia Towards 1 Million Ha in the 2025-2030 Period in Java and Outside Java

The SRP medium-term roadmap (2025–2030), which differentiates between Java and outside Java, demonstrates a more spatially and economically realistic development approach. This distinction is important because the agrarian structure, intensification levels, institutional readiness, and agroecological challenges in Java and outside Java differ significantly. Therefore, this roadmap is not a one-size-fits-all recipe; rather, it is designed to adapt to local contexts while remaining tied to a national framework toward the cumulative target of 1 million hectares.

For the Java region, *the Pilot and Consolidation phase (2025–2027)* focused on strengthening the standards, models, and credibility of the SRP system. The emphasis on SRP audits, digital MRV, offtaker contracts (Bulog, retail, HoReCa), and carbon inset pilots reflected Java's character as a region with high production intensity and relatively established market linkages. Economically, this approach was appropriate because the added value of SRP in Java no longer lay in land expansion but in product differentiation, input efficiency, and market integration. SRP in Java was thus positioned as a national benchmark in terms of system quality and data integrity.

The targeted scale-up phase in Java (2028–2029) emphasizes rapid replication in ready-to-use clusters in regions such as Central Java, East Java, and West Java. This cluster approach is economically relevant because it leverages economies of scale, relatively well-established irrigation networks, and the institutional readiness of farmers. The integration of mass GAP, AWD (water, nutrients), blended finance, and support from green KUR and green bonds creates a more mature financing ecosystem. At this stage, the SRP in Java truly functions as a production-market system, not just an environmental project.

Entering *the mainstreaming phase (2030),* the Java region is directed towards integrating the SRP into the national system through permanent policies, price differentiation, and a dashboard-based national MRV. This reflects Java's role in the national roadmap as the backbone of the SRP system's legitimacy—demonstrating that sustainability standards can go hand in hand with production stability and market competitiveness. The main risk in this phase is adoption saturation if price and financing incentives are not sufficiently attractive compared to conventional practices.

In contrast, the roadmap for regions outside Java demonstrates a more gradual development orientation based on local adaptation. In *the pilot and consolidation phase (2025–2027),* the SRP focuses on adapting the NIG based on local agroecology, piloting rainfed irrigation systems, and strengthening capacity through field schools. This approach makes more economic sense because the main challenges outside Java are not market standards but rather production risks, limited infrastructure, and unstable institutions. The role of local governments, technical centers, and deconcentrated funds is crucial in this initial phase.

The scale-up phase outside Java (2028–2029) is aimed at expanding into potential regions such as South Sumatra, South Sulawesi, West Nusa Tenggara, Lampung, and South Kalimantan, with a focus on strengthening production capacity and post-harvest infrastructure. The involvement of agricultural PPPs and regionally owned food enterprises (BUMD) demonstrates that this roadmap recognizes the high initial investment needs outside Java. From a regional economic perspective, the SRP outside Java serves as an instrument for accelerating productivity and stabilizing national supply, not simply for premium market differentiation as in Java.

In *the 2030 mainstreaming phase,* the SRP outside Java will be integrated with the national food and climate agenda through food estates, result-based payments, and access to carbon markets. This emphasizes the dual economic value of SRP outside Java: supporting national food security and as a source of environmental revenue (carbon revenue). A critical challenge at this stage is ensuring that the integration of SRP with food estates does not fall into a top-down approach that ignores local social and ecological preparedness.

In aggregate, the 2030 target of 600,000 hectares in Java and 400,000 hectares outside Java reflects a rational compromise between efficiency and equity. Java serves as the initial driver for market-based and standards-based adoption, while outside Java provides a medium-term expansion platform based on production and food security. If implemented consistently, this differential approach increases the probability of SRP success nationally while reducing the risk of failure due to imposing a uniform model on highly diverse regional contexts.

Thus, the synthesis of the medium-term roadmap between Java and outside Java confirms that the development of the Sustainable Rice Platform (SRP) (see Table 5.8) cannot be carried out with a uniform national approach. Java is positioned as an accelerator and *learning hub*, while outside Java serves as a national-scale expansion space. This division of roles reflects the logic of spatial economics: Java has denser infrastructure, market access, and more mature institutional capacity, making it effective as a policy laboratory, while outside Java provides space for production expansion and medium-term capacity-building opportunities.

The differences between the entry points for the intermediate-advanced SRP in Java and *the intermediate entry points* outside Java demonstrate a transition strategy that adapts to the heterogeneity of farmers and regions. In Java, the SRP is aimed at deepening sustainability standards through strengthening MRV, institutions, and market mechanisms, thereby increasing efficiency and added value without significant land expansion. Conversely, outside Java, the SRP functions as an instrument for increasing productivity and basic capabilities, with an initial focus on strengthening farmers' technical and managerial capacity before moving on to more complex sustainability standards.

The different initial focuses also reflect the primary risk profiles of each region. Java faces the risk of land saturation, so the primary challenge is maintaining the economic incentives for SRP attractive compared to conventional practices. Meanwhile, areas outside Java are more vulnerable to limited infrastructure and human resources, which can slow SRP adoption if not balanced with adequate technical support and public investment. Thus, the effectiveness of SRP is largely determined by the match between intervention design and regional risk characteristics.

Thus, the final target area of 500,000–600,000 hectares in Java and 400,000–500,000 hectares outside Java reflects a rational balance between efficiency and equity, with a national land area of 1 million hectares. Therefore, Java is being utilized to accelerate learning, system legitimacy, and market integration, while outside Java serves as a source of area growth and a support for medium-term food security. If this roadmap synthesis is implemented consistently, the SRP has a great opportunity to develop as a productive, inclusive, and sustainable national system, rather than simply a sectoral technical initiative.

Table 5.8. Synthesis of the Medium-Term *Roadmap* for Java and Outside Java

Aspect	Java	Outside Java
Strategic Role	Accelerator & learning hub	Expansion scale national
SRP Entry Point	Intermediate–Advanced SRP	Entry–Intermediate SRP
Initial Focus	Institutional, MRV, market	Productivity & capacity
Main Risks	Saturation land	Infrastructure & Human Resources
Final Lusa's Target	500–600 thousand hectares	400–500 thousand hectares

Table 5.5. *Roadmap* Matrix Long-Term Development: *The Sustainable Rice Platform (SRP)* in Indonesia is moving towards 1 million hectares.Period 2025-2045

Stage: Long-term	Strategic Focus	Main Agenda	Instrument Policies & Institutions	Key Output	Target Area
Stage 1: National Consolidation (2025-2030)	Strengthening the national SRP system	• SRP is established as a reference standard for sustainable rice farming. • Harmonization of SRP with food, climate, and financial policies • Consolidation of SRP farmer institutions	• National regulation (presidential decree/ministerial decree) • Permanent SRP Task Force • Integration in RPJMN/RKP	The institutional structure of SRP is well established and operational	± 650–900 thousand ha
Stage 2: Mainstreaming Policy & Markets (2031-2033)	SRP as the mainstream of rice production	• SRP is a prerequisite for accessing fiscal incentives & financing • Expansion of SRP outside Java on a large scale • Long-term market contracts with offtakers	• Green fiscal scheme • SRP-based Green KUR • State-owned food company & exporter	SRP is embedded in the production & distribution system	± 900 thousand–1 million ha
Stage 3: Global Integration & Carbon (2033-2040)	Internationalization & financing climate	• SRP connects to global carbon and ESG markets • Internationally interoperable national MRV standards • SRP rice as a superior export product	• National carbon scheme • International cooperation • Global certification	Credible SRP globally & financially	> 1 million ha
Stage 4: Food System Resilience & Innovation (2040-2045)	Resilience food term long	• Technology integration intelligent climate (AI, precision agri) • Adaptation to extreme climate • Farmer institutions as the main actors	• Agricultural innovation fund • Next-generation digital MRV	Powerful SRP system, springy tall	Stable & sustainable

Table 5.6. *Roadmap* Matrix Term Intermediate Development Indonesia's *Sustainable Rice Platform (SRP)* aims to reach 1 million hectares by 2025-2030.

Stage Term Intermediate	Strategic Focus	Main Agenda	Instrument Policies & Institutions	Key Output	Target Area
Stage 1: Model & Institutional Consolidation (2025-2027)	Build a foundation system or SRP model	• Strengthening the National SRP Task Force across Ministries/Institutions • Determination of standard national tiered SRP (*entry–intermediate–advanced*) • Initiation SRP certification • National MRV pilot & SRP data digitalization • Determination of *lighthouse* area (Boyolali et al.)	• SK/Permen across K/L • Integration of SRP into sectoral & regional planning • Donor support & Green KUR pilot	• National SRP model validated • System institutional operational	± 100,000–150,000 ha
Stage 2: Coordinated Scale-up & Financing Integration (2028-2029)	Expansion directed & incentive economy	• SRP replication to transitional areas (Java & selected areas outside Java) • Full integration of SRP with **Green KUR, blended finance, and carbon payment** • Expansion of offtaker contracts & the role of state-owned food companies • MRV capacity building & outreach	• Financing scheme green national • Official market partnership • Thematic APBN/APBD support	• SRP functions as a production–market system • Adoption increased significantly	± 400,000–600,000 ha
Stage 3: Initial National Consolidation (Year 2030)	Preparation *mainstreaming*	• SRP integrated into national food & climate policy • National MRV system walk standard • Standardization of quality and compliance of the area • Consolidation of institutional SRP farmers	• Regulation national beginning (cross-sector) • Incentive scheme based on performance	Readiness structural towards mainstreaming	± 650,000–900,000 ha

Table 5.7. Medium-Term *Roadmap* Matrix for the Development of *the Sustainable Rice Platform (SRP)* in Indonesia Towards 1 Million Ha for the 2025-2030 Period for Java and Outside Java

Java Region:

Phase	Period	Target Area Cumulative	Strategic Focus	Key Agenda	Institutions & Financing
Pilot & Consolidation	2025–2027	150,000 ha	Strengthening standard & model	• Finalization of the National & Provincial SRP Task Force • Digital SRP & MRV audit • Contract offtaker (Bulog, retail, HoReCa) • Pilot carbon inset	• Task Force SRP • APBN/APBD + Donor grants • CSR agribusiness
Directed Scale-up	2028–2029	450,000 ha	Replication fast ready area	• SRP cluster replication (Central Java, East Java, West Java) • Mass GAP & AWDi (water, nutrients) • Blended finance SRP	• SRP Cooperative • Green KUR • Danantara / green bonds
Mainstreaming	2030	600,000 ha	System integration national	• Integration of SRP into RPJMN/RKP • Standard price SRP differential • National MRV & dashboard	• Permanent national policy • Market financing

Outside Java Region:

Phase	Period	Target Area Cumulative	Strategic Focus	Key Agenda	Institutions & Financing
Pilot & Consolidation	2025–2027	100,000 ha	Adaptation of Local SRP	• Local agroecology-based NIG SRP adjustment • Rainfed & irrigation pilot simple • SRP field school	• Local Government & Technical Center • Deconcentration Fund
Directed Scale-up	2028–2029	270,000 ha	Capacity & production strengthening	• Expansion of clusters outside Java (South Sumatra, South Sulawesi, West Nusa Tenggara, Lampung, West Sumatra, South Kalimantan) • Plantation & post-harvest infrastructure • Regional offtake	• Agricultural PPP • Regionally owned food company
Mainstreaming	2030	400,000 ha	Food & climate integration	• Synchronization of SRP and Food Estate Program • Financing result-based payment • Carbon market integration	• Green climate finance • Carbon revenue

CHAPTER 6. ANALYSIS OF OPPORTUNITIES AND GLOBAL MARKET ACCESS AND INCREASING FARMERS' INCOME

Chapter 6. ANALYSIS OF OPPORTUNITIES AND GLOBAL MARKET ACCESS AND INCREASING FARMERS' INCOME

6.1. Changes in Global Market Structure and Their Relevance to SRP

Over the past five years, the global rice market structure has exhibited two major interrelated trends: growing demand for value-added rice and increasing pressure for sustainability standards in international food trade. According to FAO and ITC data, global rice trade volume has remained relatively stable at around 53–56 million tons per year during 2020–2024, but trade value has increased faster than volume. Global rice exports are expected to rise from around USD 25–26 billion in 2020 to over USD 33 billion in 2024, reflecting rising average prices and a shift in demand toward premium, specialty, and sustainably labeled rice. This indicates that the profitability of the global rice trade is increasingly determined by product differentiation, rather than simply production volume.

Correspondingly, the composition of global rice demand is undergoing structural change. Developed countries and upper-middle-income markets such as the European Union, Japan, South Korea, and Middle Eastern countries are showing increasing imports of rice with non-price attributes, including food safety, traceability, environmental sustainability, and a low carbon footprint. In the 2019–2024 period, EU rice imports remained relatively stagnant in volume, but import value increased by more than 30 percent, particularly in the specialty rice and certified parboiled rice segments. A similar trend is seen in the global HoReCa and modern retail markets, which are increasingly linking purchasing decisions to ESG principles and climate commitments, particularly following COP26 and the strengthening of food supply chain decarbonization policies.

From a global production perspective, major exporting countries such as India, Vietnam, Thailand, and Pakistan are beginning to adjust their export strategies. Vietnam, for example, has been significantly explicit in developing a “high-quality–low emission rice” strategy since 2021, while Thailand expands its rice market with hom mali and certified rice. Policy restrictions on exporting Indian rice since 2023 also provide a strong signal that the global market is increasingly sensitive to risk, sustainability, and food resilience. In the context of this, importing countries tend to look for suppliers who are not only stable in terms of supply but also credible from a standard environmental and social perspective in order to minimize reputational risk and disruption of the supply chain.

Change the market structure relevant in a way directly for Indonesia and the development of the Sustainable Rice Platform (SRP). In general, historically, Indonesia is more oriented towards self-sufficiency and relatively minimal penetration of export rice. However, in the past five years, the economic value of domestic premium rice and niche export opportunities has increased, particularly to regional and specialty markets. Without the adoption of internationally recognized sustainability standards, Indonesian rice risks falling behind its main Southeast Asian competitors, which are more aggressively positioning their products as sustainable and low-emission rice. The SRP is a strategic instrument to close this gap by providing the necessary standards framework, verification, and market credibility.

Table 6.1. Changes in Global Market Structure and Relevance to SRP

Variables	Indicator Key	Year Trend Final	Meaning Structural	Relevance against SRP
Global Trade	Trading volume worldwide rises.	Relatively stagnant 51–56 million tons/year	Growth, no volume-based	SRP opens differentiation mark
Global Trade	Trade value of world rice	Up USD 24.8 → >33 billion	Value upgrading	Opportunity to enter premium segment
International Price	Rice prices are conventional.	Significant increase post-2022	Sensitive disturbance supply	Buyer looking for stable
International Price	Premium rice prices	USD 700–1,200/ton	Price spreads widen.	Incentive SRP economy
Global Demand	EU consumers' ESG preferences	Increased >60%	Dominant non-price factor	SRP as a tool for market access
ESG & Climate	Scope 3 emission targets	>70% of global buyers	Pressure decarbonization food	SRP as a compliance tool
Competing Countries	Vietnam & Thailand Strategy	Low emission & premium rice	Class promotion competition	SRP prevents backwardness
Indonesia	Share export rice	<1% production national	Focus domestic	SRP niche exports without food disruption

Source: Various Source (2025)

From a technocratic perspective, this shift in global market structure demands a repositioning of Indonesia's rice policy from a volume-oriented to a value-oriented paradigm. The SRP is relevant because it addresses three key demands of today's global market: consistent quality, transparency of production processes, and demonstrated environmental performance. In the medium term, integrating the SRP into the national production system opens opportunities for Indonesia to enter the high-value-added rice market segment, both domestically and for export, while simultaneously protecting farmers from commodity-based price pressures. Thus, the SRP is not merely an environmental issue but a strategic instrument for Indonesia's adaptation to the structural transformation of the global rice market over the past five years.

This is reinforced by Table 6.1, which shows that changes in the global rice market structure over the past five years have been driven not by expansion in trade volume but by increases in product value and differentiation. The relatively stagnant global rice trade volume, at around 51–56 million tons per year, coupled with an increase in global trade value from approximately USD 24.8 billion to over USD 33 billion, underscores the occurrence of *a value upgrading process*. This indicates that growth opportunities for producing countries lie not in increased production alone, but in improving quality, standards, and non-price attributes. In this context, the SRP is relevant as an instrument to bring Indonesian rice into the value-added segment without having to compete directly in the low-cost commodity market.

In terms of international price and demand, the table shows a widening spread between conventional and premium rice, with premium rice prices hovering around USD 700–1,200 per ton. Concurrently, global consumer preferences, particularly in the European Union, are increasingly dominated by non-price factors, such as sustainability and carbon footprint, with more than 60 percent of consumers considering ESG aspects in purchasing decisions. Buyer pressure is also growing, as evidenced by the fact that more than 70 percent of global buyers have set Scope 3 emission reduction targets. This combination of factors explains why the SRP serves not only as a technical production standard but also as a *market access mechanism* and compliance tool to address increasingly stringent global market demands.

Furthermore, comparisons with competing countries demonstrate the escalation of high-end competition in the international rice market. Vietnam and Thailand are actively positioning their rice as premium, low-emission products, while Indonesia remains focused on the domestic market, with an export share of less than 1 percent of total national production. This situation also presents a strategic opportunity, as the development of the Rice Rice Pricing System (SRP) allows Indonesia to enter niche export markets without compromising domestic food security. Therefore, this table confirms that the SRP serves as a bridge for structural transformation, enabling Indonesian rice to shift from a low-priced commodity to a competitive, high-value-added product that aligns with changing global markets.

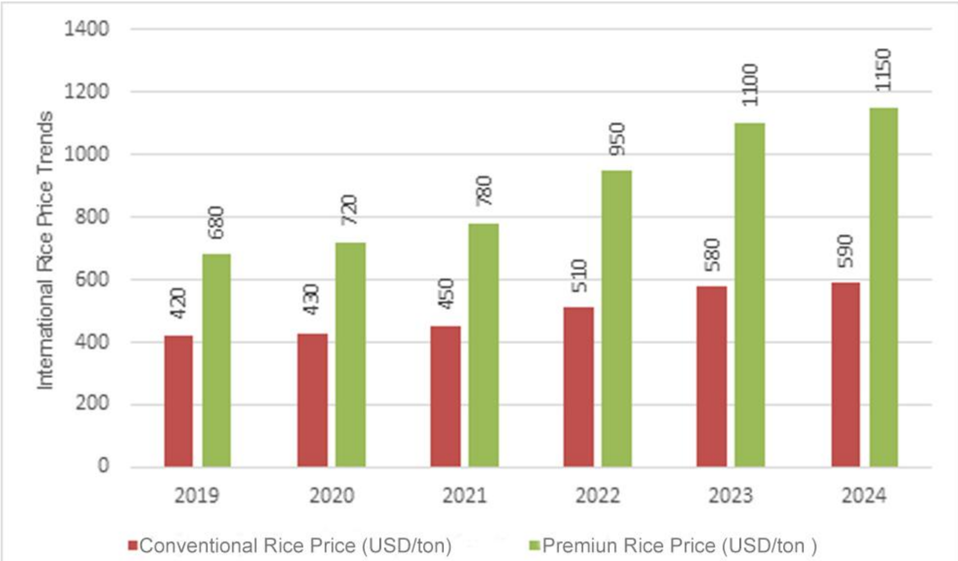
Figure 6.1 shows that during the 2019–2024 period, global rice trade growth was primarily driven by increases in value, while trade volume remained relatively unchanged. Global rice trade hovered around 51–56 million tons per year, with limited fluctuations. However, at the same time, global trade value increased sharply, from approximately USD 24.8 billion in 2019 to over USD 33 billion in 2024. This indicates that global rice market dynamics are no longer driven by increases in physical trade volume but rather by increases in selling value and price structure.

The divergence between volume and value trends reflects improvements in quality and added value in the global rice trade. The increase in trade value is driven not solely by inflationary pressures but also by the growing role of premium rice and rice with higher quality and sustainability standards. Since 2022, supply disruptions, export restrictions by several producing countries, and rising energy and logistics costs have increased price sensitivity in international markets. Under these conditions, global buyers tend to prioritize suppliers that can guarantee supply continuity, quality consistency, and compliance with environmental and social standards.

Source: UNTAD, WTO, Comtrade (2025)

Figure 6.1 Trends in Volume and Value of Rice Trade in the Global Market

For Indonesia, this pattern has important policy implications. With global trade volumes remaining relatively stagnant, opportunities to compete through improved quantity become more limited. On the other hand, the increase in mark trading opens room for strategy to enter the market segment based on certain qualities and differentiation. In this context, the implementation of the Sustainable Rice Platform (SRP) becomes relevant as an instrument to push Indonesian rice into a market worth more through attribute sustainability and traceability, without shifting the main focus of food resilience in thecountry .



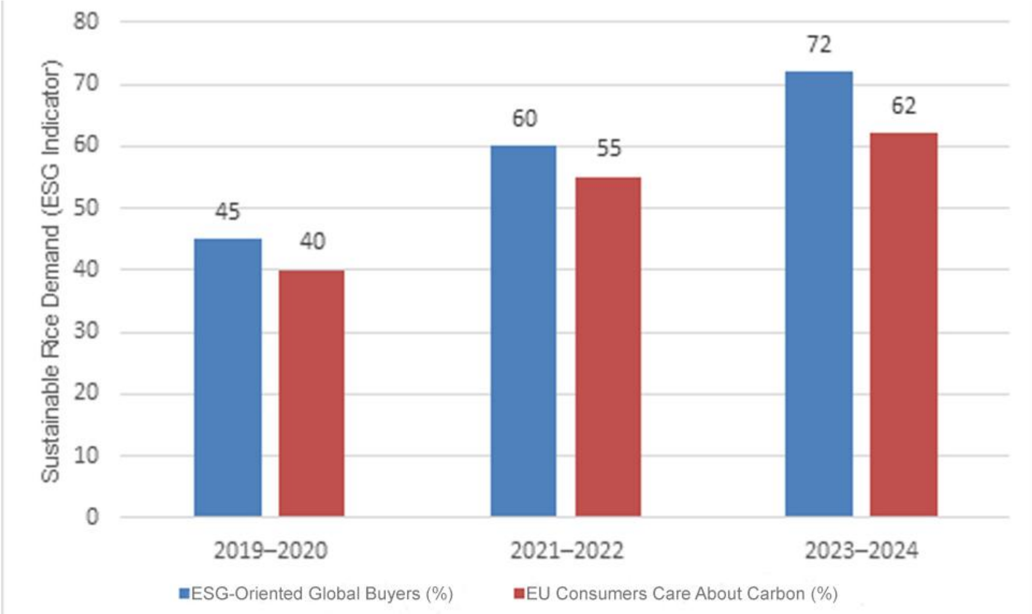
Source: CDP, SBTi, OECD (2025)

Figure 6.2 Trends in Rice Prices in the International Market

The data in Figure 6.2 shows a consistent upward trend in international rice prices from 2019 to 2024 for both conventional and premium rice, with a much stronger rate of increase in the premium segment. Conventional rice prices rose from around USD 420 per ton in 2019 to nearly USD 590 per ton in 2024. This increase reflects structural pressures on the global rice market, primarily due to post-pandemic supply disruptions, rising energy and fertilizer prices, and export restrictions imposed by several major producing countries. However, despite the price increase, conventional rice remains within a commodity market framework with relatively limited differentiation.

In contrast, premium rice prices have shown a much sharper and more consistent increase, from around USD 680 per ton in 2019 to around USD 1,150 per ton in 2024. The widening price gap between premium and conventional rice indicates a growing market segmentation, with the market placing a higher value on attributes like quality, food safety, and sustainability. This increase is not solely due to inflation but is also driven by changing consumer preferences and global buyers increasingly considering ESG aspects, carbon footprint, and supply chain traceability. In other words, the international rice market is increasingly valuing non-price attributes as a source of economic value.

These findings have significant implications for the development of the Sustainable Rice Platform (SRP). This trend indicates that strategies to increase rice competitiveness are no longer effective if they rely solely on cost efficiency and production volume. Instead, the greatest economic opportunity lies in producers entering the high-value-added rice segment, which can benefit from a price premium. The SRP is a crucial tool for bridging producers, including smallholder farmers, to access this market segment through credible and verified sustainable production standards. Thus, Figure 6.2 reinforces the argument that the SRP is not simply an environmental agenda but rather a relevant economic strategy for increasing added value and incomes within the rice value chain.



Source: UNTAD, WTO, Comtrade (2025)

Figure 6.3 Sustainable Rice Demand Trends (ESG Indicators)

Figure 6.3 shows a consistent and significant increase in demand for sustainable rice in the global market, both from buyers and end consumers. In the 2019–2020 period, approximately 45 percent of global buyers had incorporated ESG aspects into their procurement policies, while the share of European Union consumers concerned about carbon issues was around 40 percent. This figure increased sharply in the 2021–2022 period and surged again in 2023–2024, reaching approximately 72 percent for global buyers and 62 percent for EU consumers, respectively. This trend confirms that sustainability has transformed from a normative issue to a structural market preference.

Increasing ESG awareness among buyers has direct implications for the supply chain of food commodities, including rice. Global buyers, particularly multinational corporations and large retailers, are increasingly committed to Scope 3 emission reduction commitments, which cover emissions from production processes at the farm level. In this context, sustainability is no longer positioned as an optional attribute but rather as a prerequisite for market access. Rice that fails to meet sustainability standards risks being excluded from the global supply chain, regardless of price or volume offered.

On the final demand side, the increasing proportion of EU consumers concerned about their carbon footprint demonstrates the growing influence of non-price factors in consumption decisions. Consumers are beginning to place greater value on food products with credible and verified sustainability claims. This creates a clear market signal downstream and upstream in the supply chain that environmental and social standards will increasingly determine product competitiveness. This trend, therefore, opens up space for differential pricing schemes and premium products based on sustainability

In the aforementioned context, the Sustainable Rice Platform (SRP) is highly relevant as an instrument that bridges global market demands with production practices at the farmer level. The SRP provides technical standards, a recording system, and a verification mechanism that can address buyers' and consumers' needs for sustainable rice products. By adopting the SRP, Indonesian rice producers not only increase their opportunities for global market access but also gain a stronger position in the value-added market segment. Therefore, the trends in Figure 6.3 reinforce the argument that the SRP is a key strategy for ensuring the sustainable competitiveness of Indonesian rice amid shifting global preferences toward ESG principles.

Source: SRP Report (2023)

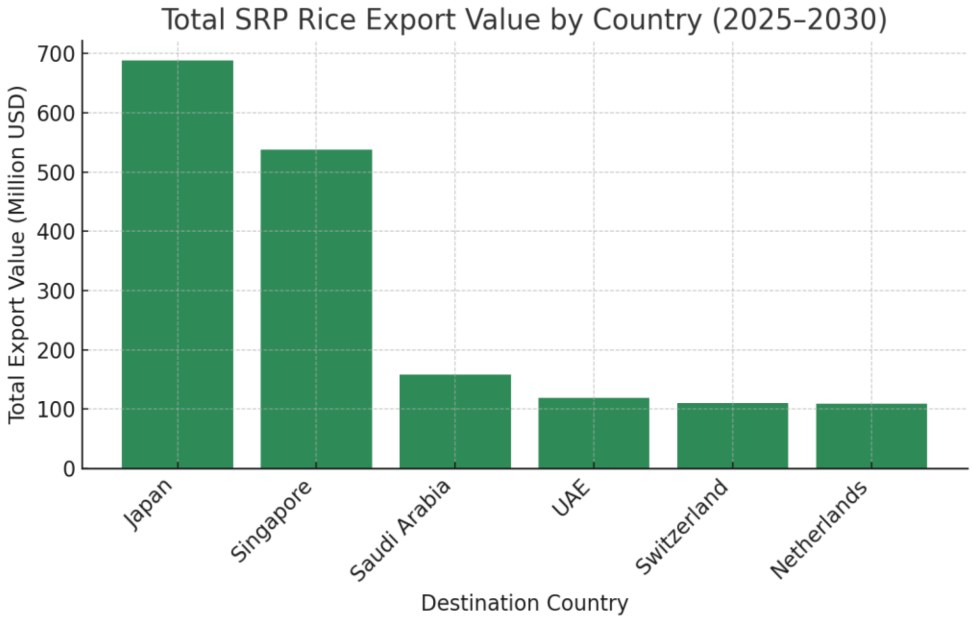
Figure 6.4 Global Market Potential for SRP Rice

Figure 6.4 above illustrates in a comprehensive way that the Sustainable Rice Platform (SRP) ecosystem has developed into a sufficient global network that is mature and institutionalized. SRP membership reached more than 110 members from 32 countries, and the existence project registered in almost 20 countries shows that SRP is not an initiative that is limited or experimental. Structurally, this reflects the increasing legitimacy of SRP as a standard international system in global food, at the same time signifying the existence of real market demand for rice produced with principle-verified sustainability.

From the side capacity production area, land rice that has been SRP verified, as well as the amount of manufacturers involved, shows that the supply of SRP rice globally is still relatively limited compared to total world rice production. However, these limitations precisely become indications of market opportunities, because the request for product rice sustainably grows faster compared to availability supply. In terms of economy, these conditions create a base for *price premiums* and open room for new producing countries, including Indonesia, to enter the SRP market without having to compete directly with big manufacturers in the mass rice segment.

The existence of retail networks in more of the 20 countries that have market SRP rice shows that the downstream supply chain is already relatively ready to absorb sustainable rice products. This is important because the success of SRP is not only determined by practice upstream production but also by the ability of the system to connect farmers with the end market. Supported by official training, power coach certification, and the formation of a *national chapter*, SRP has built infrastructure enabling support replication and expansion adoption standards in a systematic, cross-country way.

In the Indonesian context, the findings in Figure 6.4 have strong strategic implications. The empirical scale of SRP at the global level shows that the market for SRP rice is really available and continuously growing, but still leaving spacious room for improvement insupply . With structure, Indonesia's large rice production and small farmerbase , SRP implementation has the potential to become a track entry to the global market worth plus without bothering domestic food resilience. Thus, Figure 6.4 also confirms that SRP is not only relevant as a sustainability agenda but also as a real opportunity economy that can be utilized in a strategic way in the transformation agenda sector of national rice.



: Calculation based on a gravity model where a *gravity-style* approach fits the model result coefficients (β_gdp_partner ≈ 0.84; β_dist ≈ −0.82; small RTA effect). (2025)

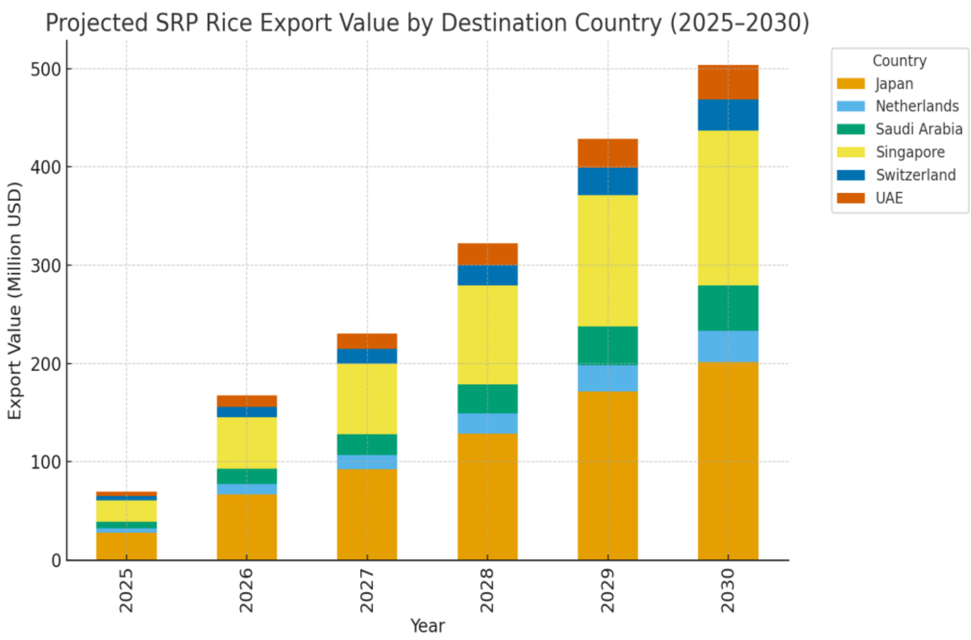
Figure 6.5 Potential Demand for SRP Rice by Country

Figure 6.5 shows that global market potential for rice based on the Sustainable Rice Platform (SRP) concentrated on countries with high purchasing power and a strong preference for quality as well as sustainability. Japan and Singapore emerged as key markets with the largest SRP export values in the 2025–2030 period, approaching USD 700 million and USD 500 million, respectively. This reflects the demand structure in both countries, which is relatively insensitive to price but highly responsive to aspects of quality, food safety, traceability, and environmental standards. In this context, SRP aligns with market needs that demand credible assurance of quality and sustainability.

The next group of destination countries, such as Saudi Arabia, the United Arab Emirates, Switzerland, and the Netherlands, demonstrates smaller market potential in nominal terms but remains significant within the framework of a *niche market strategy*. These countries generally rely heavily on food imports, have strong modern retail networks, and have consumers with a preference for premium products and sustainable labels. Structurally, these markets tend to be governed by medium- to long-term contracts with large offtakers, providing SRP rice suppliers with the opportunity to secure more certainty of uptake and more stable prices than in the spot market.

The distribution of market potential in Figure 6.5 also shows that developing SRP rice exports does not require a large volume orientation. A relatively high export value can be achieved through a limited market segment at a premium price, without having to divert a significant portion of national production to the export market. From a policy perspective, this is important because it allows a sustainable rice export strategy to align with domestic food security priorities. SRP, in this case, functions as a selective instrument targeting specific markets, rather than a mass export strategy.

Overall, Figure 6.5 reinforces the argument that SRP opens realistic and measurable economic opportunities for Indonesia in global value-added markets. The concentration of demand in high-income countries suggests that the competitive advantage of SRP rice lies in quality differentiation and standards compliance, rather than production scale. With a targeted approach through offtaker partnerships, quality standardization, and strengthening farmer institutions, SRP has the potential to become a strategic entry point for Indonesia to monetize the sustainability of its rice sector without putting pressure on the domestic supply balance.



Source: Comtrade (2025)

Figure 6.6 SRP Export Projections by Destination Country 2025-2030

The graph of the projected value of SRP rice exports for the 2025–2030 period in Figure 6.6 shows a consistent and increasingly accelerated growth trajectory, from around USD 70 million in 2025 to nearly USD 500 million in 2030. This pattern reflects the assumption of a gradual transition from *the market entry phase* to *market deepening*, where SRP adoption is increasingly established upstream, while destination markets are increasingly mature in absorbing sustainable rice products. The relatively linear increase at the beginning of the period, then a sharper climb after 2027, indicates a *scaling effect* as verified volumes increase and medium-term contracts with international offtakers become operational.

In terms of market structure, Japan and Singapore have consistently been the main contributors to SRP export value. This confirms that high-income markets in developed East and Southeast Asia are *anchor markets* for SRP rice, which has relatively low price sensitivity but high demands on quality, food safety, and traceability. Meanwhile, countries such as Saudi Arabia and the United Arab Emirates have shown steady, gradual growth, reflecting the nature of food import markets that are dependent on external supplies and are beginning to adopt sustainability standards as part of national food security and ESG policies.

The role of European countries like Switzerland and the Netherlands, although nominally smaller, holds high strategic significance. These countries serve as *gateway markets* to the broader European market, where sustainability standards and carbon footprint are prerequisites for entry. In this context, relatively limited export volumes can still generate high value due to premium prices and specification-based contracts. This reinforces the argument that the SRP strategy is not oriented toward mass exports but rather toward penetrating value-added market segments with more manageable risks.

Overall, this graph illustrates the potential of the SRP as an instrument for structural transformation of Indonesian rice exports. Projected strong value growth without extreme volume spikes demonstrates that sustainability can be economically monetized without compromising domestic food security priorities. By strengthening farmer institutions, ensuring consistent certification, and partnering with credible offtakers, the SRP can drive a paradigm shift from quantity-based to value-based exports while simultaneously improving income stability for farmers along the value chain.

6.2. SRP as an Instrument for Market Access and Price Differentiation

The Sustainable Rice Platform (SRP) serves as a market access instrument by providing credible, measurable, and internationally recognized rice production standards. In the context of global food trade, market access is increasingly determined by compliance with non-tariff measures, particularly those related to environmental sustainability, food safety, traceability, and social aspects. The SRP addresses this need with a clear indicator framework—covering input efficiency, environmentally friendly cultivation practices, water management (AWD), methane emission reduction, and farmer welfare aspects—that can be verified through an audit and MRV system. Thus, the SRP is not simply a technical production guide but serves as a market passport for Indonesian rice to enter certain export segments and the increasingly selective premium domestic market.

In export markets, the SRP is particularly relevant for countries and buyers with ESG commitments and Scope 3 emissions reduction targets. Over the past five years, multinational food companies, global retailers, and international HoReCa companies have increasingly required food suppliers to demonstrate their sustainability practices. Rice—as an agricultural commodity that produces relatively high methane emissions—has become a focus of attention. The SRP provides a relatively simpler and sector-specific *proof of compliance compared to generic environmental certification, making it more readily accepted by buyers seeking a practical and scalable solution.* Technocratically, this lowers *market entry costs* for Indonesian rice producers and exporters into the value-added market segment, especially for medium- to long-term contracts.

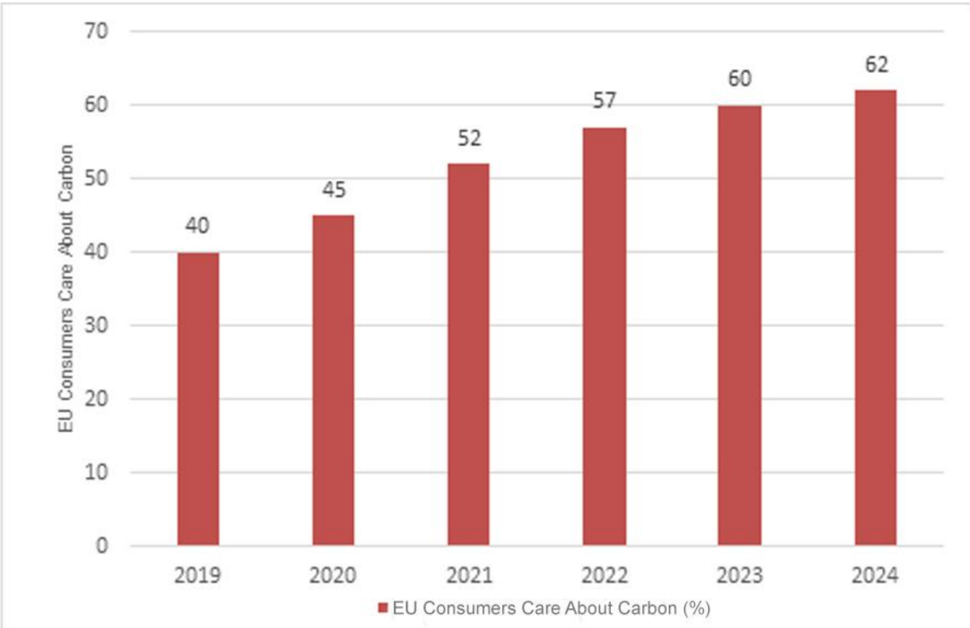
In the domestic market, the SRP's role as a differentiation standard is also increasingly relevant with the development of the middle-upper consumer segment, modern retail, and institutional markets (hotels, restaurants, catering). In this context, the SRP enables clear *product differentiation* between conventional and sustainable rice. This differentiation is not based solely on claims but is supported by measurable technical indicators that can be communicated to consumers. With urban consumers' increasing awareness of health, environmental issues, and product origin, the SRP has the potential to become a strong *quality signal, replacing low-price competition that tends to squeeze farmers' margins.*

The differential pricing mechanism is a logical consequence of the SRP's function as a credible standard. In the current rice market structure, conventional rice prices tend to be formed in a near-*commodity market*, where differentiation is low and farmer margins are limited. The SRP shifts this position by creating *vertical differentiation*, namely differences in product quality and attributes that can be valued more highly by the market. The resulting price premium is not speculative but rather based on market recognition of risk premium reduction, quality assurance, and verified sustainability value.

The SRP-based price premium varies by market and business model, but global studies indicate a range of 5–20 percent above conventional rice prices for certain segments. In specialty export markets and premium retail markets, this premium can be directly reflected in selling prices. In domestic markets, however, the premium can be internalized through offtaker contracts, institutional purchasing schemes, or brand differentiation. Economically, the premium must cover the additional costs of SRP compliance (audits, record-keeping, and practice changes) while simultaneously increasing farmers' net margins if the value chain is managed fairly.

In addition to direct price premiums, SRP also creates implicit premiums through cost and risk reductions. SRP practices such as fertilizer efficiency, improved water management, and integrated pest management contribute to lower input costs and yield volatility. From a farmer welfare economic perspective, reducing income variance is often as important as increasing average prices. Thus, SRP increases farmers' *expected income* not only through higher selling prices but also through greater farm business stability.

Furthermore, the SRP opens up opportunities for integration with sources of added value beyond the rice price itself, such as *carbon offsets*, green financing, and environmental performance-based incentives. In this scheme, price differentials are not always passed on entirely to end consumers but rather come in part from corporate buyers or climate finance that rewards reduced emissions and environmental impact. Technocratically, this expands policy space to increase farmer incomes without unduly burdening consumer purchasing power.



Source: WTO I-TIP, UNCTAD TRAINS (2025)

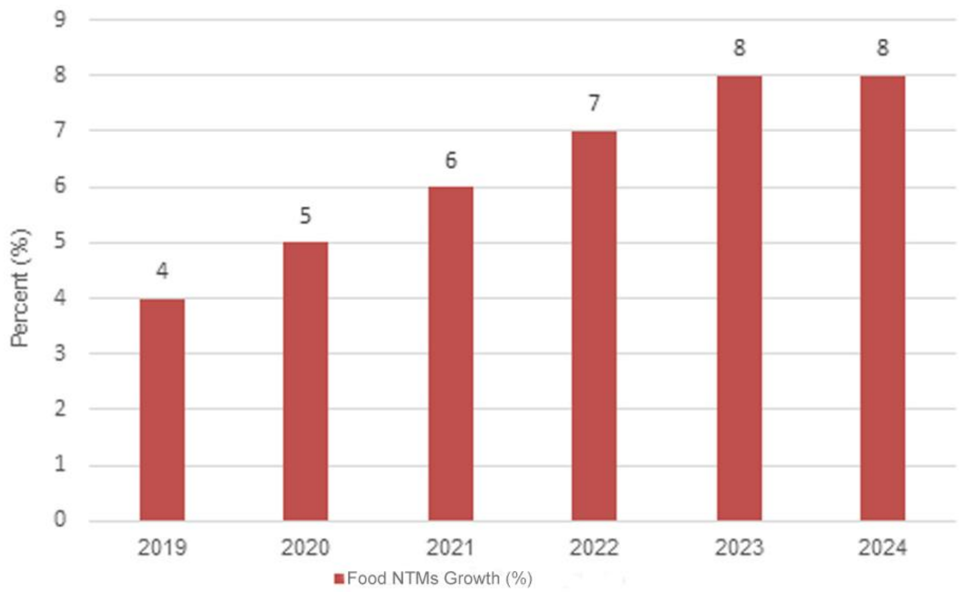
Figure 6.7 Trends EU Consumers Care About Carbon Products

Figure 6.7 above shows a consistent increase in the proportion of EU consumers concerned about low-carbon products throughout the 2019–2024 period. The percentage of consumers considering carbon aspects in consumption decisions increased from around 40 percent in 2019 to over 60 percent in 2024. This increase is gradual but steady, reflecting a structural shift in consumer preferences, not simply a temporary reaction to environmental concerns. For the food market, this trend marks a shift from price-based consumption patterns to value-based consumption patterns and sustainability attributes.

From an international market perspective, EU consumers' growing awareness of their carbon footprint has strengthened environmental standards as a determinant of market access. Consumers respond not only to price but also to information attached to products, such as sustainability labels, certifications, and supply chain transparency. In the context of increasingly stringent EU policies, including the European Green Deal and various carbon-related regulations, these consumer preferences serve as both a driver of demand and pressure for businesses to adapt their production practices. Thus, carbon has become a significant element of market competition.

The implications of this trend for rice are significant. Rice lacking credible sustainability claims risks being increasingly marginalized in the EU market, regardless of its physical quality or competitive pricing. Conversely, rice that demonstrates low-emission production practices and traceability has a greater opportunity to enter the premium market segment. This opens up space for differential pricing schemes and more stable medium-term contracts, particularly for products that meet consumer expectations regarding environmental impact.

Within this framework, the Sustainable Rice Platform (SRP) is a highly relevant instrument for Indonesia. The SRP provides technical standards and a verification system that enable sustainability claims, including those related to water management, input use, and recording of cultivation practices, to be translated into evidence acceptable to the EU market. With the growing proportion of carbon-conscious EU consumers, the implementation of the SRP not only increases market access opportunities but also strengthens the position of Indonesian rice in the high-value-added segment. Therefore, the trends in Figure 6.4 confirm that the SRP is a strategic response to changing global consumer preferences rather than simply an environmental initiative.



Source: UNTAD, WTO, Comtrade (2025)

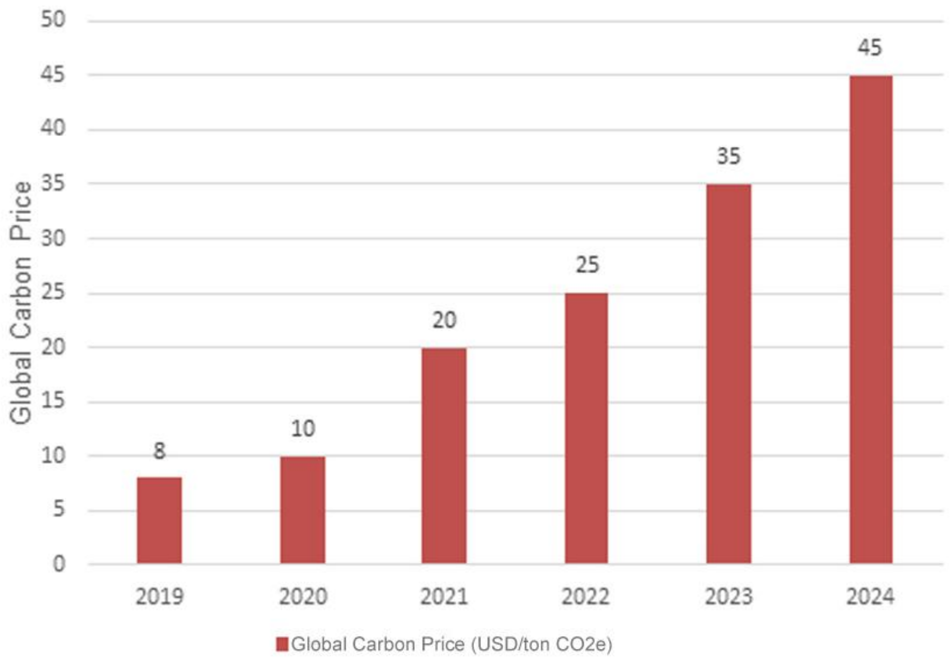
Figure 6.8 Growth of Non-Tariff-Based Barriers Sustainability Standards (SRP urgency)

Figure 6.8 shows that during the 2019–2024 period, there has been a consistent increase in food non-tariff barriers (NTMs) based on sustainability standards. The growth rate of NTMs increased from around 4 percent in 2019 to 8 percent in 2023–2024, reflecting the trend of global trade regulations increasingly prioritizing technical, environmental, and social requirements. This pattern indicates that access to international food markets is increasingly determined by compliance with standards rather than simply tariffs or prices. This means that the Sustainable Rice Platform (SRP) can be a relevant and strategic instrument to respond to the growth of sustainability-based NTMs. The SRP provides technical standards, a recording system, and a verification mechanism that aligns with global regulatory trends, thereby reducing the risk of market rejection due to non-compliance with standards.

Structurally, the rise in sustainability-based NTMs reflects a shift in the trade policy approaches of import destination countries. Food regulations are now increasingly linked to issues of carbon footprint, chemical input use, food safety, and supply chain transparency. While NTMs are often positioned as instruments for consumer and environmental protection, in practice, these policies also function as *market selectors* that screen suppliers. Countries or producers unable to meet sustainability standards risk losing access, even if their products are price competitive.

For producing countries like Indonesia, this trend has significant strategic implications. The rise in non-tariff-based measures (NTMs) means that the primary risk in future food trade will no longer be tariffs, but rather the inability to meet technical and verification standards. In the context of rice, this narrows the scope for undifferentiated, bulk commodity-based exports and drives the need to adopt internationally recognized production standards. Without policy responses and capacity building at the producer level,

sustainable access to the global market will be difficult.



World Bank, FAO GIEWS, ITC (2025)

Figure 6.9 Global Carbon Price **Trends** (Additional Income Opportunities & *Price Stacking*)

has seen a significant upward trend over the past five years, from around USD 8 per ton of CO_2e in 2019 to USD 45 per ton of CO_2e in 2024. This surge reflects the strengthening of the global carbon economy regime, driven by increased commitments by governments and corporations to decarbonization targets, strengthening voluntary carbon markets and compliance, and increasingly stringent global climate policies. This consistent price increase indicates that carbon has evolved from an environmental policy instrument into an economic asset with real market value. This can be seen in Figure 6.9.

From a structural perspective, the carbon pricing trend demonstrates a shift in how markets value food and commodity production. Greenhouse gas emissions are no longer positioned as mere externalities but rather as both a cost component and a revenue opportunity. For the agricultural sector, including rice, this means low-emission cultivation practices—such as water efficiency, reduced synthetic inputs, and straw management—have the potential to be converted into economic value through carbon credit mechanisms. With carbon prices continuing to rise, financial incentives for transforming production practices become increasingly strong and relevant.

In the context of SRP development, this trend opens up opportunities for *price stacking*, the combination of multiple sources of economic value within a single production system. SRP rice not only has the potential to command *a premium price* from the sustainable rice market but can also generate additional revenue from verified emissions reductions that can be traded as carbon credits. This strengthens the economic rationale of SRP, as the benefits received by farmers and supply chain actors are not simply one-dimensional (rice selling price) but multidimensional through diversified income sources.

6.3. SRP Integration with Offtakers and Global Supply Chains

Integrating the Sustainable Rice Platform (SRP) with offtakers and the global supply chain is a key prerequisite for converting sustainability benefits into tangible economic incentives for farmers. In conventional rice market structures, farmers generally face spot markets, information asymmetry, and high price volatility, so that productivity increases often do not translate directly to increased income. The SRP changes this mechanism by promoting a coordinated value chain, where sustainable production practices upstream are directly linked to the needs and commitments of downstream markets through the role of offtakers, including state-owned food enterprises, exporters, modern retailers, and global buyers.

Over the past five years, the role of offtakers in the global food system has increased significantly due to strengthening ESG standards and the need for supply stability. OECD and FAO data show that since 2019, a growing number of global food companies have shifted from spot purchases to medium- to long-term contracts for strategic commodities, including rice. The proportion of contract-based purchases for key food commodities in OECD markets has increased from around 35–40 percent in 2019 to over 55 percent in 2024. This shift is driven by supply risk management efforts following the pandemic, global supply chain disruptions, and export restriction policies (e.g., India in 2023). The SRP is relevant because it provides technical standards and a verification system that allows offtakers to enter into contracts with lower reputational and sustainability risks.

In the global market, international buyers increasingly link supplier relationships to the ability to provide traceable, consistent, and compliant products. In the context of rice, a key challenge is the fragmentation of production at the smallholder level. The SRP serves as *a coordination device* that bridges this fragmentation by uniting farmers under a single standard system, supported by cultivation records and MRV. For global offtakers, this reduces *transaction costs* because procurement is no longer based on individual inspections but rather on a collective, auditable system. Economically, this increases the opportunity for Indonesian smallholder farmers to integrate into international supply chains without having to change their land ownership structure.

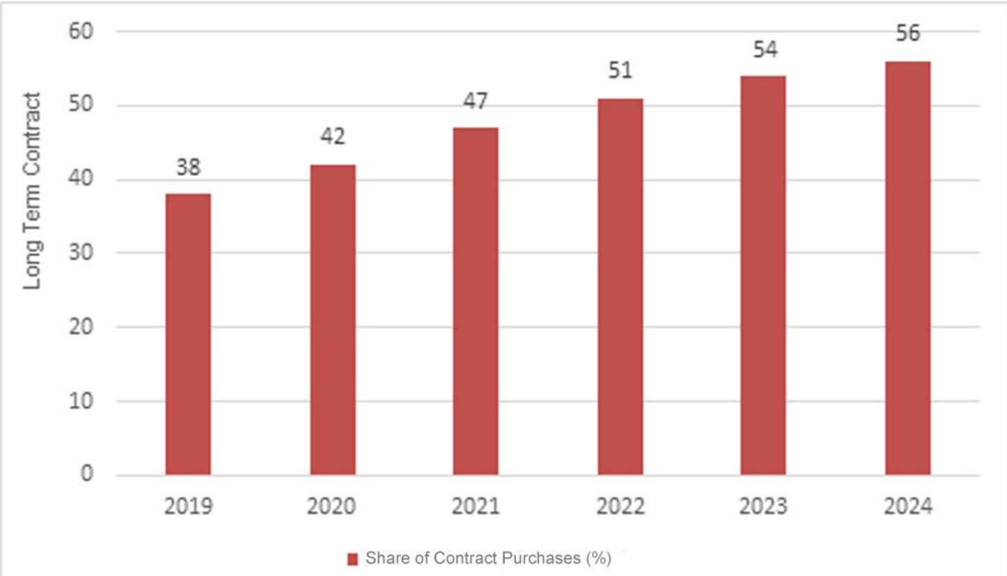
At the domestic level, SRP integration with offtakers such as Bulog, ID Food, regionally owned food enterprises (BUMD), as well as modern retailers and HoReCa, has also shown increasing relevance over the past five years. Data from Statistics Indonesia (BPS) and the Ministry of Trade show that the share of rice distributed through modern retailers and institutional channels increased from around 18 percent of urban rice consumption in 2019 to over 25 percent in 2024. This segment is relatively more responsive to quality and sustainability standards than traditional markets. With SRP, domestic offtakers have the technical basis to differentiate their products and enter into purchasing contracts with clearer specifications, including volume, quality, and environmental attributes.

The SRP offtaker integration mechanism also strengthens the price stabilization function and farmers' incomes. FAO Food Price Index data shows increased volatility in global rice prices post-2021, with increasing annual price deviations in 2023–2024. In this context, SRP contracts that link farmers with offtakers before the planting season serve as a risk-sharing instrument, reducing farmers' exposure to spot market price fluctuations. While contract prices may not always be optimal, the resulting income stability improves farmers' *expected welfare*, especially for risk-averse smallholders.

In addition to price contracts, the past five-year trend also shows increasing integration of financing in the global rice supply chain. The volume of ESG-based *supply chain finance* for the food sector has increased from approximately USD 40 billion in 2019 to over USD 90 billion by 2024 (World Bank, IFC). SRP enables farmers and aggregators to access such financing because the standards and production data generated meet the *due diligence requirements* of financial institutions. Thus, offtakers act not only as buyers but also as financing *anchors*, lowering upstream capital costs.

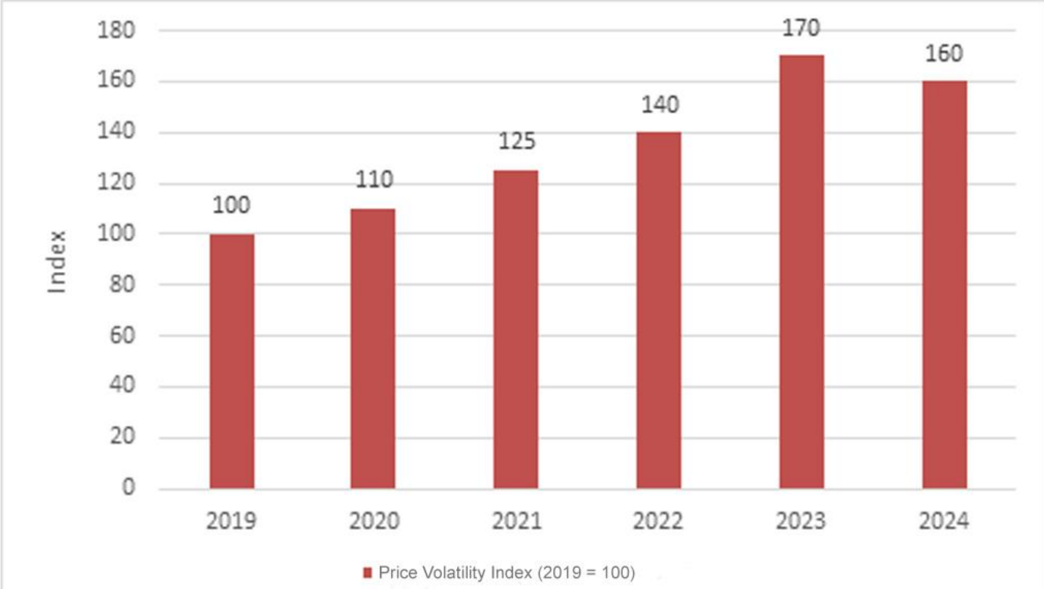
From a value chain perspective, SRP integration with offtakers contributes to a more proportional redistribution of added value. In conventional models, price premiums are often absorbed downstream. SRP-based integration opens up opportunities for *value sharing* through differential pricing schemes, performance bonuses, or results-based payments (e.g., emissions reductions). However, the effectiveness of these mechanisms depends heavily on contract governance and the institutional capacity of farmers. Without strengthening farmer cooperatives or aggregators, their bargaining position with offtakers remains weak even if farmers meet SRP standards.

Overall, data and trends over the past five years demonstrate that SRP integration with offtakers and global supply chains is not only possible but increasingly necessary. The shift by global buyers to long-term contracts, increasing demands for traceability, and the expansion of ESG-based supply chain financing create *a window of opportunity* for SRP. Within a technocratic framework, SRP functions as *institutional infrastructure* that aligns upstream and downstream incentives, lowers transaction costs, and transforms sustainability from a cost to a source of economic value for Indonesian farmers. The last five years of data show a significant increase in the role of offtakers and medium-to-long-term contracts in the rice supply chain, amid rising price volatility and global ESG demands. In this context, the SRP serves as an institutional infrastructure that lowers transaction costs, improves traceability, and enables more stable and sustainable integration of smallholder farmers into the global supply chain.



Source: OECD Agro-Food Supply Chain Analysis, FAO (2025)

Figure 6.10. Share of Contract-Based Food Purchases Medium–Long Term (SRP–Offtaker Integration Basis)



Source: FAO Food Price Index (2025)

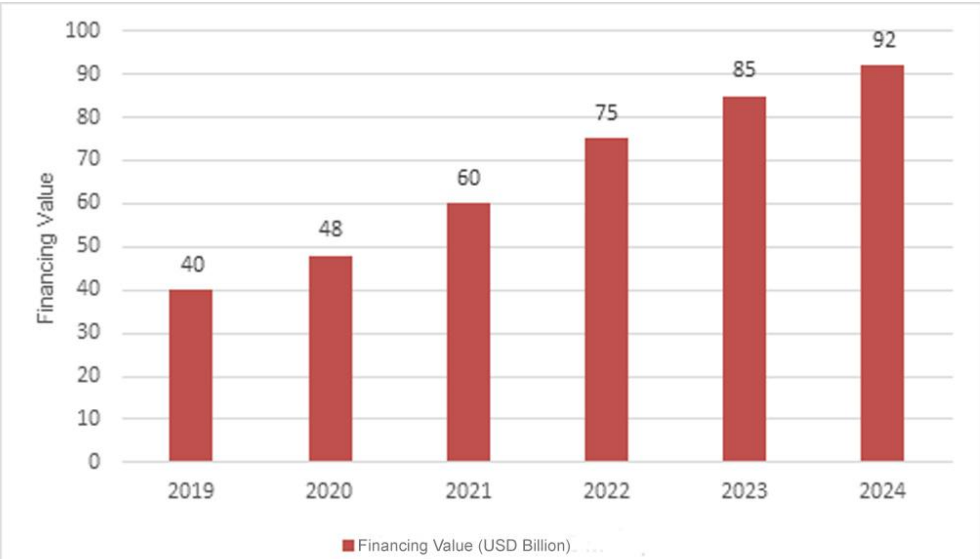
Figure 6.11. Index Global Rice Price Volatility (Urgency of Stabilization Through SRP Contracts).

Figure 6.11 shows that global rice price volatility has increased sharply over the past five years, with the index rising from a base of 100 in 2019 to 170 in 2023, before correcting slightly to 160 in 2024. This surge reflects the high uncertainty in the global rice market post-2020, triggered by a combination of climate shocks, global supply chain disruptions, export restrictions by major producing countries, and rising agricultural input and energy costs. Despite a moderate correction in 2024, volatility levels remain significantly higher than the pre-pandemic period, indicating that price risks are still structural rather than temporary.

From a farming perspective, increased price volatility increases the risk to farmers' incomes, particularly for smallholder farmers who lack hedging instruments or market certainty. Input and output price instability creates cash flow uncertainty, weakens incentives for technology investment, and increases the vulnerability of farming households to external shocks. In this context, policies that focus solely on increasing production without price stabilization mechanisms have the potential to exacerbate systemic risk at the farm level.

This is where the SRP plays a strategic role as a risk mitigation instrument for farming businesses, not just as a sustainability standard. By integrating the SRP with medium- to long-term offtaker contracts, rice prices can be linked to a differential pricing scheme based on quality and sustainability, thereby shifting some of the risk of market fluctuations from farmers to downstream buyers. The SRP contract also allows for the establishment of floor prices, cost-plus schemes, or limited indexation, which have been proven to reduce income volatility compared to spot market transactions.

Furthermore, increased global volatility actually strengthens the economic value of SRP within the national risk management framework, as SRP rice competes not solely on price, but also on supply consistency, traceability, and ESG compliance. In increasingly volatile market conditions, global buyers tend to seek suppliers that can guarantee the stability of volume, quality, and emissions footprint—attributes inherent to the SRP scheme. Thus, SRP is not only relevant as a market differentiation tool but also as a mechanism for stabilizing farmer incomes and strengthening the resilience of Indonesia's food system amidst increasing global price volatility.



Source: BPS, Ministry of Trade, Nielsen (2025)

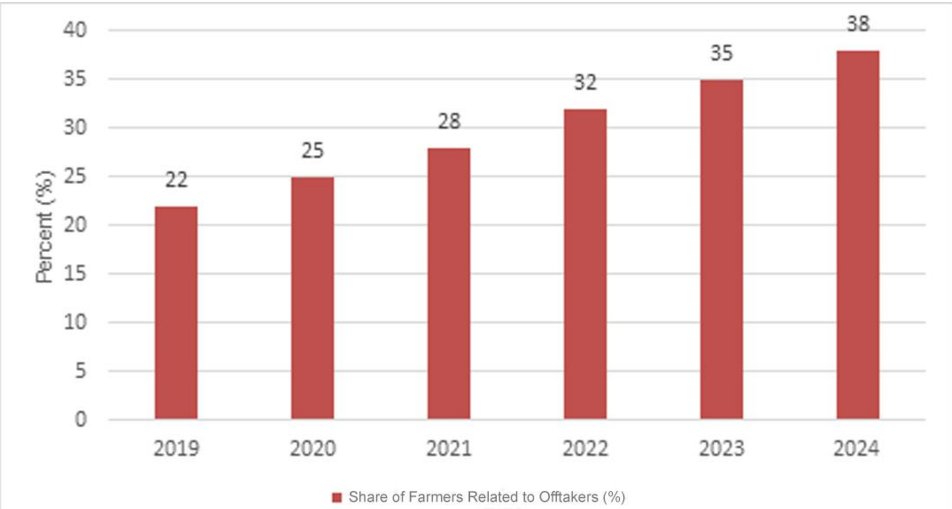
Figure 6.12. Development of Indonesian Modern & Institutional Retail Domestic SRP Market)

Based on Figure 6.12, the domestic market SRP rice has strong and consistent growth in five years, lastly reflected in the improvement mark in modern financing and institutional retail from around USD 40 billion in 2019 to more than USD 90 billion in 2024. This trend signifies that the request for high and differentiated products within the country is not marginal but has become part of current main consumption, especially in the modern retail, *hotel-restaurant-catering* (HoReCa), and procurement segments.

Structurally, this growth reflects a shift in consumer and institutional preferences from price to quality, food safety, and sustainability, in line with the rise of the middle class and urbanization. Modern retailers and institutional buyers are increasingly implementing stringent supply standards, ranging from traceability and quality consistency to adherence to ESG principles, which implicitly open up space for standardized production systems such as SRP. In other words, the domestic market is beginning to resemble the characteristics of a premium export market, even though it still operates within a national framework.

In this context, the SRP has the potential to serve as an upstream-downstream integration instrument in the domestic market, not just an export platform. The SRP standard enables domestic offtakers to secure rice supplies with consistent quality and a credible sustainability narrative while also providing demand certainty for farmers. This is crucial for establishing stable medium-term contracts, reducing farmers' dependence on the spot market, and mitigating the risk of price fluctuations.

Furthermore, the expansion of domestic retail and institutional markets demonstrates that SRP development does not have to be a trade-off with national food security. Instead, SRP can be developed as a *dual-track market strategy*, with some production directed to premium domestic and institutional markets, while the remainder reaches niche export markets. With this approach, increasing farmer incomes, stabilizing farming businesses, and strengthening the domestic market can occur simultaneously and sustainably.



Source: FAO, IRRI, World Bank Agriculture Reports (2025)

Figure 6.13. Increasing Farmer Engagement with Offtakers (Inclusion of Smallholder Farmers).

Next, Figure 6.13 shows a consistent upward trend in farmer engagement, including smallholder farmers, with off-takers throughout the 2019–2024 period, from around 22% to nearly 38%. This increase reflects a shift in the agricultural market structure from spot transaction patterns to more organized and contract-based supply relationships. Economically, this higher level of engagement reduces the uncertainty of crop absorption and lowers price risks at the farmer level.

From an institutional perspective, this trend indicates a strengthening of the role of off-takers as coordination hubs in the value chain, particularly in providing market certainty, quality standardization, as well as input and financing support. For small farmers who were previously fragmented and had low bargaining power, engagement with off-takers provides access to better cultivation practices, price information, and contract-based informal financing mechanisms. This is an important prerequisite for integrating small farmers into modern supply chains.

In the context of SRP, increasing farmers' engagement with offtakers has strategic significance because SRP standards essentially require supply relationships that are relatively stable, verifiable, and traceable. Without committed offtakers, SRP adoption risks stalling at the pilot level because farmers do not receive clear market incentives. Therefore, the trend in Figure 6.13 reinforces the argument that SRP aligns with the direction of the evolution of both global and domestic food markets.

6.4. Implications of SRP on Farm Income and Business Risk

The implementation of the Sustainable Rice Platform (SRP) has structural economic implications for the income and risks of rice farming. In conventional systems, rice farmers' income is highly influenced by fluctuations in spot market prices, input cost volatility, and production risks due to climate and inefficient cultivation practices. SRP intervenes in these points of vulnerability through technical standards that promote input efficiency, climate-adaptive cultivation practices, and market integration mechanisms. Therefore, the impact of SRP on farmers' income cannot be measured solely by an increase in selling prices, but rather by comprehensive changes in cost structure, production stability, and the probability of more predictable income.

In terms of gross revenue, SRP offers opportunities to increase selling value through product differentiation and integration with offtakers. As discussed in the previous subsection, the implementation of SRP can result in a premium price ranging from 5–20 percent in certain markets, especially when linked to purchase contracts that appreciate sustainability attributes. However, from a technical standpoint, more consistent revenue growth actually comes from market certainty and absorption volume. With SRP contracts, farmers are no longer entirely dependent on the often declining harvest prices, making expected revenue more stable even though contract prices are not always at their maximum.

From the cost structure perspective, SRP directly affects the efficiency of production input use. Practices such as balanced fertilization, alternate wetting and drying (AWD) water management, and integrated pest management empirically reduce fertilizer and water consumption without significantly lowering yields. In various SRP studies and FAO–IRRI pilot projects, the input costs for SRP rice farmers were recorded to decrease by about 5–15 percent compared to conventional practices. This cost reduction increases the net margin of farming and strengthens farmers' resilience to rising input prices, which over the past five years has become one of the main sources of risk for rice farming.

The implications of SRP for yield and productivity are conservative yet stable. Unlike short-term intensification interventions, SRP does not aim to drive aggressive yield surges, but rather to maintain stable productivity while reducing resource degradation. From a risk economics perspective, this yield stability is crucial because it lowers the variance in annual income. In the context of smallholder farmers, who are generally risk-averse, reducing income variance is often more valuable than increasing uncertain average income.

From the price risk perspective, SRP contributes significantly through contract and offtaker mechanisms. Global and domestic rice price volatility increased sharply after 2021 due to supply disruptions, changes in trade policies, and geopolitical factors. Without a contract, farmers bear the full risk of price declines. With SRP, part of that risk is transferred to the offtaker through agreements on price, volume, or minimum purchase schemes. Economically, this represents a form of risk sharing that improves farmers' welfare, although theoretically farmers may 'sacrifice' the opportunity for peak prices in the spot market.

SRP also impacts access to financing and farm liquidity, which often becomes a source of hidden risk. Documented and verified SRP standards make it easier for financial institutions or off-takers to provide supply chain-based financing, such as input financing or advance payments. This reduces farmers' dependence on high-interest informal credit, thereby lowering financial risk and the cost of capital. From a medium-term perspective, improved access to financing enhances farmers' capacity to adopt better technologies and climate adaptation practices.

From the perspective of climate and production risks, SRP strengthens farm resilience through adaptive cultivation practices. More efficient water management, record-keeping of practices, and land monitoring help farmers respond to climate variability more systematically. Although SRP does not completely eliminate the risk of crop failure, implementing these standards reduces the probability of extreme losses (downside risk), which are economically far more damaging than moderate income fluctuations.

Another significant implication is the change in the aggregate risk profile of the rice sector. When SRP is widely adopted, national supply volatility decreases and production quality becomes more consistent. This indirectly impacts the stability of national prices and the government's fiscal burden in implementing Government Purchase Price (HPP) interventions or market operations. From a public policy perspective, improving farmers' welfare through SRP also contributes to reducing the need for ad hoc subsidies, which are often fiscally inefficient.

Sourcer: BPS, Ministry of Trade, IRRI–FAO pilots (2025)

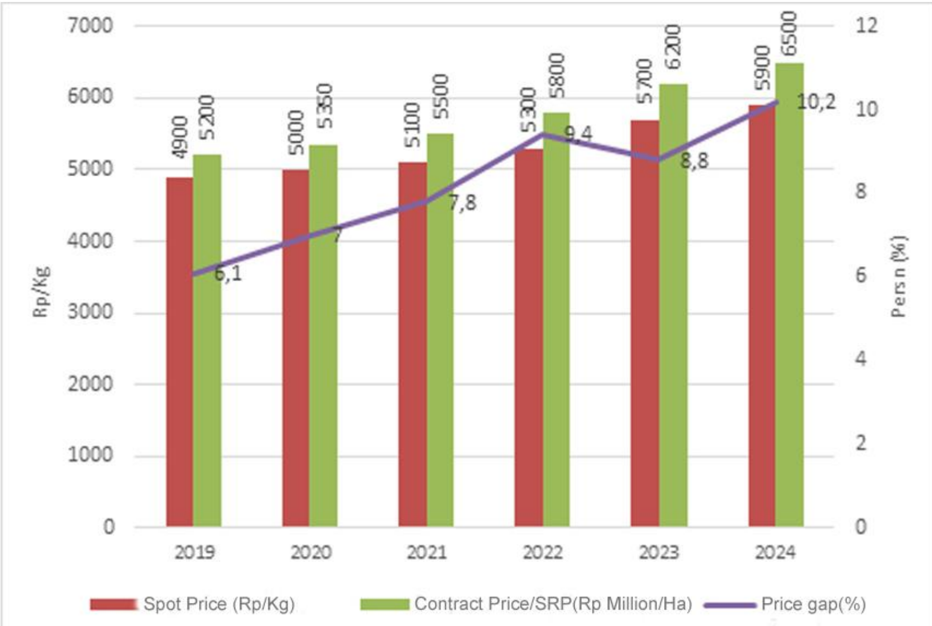


Figure 6.14. Comparison of Spot Market Prices vs Contract Scheme Including SRP (Basis for Revenue Increase)

Based on Figure 6.14 (Comparison of Spot Market Prices vs Contract Scheme including SRP), there are four important economic implications relevant to Chapter 6, particularly related to farmers' income and risk management. First, contract/SRP prices consistently remained above spot market prices throughout the 2019–2024 period. The price gap increased from around 5.1% (2019) to over 10% in 2024, indicating a strengthening premium from the sustainable contract scheme. Structurally, this confirms that SRP is not just a technical cultivation scheme, but a value upgrading instrument capable of moving farmers from the generic commodity market to a sustainability-based market..

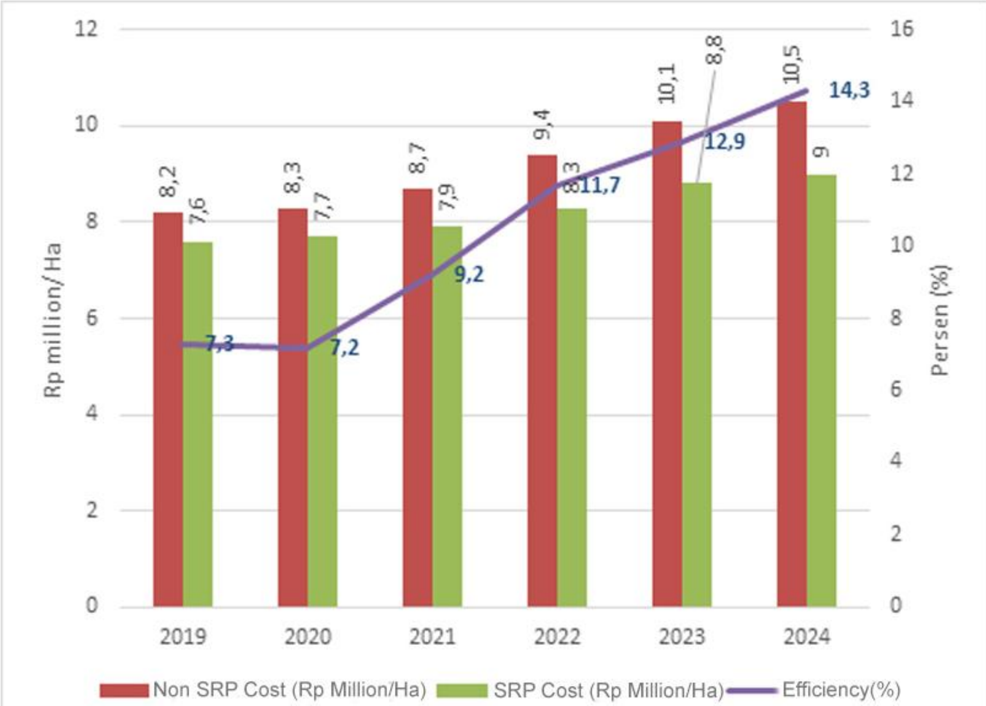
Next, with the absolute increase in contract/SRP prices (from ±Rp5,200/kg to ±Rp6,500/kg) occurring faster than the spot price, it indicates that the contract mechanism is able to amortize global market volatility into a more stable and predictable price. For farmers, this stability has high economic value as it reduces income uncertainty (income risk), improves cash flow, and enhances bankability in accessing financing. In agricultural policy terminology, SRP functions as a risk management instrument, not just a price incentive.

The sharp increase in price differences post-2021 is directly linked to global dynamics: the food crisis, rising carbon prices, and increasing demand for ESG-compliant products. This indicates that the SRP premium prices increasingly reflect global market signals, rather than merely implicit subsidies or domestic policies. In other words, SRP has begun to connect with international market mechanisms, so its potential financial sustainability is stronger compared to budget-based incentive schemes..

Furthermore, the data in Figure 6.15 shows that over the past five years, the cost of rice farming has continued to increase, both in non-SRP and SRP systems. However, it is worth noting that the cost increase for farmers who implement SRP occurs more slowly compared to conventional farming patterns. This means that, amid rising fertilizer, energy, and labor prices, SRP farmers are relatively better able to withstand spikes in production costs. Simply put, SRP helps farmers “save” without having to compromise the production process.

Figure 6.15 clearly shows the difference in production cost dynamics between non-SRP and SRP rice farming enterprises during the period 2019–2024. In 2019, the input cost per hectare in the non-SRP system was around Rp8.2 million/ha, while in the SRP system it was slightly lower, at about Rp7.6 million/ha. This difference is equivalent to an initial efficiency of around 7.3%. Over time, costs in both systems increased, but at different rates. In 2020 and 2021, non-SRP costs rose to around Rp8.3–8.7 million/ha, while SRP costs were in the range of Rp7.7–7.9 million/ha. This condition indicates that from the beginning of implementation, SRP has already provided input cost savings of around Rp500–800 thousand per hectare compared to conventional practices.

The difference became even more apparent during the 2022–2024 period when input price pressures grew stronger. In 2022, non-SRP farming costs increased to around Rp9.4 million/ha, while SRP costs were around Rp8.3 million/ha. The cost difference reached more than Rp1.1 million/ha with an efficiency rate of about 11.7%. This trend continued in 2023, when non-SRP costs rose to nearly Rp10.1 million/ha and SRP costs were around Rp8.8 million/ha, resulting in an efficiency of 12.9%. In 2024, the cost gap peaked: non-SRP around Rp10.5 million/ha compared to SRP at about Rp9.0 million/ha, or a saving of roughly Rp1.5 million/ha with an efficiency rate of around 14.3%..

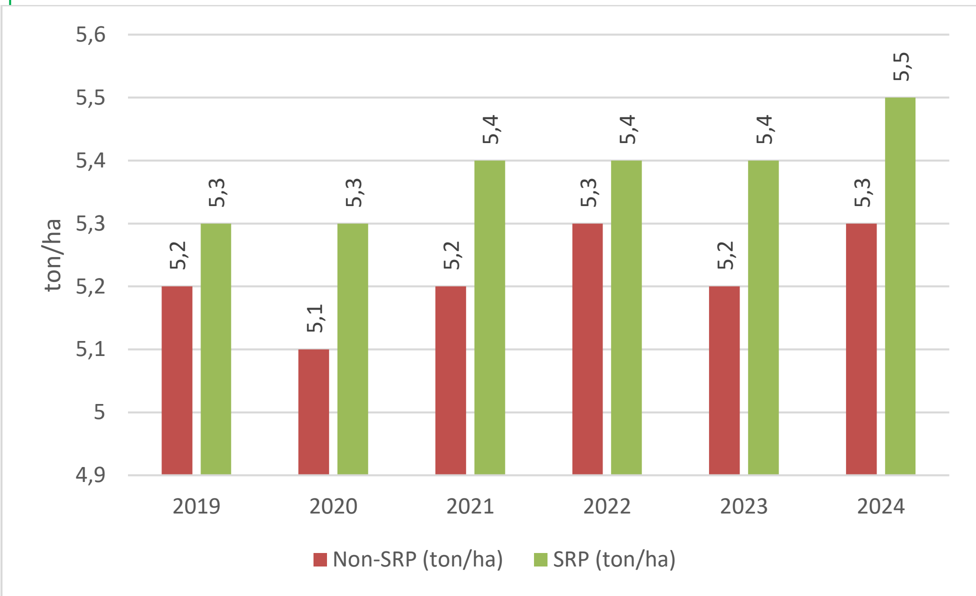


Sourcer: BPS, FAO, SRP Global Impact Report (2025)

Figure 6.15. Non-SRP Input Cost Efficiency vs SRP (Strengthening Farmer Margins)

These figures indicate that the cost efficiency of SRP is not static, but gradually improves over time. The increase in efficiency from around 7.3% in 2019 to over 14% in 2024 reflects the growing effectiveness of SRP cultivation practices in controlling input usage. In practice, this relates to more precise fertilization, more efficient water use through methods such as AWD, and the reduction of unnecessary chemical inputs. With a leaner cost structure, SRP farmers have a wider profit margin, even if the selling price of unhusked rice does not increase significantly.

If extrapolated on a larger scale, the cost savings of around IDR 1–1.5 million per hectare have significant economic implications. Over an area of 1 million hectares, this efficiency is equivalent to the potential national production cost savings of IDR 1–1.5 trillion per planting season. This means that SRP not only provides micro-level benefits for farmers but also contributes to the efficiency of the national food system. Thus, SRP can be seen as an approach that simultaneously enhances farmers' competitiveness, reduces farming risks, and improves the economic resilience of the rice sector in the medium and long term.



Source: IRRI, FAO, pilot SRP Asia (2025)

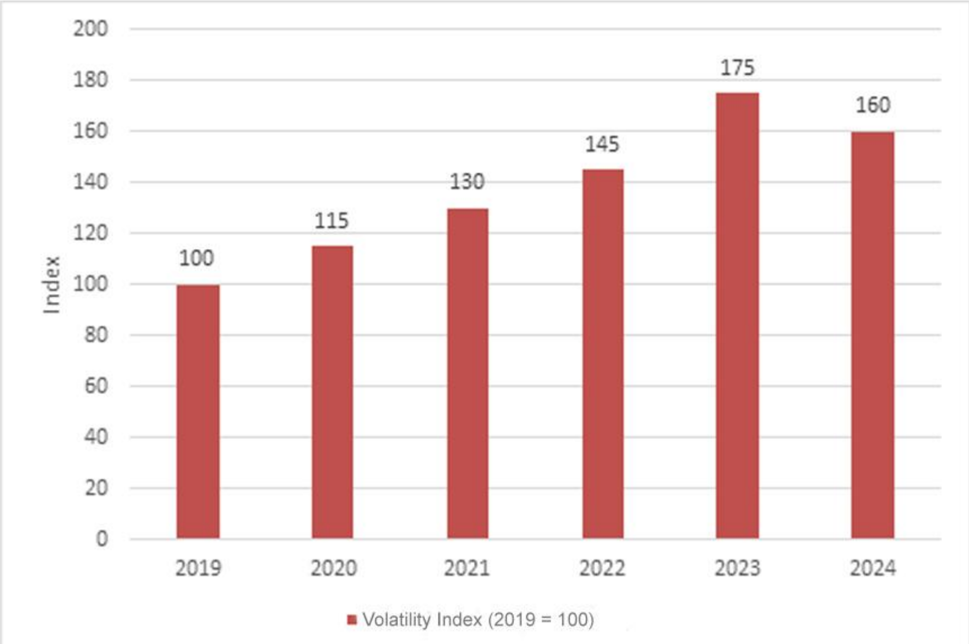
Figure 6.16. SRP Harvest Yield Stability Compared to Conventional Practices

Figure 6.16 shows that during the 2019–2024 period, rice yields under the SRP system were consistently higher and more stable compared to non-SRP practices. In 2019, non-SRP productivity was around 5.2 tons/ha, while SRP had already reached about 5.3 tons/ha. The difference is relatively small, but it is important as a starting point to indicate that SRP practices do not reduce yields and, even from the early adoption phase, are able to maintain productivity equivalent to or slightly better than conventional systems.

The difference in performance became more apparent in the following years. In 2020, while non-SRP productivity actually dropped to around 5.1 tons/ha, SRP remained stable at about 5.3 tons/ha. This situation indicates that SRP has better resilience to external disturbances, such as weather, pest pressures, or changes in input patterns. This stability is important, as even a small decline in rice yields can directly impact farmers' income.

Entering the 2021–2024 period, the productivity gap between SRP and non-SRP tended to widen. In 2021, non-SRP yields were around 5.2 tons/ha, while SRP increased to about 5.4 tons/ha. In 2022 and 2023, this pattern continued: SRP yields remained relatively consistent at around 5.4 tons/ha, while non-SRP fluctuated more between 5.2–5.3 tons/ha. In 2024, the difference became most evident, with SRP yields reaching about 5.5 tons/ha compared to non-SRP at around 5.3 tons/ha. On average, SRP provided an additional yield of about 0.2 tons/ha, or approximately 3–4% higher than conventional practices.

In the context of farm economy, this increase and stability in yield is very significant. An additional yield of around 0.2 tons/ha, when multiplied by the price of unhusked rice and combined with the cost efficiency previously demonstrated, will directly strengthen farmers' income. More than that, yield consistency from year to year reduces production risks, allowing farmers to have better certainty in business planning and relationships with offtakers. Thus, SRP not only provides environmental benefits but also strengthens the foundation of productivity and farmers' income resilience in the medium and long term.



Source : FAO Food Price Index (Rice), World Bank (2025)

Figure 6.17. Trend of Increasing Price Risk (Contract & Offtaker Justification)

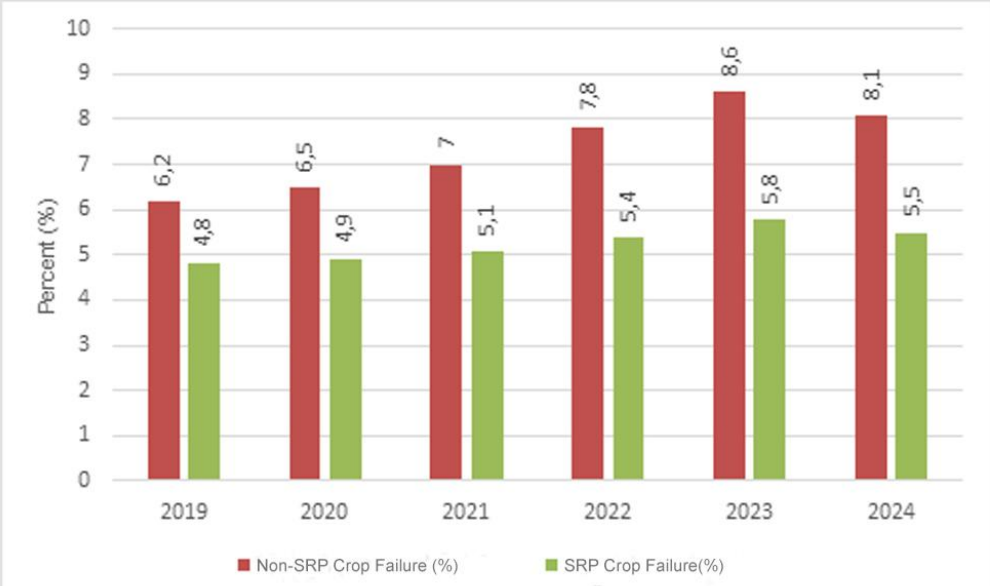
Figure 6.17 shows a fairly sharp upward trend in the global rice price risk during the 2019–2024 period, reflected in the increase of the price volatility index with 2019 as the base year = 100. In 2019, the index was at level 100 as a reference point. In 2020, the index rose to 115, which means the risk of price fluctuations increased by about 15 percent in just one year. This rise reflects the beginning of global pressures on the food market, mainly due to supply chain disruptions, the pandemic, and international trade uncertainties that started to be felt during this period.

Price risk pressure strengthened further in 2021 and 2022. The volatility index rose to 130 in 2021 and increased again to 145 in 2022. Cumulatively, this means that global rice price risk has increased by about 45 percent compared to the pre-crisis conditions of 2019. This increase not only indicates generally higher prices, but more importantly, greater price uncertainty, so both producers and consumers face more unpredictable market risks. For farmers, this often means income uncertainty, while for large buyers such as mills and retailers, cost risks also rise.

The peak pressure was seen in 2023, when the volatility index surged to 175. This figure indicates that price risk was nearly double compared to normal conditions in 2019. This situation aligns with various global factors such as production disruptions due to extreme weather, export restrictions from several producing countries, as well as increased speculation and geopolitical tensions. In 2024, the index did decrease slightly to 160, but this level remains very high and still reflects a much greater risk compared to the pre-crisis period. In other words, despite a slight correction, the global rice market has not yet returned to stable conditions.

In this context, the trend of increasing price volatility becomes a strong justification for strengthening contract schemes and offtaker involvement, including through SRP. When price risk rises from an index of 100 to 160–175, the spot market mechanism becomes increasingly risky for farmers because their income is highly dependent on short-term fluctuations. Contract schemes with more certain prices and clearly defined timeframes serve as a tool for stabilizing farmers' income, while also providing supply and cost certainty for offtakers. In other words, this data shows that SRP and offtaker-based contracts are not just additional options, but are important instruments to mitigate market risk and maintain the sustainability of the rice production system amidst the growing volatility of global prices.

This condition is influenced by the decrease in probability illustrated in Figure 6.18. The figure clearly shows that the implementation of SRP practices significantly contributes to reducing the risk of crop failure compared to non-SRP practices during the 2019–2024 period. In 2019, the probability of crop failure on non-SRP land was recorded at 6.2 percent, while on SRP land it was only 4.8 percent. This difference of about 1.4 percentage points indicates that from the outset, cultivation approaches based on SRP principles have provided better protection against climate risks and production disturbances.



Source: FAO Climate Risk (2025)

Figure 6.18. Reduction of Crop Failure Probability on SRP Land

These differences are increasingly consistent seen in the following years. By 2020, non-SRP crop failure rates increased to 6.5 percent, while SRP only rose to 4.9 percent. In 2021 the same pattern continued, where non-SRPs reached 7 percent and SRPs were in the range of 5.1 percent. That is, although climate and production risks are generally increased, land managed to SRP standards undergo a more controlled increase in risk. Relatively, SRP is able to suppress the probability of crop failure by about 25–30 percent compared to conventional practices. The most powerful risk pressure is seen in the period 2022–2023, which is also characterized by a variety of climate anomalies. By 2022, the probability of non-SRP crop failure rose to 7.8 percent, while SRP was only 5.4 percent. By 2023, this difference is even slightly widened, with non-SRP reaching 8.6 percent and SRP 5.8 percent. This means that amid more extreme climate conditions, SRP is able to withstand a surge in the risk of crop failure by about 2.8 percentage points. Economically, this difference is very significant because it is directly related to the stability of production and the certainty of the farmers' income.

In 2024, although there was a slight overall reduction in risk, the gap between SRP and non-SRP remained. The probability of crop failure for non-SRP was recorded at 8.1 percent, while SRP was 5.5 percent. The consistency of this risk difference indicates that SRP is not only effective under normal conditions but also serves as an instrument for mitigating structural risk in the medium term. For farmers, this reduction in crop failure risk means more stable and predictable income. In a policy context, these findings strengthen the argument that expanding SRP to a large scale, including up to 1 million hectares, not only impacts environmental sustainability but also becomes an important strategy for managing national food production risks amidst increasing climate uncertainty.

```
Random-effects GLS regression                   Number of obs     =         51
Group variable: partner_id                      Number of groups  =          6

R-sq:                                           Obs per group:
     within  = 0.2263                                         min =          7
     between = 0.9897                                         avg =        8.5
     overall = 0.5983                                         max =         10

                                                Wald chi2(5)      =    5073.63
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

                             (Std. Err. adjusted for 6 clusters in partner_id)
------------------------------------------------------------------------------
             |               Robust
         lnX |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  ln_gdp_idn |  -7.631276   3.517658    -2.17   0.030    -14.52576   -.7367931
ln_gdp_partner |   .843875   .2368017     3.56   0.000     .3797523    1.307998
     ln_dist |  -.8151621   .3979245    -2.05   0.041     -1.59508   -.0352443
         RTA |   .4141961   .7349679     0.56   0.573    -1.026314    1.854707
       ln_fx |   -.349682   .0657705    -5.32   0.000    -.4785898   -.2207742
       _cons |   207.3965   96.85993     2.14   0.032     17.55455    397.2385
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  2.1817275
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Source: Slowan authors using Gravity Model (2025)

Figure 6.19. Sustainable Competitiveness of Indonesian Rice Exports in the Global Market

In Figure 6.19, it shows that the results of gravity model estimates show that overall models have a strong enough performance in explaining Indonesia's sustainable rice export patterns to global markets. The very high R^2 Between value (0.9897) indicates that the characteristic differences between partner countries—such as economic size (GDP), geographical distance, and other structural factors—are dominant in determining export variations. Meanwhile, R^2 within 0.2263 showed that export variations over time in the same partner country are relatively more limited explanation, something common in small-scale panel trading models. A very significant Wald chi-square test (Prob > chi² = 0.000) confirms that the model as a whole is viable and the coefficient-key inside does not appear by chance.

From the perspective of key economic variables, the most interesting result is the negative and significant coefficient of Indonesia's GDP (ln_gdp_idn). This finding indicates that when the domestic economy grows faster, rice exports tend to decrease, reflecting a priority on absorbing production for domestic consumption rather than export orientation.Conversely, the partner country's GDP (ln_gdp_partner) has a positive and highly significant effect, confirming that Indonesia's rice exports are demand-driven from the destination country's side: the higher the trading partner's income, the greater the potential absorption of rice, including sustainable rice. The distance variable (ln_dist) also has a negative and significant effect, reinforcing that transportation and logistics costs remain a major constraint, especially for food commodities with relatively sensitive price margins.

From the policy and competitiveness side, the exchange rate variable (ln_fx) that is negatively coefficient and significant shows that the appreciation of the rupiah consistently weakened the competitiveness of Indonesia's rice exports in the global market. This strengthens the argument that the stability and direction of exchange rates play a significant role in the sustainability of food exports. Meanwhile, the RTA variable is insignificant, indicating that membership in regional trade agreements has not yet automatically translated into increased rice exports, possibly because of the strong non-tariff barriers, food regulation and quality standardization in partner countries. Overall, the results of this model gravity imply that the increase in Indonesia's sustainable rice export competitiveness is not enough to rely solely on trade agreements, but it needs to be sustained by a strategy of strengthening logistics efficiency, exchange rate management, and high-income market penetration that has strong demand for sustainable rice products.

CHAPTER 7. CONCLUSION AND POLICY RECOMMENDATIONS

CHAPTER 7. CONCLUSION AND POLICY RECOMMENDATIONS

7.1. Conclusion

Based on the analysis and findings in Chapters 4, 5, and 6, the conclusions are as follows:

1. The readiness of the regions and SRP institutions shows a diverse pattern, with Boyolali being the most prepared region and Sragen still requiring basic interventions. The achievement of the 1 million hectares SRP target can be accelerated if institutional strengthening, technical training, and cross-department coordination are carried out in an integrated manner based on regional readiness.
2. The development of the Sustainable Rice Platform (SRP) is feasible to implement on a large scale and is realistic for achieving the target of 1 million hectares in Indonesia. Technically and economically, SRP practices can maintain crop yield stability, reduce input costs, and lower the risk of crop failure compared to conventional systems.
3. Cost efficiency and increased farming margins are key factors that ensure the sustainability of SRP adoption by farmers, especially in facing climate and price volatility.
4. From a market perspective, there is a strong opportunity for low carbon rice to be developed as a specialty rice product both in the global and domestic markets.
5. The increasing demand for sustainable food products, the strengthening of environmental standards as non-tariff barriers, and the premiumization trend in modern retail reinforce SRP's position as a market access and price differentiation instrument. SRP serves as a credible standard that enables the formation of premium prices and sustainability-based added value.
6. The most effective development model is a cluster-based development approach that integrates farmers, extension services, offtakers, milling, as well as financial and policy support.
7. The development of SRP cannot be carried out generically; it must be based on a spatial, institutional approach, and clear implementation stages through a roadmap.
8. A gradual development roadmap for SRP, starting from the pilot phase, scaling up, to mainstreaming, is key to ensuring adoption progresses realistically, measurably, and is able to reach a scale of 1 million hectares without compromising quality standards and the economic sustainability of farmers.

7.2. Policy Recommendation

Based on that conclusion, policy recommendations based on actors and their implications that can be suggested (also explained in the form of a policy matrix in Table 7.1) are as follows:

For the Central Government:

1. The central government needs to make the Sustainable Rice Platform (SRP) an integral part of the national policy on sustainable and low-carbon rice agriculture. The integration of SRP should be explicitly included in national planning documents (RPJMN, Ministry of Agriculture Strategic Plan) and linked to the food security agenda and commitments to reduce emissions in the agricultural sector. Additionally, the central government needs to establish a national SRP roadmap framework that includes gradual area targets, key performance indicators, and uniform implementation standards to ensure quality adoption when scaling up

2. From an economic perspective, the central government needs to develop performance-based incentive schemes for SRP actors, such as support for transition financing, facilitation of contract partnerships with off-takers, and integration of SRP into green financing schemes and the carbon market. Strengthening coordination across the ministries of agriculture, trade, industry, and finance is also key so that SRP is not fragmented and can function as an instrument to enhance national competitiveness.

For Local Governments:

1. Local governments play an important role as the main executor of SRP development in the field. Regions need to develop implementation strategies based on regional readiness, distinguishing approaches between areas that are ready and areas that still require foundational strengthening. In ready areas, policy focus can be directed towards expanding coverage, market integration, and improving the quality of SRP products. Meanwhile, in areas that are not yet ready, local governments need to prioritize strengthening farmer institutions, enhancing extension capacity, and improving cross-agency coordination.

2. In addition, local governments need to integrate SRP into regional agricultural development programs through budget support, facilitation of technical training, and strengthening of monitoring systems. The role of local governments is crucial in ensuring effective connectivity between farmers, mills, and offtakers, so that SRP does not stop at the cultivation level but forms a sustainable production and market ecosystem.

For Mill Operators and Offtakers:

1. Rice milling operators and off-takers are expected to become the main drivers of downstream development and market stabilization for SRP. Milling companies need to invest in post-harvest capacity improvements, sorting systems, and the separation of SRP rice to ensure product quality and traceability. In addition, business actors need to develop medium-term contract schemes with SRP farmers or farmer groups, which provide price certainty and assured purchase of the harvest.

2. From a market perspective, millers and offtakers need to actively build and develop the SRP rice market, whether in modern retail, institutional markets, or niche exports. This role is crucial to ensure that the sustainability advantages of SRP can be monetized in the form of premium prices and sustainable added value throughout the supply chain.

For Farmers and Farmer Institutions:

1. Farmers, especially smallholders, need to promote the strengthening of collective institutions through farmer groups, cooperatives, or farmer corporations as a key prerequisite for the adoption of SRP. Strong institutions enable consistent implementation of SRP standards, cost-effective mentoring, and improved bargaining power with mills and off-takers. Without solid institutions, the economic benefits of SRP are at risk of being fragmented and unsustainable.

2. From a technical perspective, farmers need to focus on the consistency of implementing core SRP practices, such as efficient water management, balanced fertilization, and cultivation activity record-keeping. Discipline in adhering to these standards not only affects crop yields and cost efficiency but also determines market access and opportunities to obtain premium prices. With the right policy and market support, SRP farmers can evolve from merely being raw material producers to becoming key players in a value-added sustainable rice system.

Table 7.1. Actor, Key, Direction, and Policy Recommendation Matrix

Actor	Key Policy	Direction of Policy	Recommended Policy Recommendations
Central Government	SRP has not become a priority in national policy	Mainstreaming SRP as a national policy for sustainable and low-carbon rice	• Integration of SRP in the National Medium-Term Development Plan (RPJMN) and the Ministry of Agriculture's Strategic Plan • Establishment of a national SRP roadmap for a phased approach (pilot–scale-up–mainstreaming) • Alignment of SRP with the food security agenda and agricultural sector emission reduction targets
	Economic incentives are not yet attractive enough for large-scale adoption	Strengthening performance- and market-based incentive schemes	• SRP transition financing support • Facilitation of market contracts with national off-takers and for export • Integration of SRP with green financing and carbon markets
Local Govermment	Readiness of diverse regions and institutions	Region-based readiness approach	• Differentiation of strategies between ready and not ready areas • Strengthening farmer institutions in areas with low readiness • Synchronization of programs across agricultural, irrigation, and trade government agencies
	Weak coordination in field implementation	Strengthening the role of regions as executors of SRP	• Integration of SRP into regional programs and budgets • Strengthening the role of extension workers and technical SRP training • Periodic monitoring of the extent and performance of SRP adoption
Ricel millers & Offtaker	Limitations of upstream–downstream SRP integration	Strengthening the downstream process and SRP market	• Milling investment for the separation and traceability of SRP rice • Development of medium–long-term contracts with SRP farmers • Development of SRP market to modern retail, institutions, and niche exports
	Price incentives have not been fully internalized	Monetization of SRP sustainability	• Establishment of a premium pricing scheme based on quality and sustainability • Development of low carbon rice branding as specialty rice
Farmers & Farmers institution	Fragmentation and low bargaining power of farmers	Strengthening the collective institution of SRP farmers	• Strengthening farmer groups, cooperatives, or SRP farmer corporations • Land and production consolidation based on clusters
	Consistency in applying standards still remains a challenge	Improvement of technical capacity and implementation discipline	• Ongoing technical assistance (AWD, balanced fertilization, record-keeping) • Enhancing market literacy and understanding the economic benefits of SRP

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APPENDIX

APPENDIX

Link to the questionnaire distributed and used in this study:

- Farmers: https://bit.ly/srp-petani
- Extension Worker: https://bit.ly/srp-penyuluh
- Rice Millers: https://bit.ly/srp-penggiling
- Trader: https://bit.ly/srp-pedagang
- Local Goverment: https://bit.ly/srp-dinas

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