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A participatory approach: Empowering farmers through rice-fish integrated farming systems in Sungai Rebo Village South Sumatra (Case Study Corporate Social Responsibility [CSR] of PT Kilang Pertamina Internasional Refinery Unit III Plaju)

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Abstract

This investigation examines the implementation of a participatory approach to empower local farmers in Sungai Rebo Village, South Sumatra, through the use of Rice-Fish Integrated Farming Systems. It concentrates on the Corporate Social Responsibility (CSR) initiative of PT Kilang Pertamina Internasional Refinery Unit III Plaju. The program endeavors to improve the community's well-being by advocating for sustainable agricultural practices that synergistically integrate paddy, livestock, and aquaculture. The research assesses the impact of corporate social responsibility and community engagement on rural development using qualitative methods, including field observations, interviews, and documentation. The results indicate that the integrated agricultural system has enhanced the economic resilience, environmental awareness, and food security of local farmers, as a result of corporate facilitation and active community participation. The research underscores the significance of participatory development in achieving community empowerment and long-term sustainability.

Keywords: Participatory approach; Integrated farming system; Community empowerment; CSR

1. Introduction

In Indonesia, the agricultural sector continues to be a fundamental component of rural livelihoods; however, it is confronted with a variety of obstacles, such as environmental degradation, low productivity, and restricted access to resources [1,2] Integrated Farming Systems (IFS) provide a comprehensive solution by integrating a variety of agricultural components, including cereals, livestock, and aquaculture, into a sustainable and unified model. IFS has been demonstrated to improve ecological balance, income diversification, and resource efficiency [3,4,22].

In recent years, participatory approaches have acquired momentum in development programs, particularly in rural areas where community engagement is crucial for the long-term success of their initiatives [5]. The importance of local participation in fostering a sense of ownership and ensuring that development interventions are in accordance with the requirements of the community [6,7,8]. This concept serves as the foundation for numerous Environmental Social Responsibility (CSR) initiatives implemented by Indonesian corporations, such as PT Kilang Pertamina Internasional Refinery Unit III Plaju [9,10,11].

The CSR initiative in Sungai Rebo Village, South Sumatra, is a strategic endeavour to empower farmers by implementing a participatory integrated agricultural model [10,12,13,14]. The initiative endeavours to establish sustainable livelihoods, enhance food security, and encourage environmental stewardship by involving farmers in the design,

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implementation, and administration of the program [15]. Nevertheless, empirical insights into the impact of participatory models on the outcomes of corporate social responsibility programs in rural Indonesia are still scarce [16,17].

Despite the growing emphasis on participatory development and integrated farming systems, there remains a paucity of empirical studies that critically assess how participatory approaches within corporate social responsibility (CSR) programs influence agricultural sustainability and rural empowerment in the Indonesian context [18,19,21,28]. Most existing study either focuses on the technical outputs of integrated farming or on the overall implications of CSR programs, typically portraying involvement as a peripheral aspect rather than a fundamental mechanism [21]. There is minimal information of how community involvement directly influences program ownership, adoption of sustainable practices, and long-term livelihood results [24]. This research tries to bridge that gap by giving in-depth insights into the participatory dynamics of the CSR program conducted by PT Kilang Pertamina Internasional in Sungai Rebo Village and analyzing its influence on the success and sustainability of integrated farming practices [7,6,15].

Consequently, the objective of this investigation is to investigate the degree to which a participatory approach can improve the effectiveness of integrated agricultural systems within the context of corporate social responsibility [2,5,9]. It also examines the role of PT Kilang Pertamina Internasional in facilitating this empowerment process in Sungai Rebo Village.

2. Material and methods

The participatory implementation of an Integrated Farming System (IFS) as part of the CSR (Environmental Social Responsibility) program by PT Kilang Pertamina Internasional Refinery Unit III Plaju in Sungai Rebo Village, South Sumatra, is the primary focus of this research, which employs a qualitative descriptive methodology with a case study framework. The qualitative approach is implemented to conduct a comprehensive examination of stakeholder engagement, local perspectives, and social dynamics [20].

The study was conducted in Sungai Rebo Village, located close to the operational area of PT Kilang Pertamina Internasional in Plaju, South Sumatra Indonesia. The location was selected purposively due to the implementation of the company's CSR-based integrated agricultural initiative. Participants in the study included:

- 10 local farmers involved in the Rice-Fish IFS program,
- Village officials and community leaders,
- Program facilitators or agricultural extension workers,
- CSR officers from PT Kilang Pertamina Internasional. Purposive sampling was applied to select informants with direct involvement and pertinent experience in the program.

The research utilized many data collection methods to guarantee triangulation and data validity:

- In-depth Interviews: Executed with chosen participants via semi-structured enquiries to obtain qualitative insights into participation, perspectives, and the program's impacts.
- Observation: Non-participant observation was undertaken during agricultural activities, training sessions, and community gatherings to comprehend the actual implementation and engagement process.
- Documentation Review: Internal reports, CSR planning documents, farmer training materials, and monitoring data were examined to enhance primary data sources

3. Results and discussion

3.1. The Function of Participatory Methods in the Development and Execution of Integrated Farming Systems

The research indicated that a participatory methodology markedly improved the design and execution of the Rice-Fish Integrated Farming System (IFS) in Sungai Rebo Village. Agriculturalists participated in planning discussions, land preparation, training sessions, and decision-making processes. This comprehensive participation enhanced community ownership of the initiative and encouraged local farmers to provide resources, including labour and expertise [11,22,24].

These findings indicate that engagement enhances program acceptance and sustainability. Local expertise was integrated into technical determinations, including crop rotation plans and livestock integration, enhancing the

program's contextual relevance and acceptability [24,31,36]. Nonetheless, difficulties were observed in the initial phases, including inadequate communication between firm personnel and certain farmer groups. This was subsequently resolved through the establishment of community-based working groups coordinated by Pertamina and local leaders [25,26].

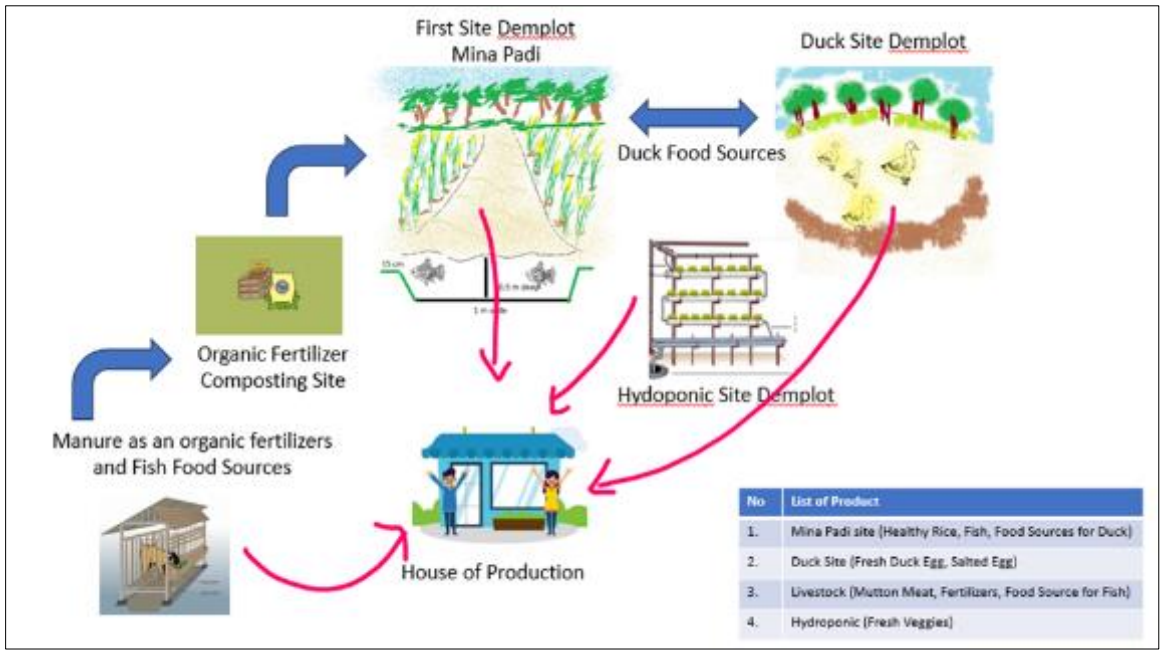

Figure 1 Integrated Demo Plot System for Sustainable Food Production

The rice-fish IFS system is a polyculture system based on the potential for reciprocal benefits. To make this happen, channels are built in previously flat rice fields so that fish can continue to develop even during the rice harvest and dry seasons [30]. Before creating rice fields, rice fields can be fed organic fertilizer as much as 4.5–5.25 tons per hectare [31,36]. Organic fertilizers are applied again during the main planting season 2 times at a dose of roughly 3 tons per hectare in one month [32].

This fertilizer supplies nutrients for rice and additional cultures of plankton and benthos that are utilized as fish feed. Not only as a fertilizer and food source, it may also serve as a plant pesticide to fight the attack of some insects on rice plants [34]. During the primary growing season, extra feed complements the plankton and benthose cultures and is supplied once or twice a day. The supplemental feed comprises fishmeal and rice bran. The next fish stocking is carried out when the rice plants are about 2-3 months old. Fish are seeded at a rate of 0.25 to 1 per square meter [35,37]. Unwanted fish or invasive species can harm the mutualistic interaction between rice and fish, and hence lower productivity [38]. For example, in the Integrated Rice-Swamp Aquaculture Model, catfish, snakehead fish (*Channa argus*), and rice field eel (*Monopterus albus*) are considered undesirable species. In the rice-fish demonstration plot, Rice-Fish IFS used a type of fish of Oreochromis niloticus known as Nile Tilapia [36].

Rice and fish will create a mutualistic relationship, both profit from growing together. Rice provides protection and shade for fish and lower water temperatures, along with herbivorous insects and other small animals that feed on rice [37,38]. Rice benefits from nitrogen emissions from fish, while fish reduces insect pests such as brown leafhoppers, illnesses such as rice leaf blight, and weeds. By reducing weeds, competition for nutrients is decreased [39,43]. The CO2 generated by fish can be used in photosynthesis by rice [39,36]. The continual movement of fish allows for loosening of surface soils which can boost oxygen levels by increasing the amount of dissolved oxygen. As a result, the activity of microorganisms improves and they create more useable nutrients, which will allow for increased nutrient uptake for rice [53]. Other benefits of fish movement are enhancing the mineralization of organic matter, optimizing the release of nutrients in the soil, accelerating the process of decomposition of fertilizers and therefore boosting the effectiveness of fertilizers and promoting the development of rice roots [54,6,11].

3.2. Impact of Integrated Farming Systems on the Economic, Social, and Environmental Conditions of Local Farmers

Rice-Fish IFS has a beneficial impact on farmers' net profitability. In the demonstration plot, the net profit reached more than 50% when utilizing Rice-Fish IFS, larger than with rice monoculture. In other sections of the Java archipelago, net profit might hit between 45% and 270%. Globally, the adoption of Rice-Fish IFS has delivered maximum benefits for farmers. However, there are also occurrences of net profit losses discovered in Thailand with just 80% of the profitability of rice monocultures [40]. This may be owing to the initial investment necessary while launching the system [41,42]. The implementation of the rice mina method has resulted in an increase in rice output and productivity from 6.7–7.5 tons per hectare and simultaneously from 0.75–2.25 tons per hectare of fish [43]. The Rice-Fish IFS system represents a viable tourism attraction, as this method generates a distinctive landscape. The addition of fish will diversify agricultural production, boost food security, and produce money; Halwart and Gupta suggest that if this would also increase rice yields and minimize the need for fertilizers and pesticides, then this is a "added bonus". As a pest and weed management, Rice-Fish IFS employs fewer chemicals (such as insecticides and herbicides), therefore minimizing the emission of these agricultural chemicals into the environment. Fish-planted rice fields are known to require 20% less fertilizer and 75% less pesticides compared to rice cultivated without pesticides [24,43,55]. In addition, farmers generally prefer not to use pesticides, to avoid harm to fish [39]. In addition, Rice-Fish IFS can minimize methane emissions compared to rice monocultures. Rice paddies are a major contributor of greenhouse gases from the agricultural sector, which contributes to climate change, mainly because when flooded, as is often the case in regular cycles, rice paddies support methanogenic bacteria; overall, rice paddies contribute about 10% of the global greenhouse effect [24,38]. Rice-fish systems may be able to contribute to the reduction of methane emissions on a worldwide scale. Climate change concerns global food supply because it generates many changes to regional weather, such as greater temperatures, high rainfall, and storms [51,52]. These changes can lead to pest outbreaks, for example, an increase in the number of leafhoppers and stem borers. Rice-Fish IFS offers potential benefits in future climates as the system has more reliability and stability than rice monocultures in the face of changing weather patterns [31,43]. Diversified agricultural ecosystems tend to be more robust to climate change, make better use of resources, and sustain a wide range of ecosystem services [31].

The Rice-Fish IFS initiative resulted in numerous beneficial outcomes. Farmers indicated enhanced income through varied production, particularly by integrating rice agriculture with catfish aquaculture and small animals such as goats or chickens [11,22]. Production surpluses were marketed locally, bolstering household financial stability. The program enhanced community cohesion through collaborative farming practices and communal infrastructure, such as fish ponds and composting units [43,51]. The repurposing of organic waste into compost and animal feed promotes sustainability and diminishes dependence on chemical inputs. These results align with the observations of [3][4], who indicated that Rice-Fish IFS models improve livelihood security while fostering environmental sustainability. The farmers' enhanced proficiency in organic agriculture and compost generation indicated a transition to environmentally sustainable techniques [6,11].

3.3. Contribution of PT Kilang Pertamina Internasional's CSR Program to Community Empowerment and Rural Development

The research indicated that PT Kilang Pertamina Internasional significantly contributed to community empowerment [27,32]. The corporation, via its CSR project, offered technical training, startup kits (including seeds, fish fingerlings, and cattle), and access to experienced advisors [44,45]. Significantly, Pertamina functioned as a facilitator rather than a hierarchical benefactor, fostering self-sufficiency among community members [11,15]. The program's alignment with Sustainable Development Goals (SDGs)—especially those concerning poverty alleviation, responsible consumerism, and climate action—illustrated the overarching developmental purpose of corporate social responsibility [32,42,29]. The effort established trust between the corporation and the local community, promoting a model of shared value. Nonetheless, enduring success relies on institutional continuity, since several farmers voiced apprehension regarding the durability of assistance following the conclusion of the CSR program [47,48,49].

3.4. Challenges and Success Factors in Implementing Participatory-Based CSR Programs in Rural Agricultural Settings

Several essential success factors emerged from this programme. Strong leadership by village authorities provided crucial coordination and legitimacy [15]. Ongoing backing from Pertamina staff and local agricultural extension agents offered technical advice and resources, ensuring continuity [31,6]. Moreover, demonstration plots and interactive, hands-on teaching methods effectively conveyed new farming techniques, boosting farmer confidence and uptake [15,31].

Figure 2 Sungai Rebo Village Area, Community and CSR Pertamina Team

However, notable challenges included: uneven participation across demographic groups, with women and the elderly significantly less involved [18]; early scepticism toward innovative agricultural methods, slowing adoption; and initial dependence on external resources or subsidies, risking long-term sustainability. Recent studies substantiate these points [50.51,52]. For example, a randomized-controlled trial in India found that community-led institutions—especially women's groups—enhanced adoption rates and capacity-building compared to top-down interventions [27,28] Likewise, a 2024 systematic review emphasized that gender norms and unequal participation can hinder innovation, while empowering women with resources and decision-making boosts outcomes. These align well with [53,54,55], who highlighted the importance of institutional support, adaptive learning, and capacity-strengthening in participatory rural development. Thus, the Sungai Rebo case illustrates that success depends on leadership, sustained institutional backing, practical demonstrations, and inclusive engagement—while cautioning against initial reliance on external subsidies and the necessity of addressing social participation barriers.

4. Conclusion

This study illustrates that a participatory methodology in the execution of Rice-Fish Integrated Farming Systems (IFS), bolstered by the Environmental Social Responsibility (CSR) initiative of PT Kilang Pertamina Internasional Refinery Unit III Plaju, has substantially empowered farmers in Sungai Rebo Village, South Sumatra. The subsequent conclusions may be inferred:

- The active involvement of farmers in the planning, execution, and evaluation phases of the Rice-Fish IFS program has fostered a profound sense of ownership and accountability, thereby enhancing the program's sustainability.
- The Rice-Fish IFS model, integrating crop farming, aquaculture, and livestock, has enhanced the economic resilience of local households, fortified social cohesiveness, and encouraged environmentally sustainable practices.
- The CSR program of PT Kilang Pertamina Internasional has been instrumental in promoting community empowerment by not only supplying resources but also by cultivating self-sufficiency through training, mentoring, and participatory facilitation.
- Notwithstanding its overall effectiveness, the program encountered multiple hurdles, including disproportionate involvement among demographics and initial reliance on external support.

Nonetheless, these challenges were partially alleviated by robust local leadership and flexible facilitation strategies. These findings validate the importance of combining community engagement with corporate social responsibility to attain sustainable rural development.

Recommendation

In light of the study's findings, the subsequent recommendations are:

- Enhance capacity-building for all agricultural collectives, particularly marginalised groups such as women and youth, to guarantee inclusive and equitable engagement.
- Establish local ownership of the Rice-Fish IFS program by creating farmer cooperatives or community-based organisations capable of sustaining the initiative beyond the CSR funding cycle.
- Establish a monitoring and evaluation structure that incorporates community stakeholders to assess progress, identify obstacles, and facilitate ongoing enhancement.
- PT Kilang Pertamina Internasional should duplicate and expand its participatory Rice-Fish IFS concept to additional communities within its operational region, utilising Sungai Rebo as a benchmark best practice model.

Government agencies and NGOs should be urged to work with business sector CSR projects to enhance outreach, pool resources, and amplify impact in rural agricultural development

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

All participants were informed about the study and provided their consent to participate.

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