

*Learning of Glutinous Rice Community Achieves Sustainable Development Goals (SDGs)
in Sakon Nakhon Province, Thailand*

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Abstract

The production and consumption of glutinous rice has been a vital part of the local culture and daily lives of the farmers in the Greater Mekong sub-region. The production of glutinous rice provides food security to rural farmers and consumers even in the face of economic, social, and environmental changes. This paper presents the process we used to develop farmer performance and community enterprise towards food security, family and community security, and preservation of biological and cultural assets. The researchers used Participatory Action Research Methodology in Organic Glutinous Rice Seed Community Enterprises and Na Yor Community Enterprise. The research approach involved the principal participation of the stakeholders, including observation, community preparation, lesson learning, knowledge transfer, experimentation, follow-up, and appraisal. The researchers used production standards as mechanisms for development toward SDGs. The study found that a deliberate process eventually brought about an increase in revenue of 19% per month for selling rice seed and processing products. The community enterprises got the certification of organic rice production standards and food safety standards for local wisdom rice production. The researchers discovered more than 30 indigenous glutinous rice varieties in the community and isolated them for future use. We still have the project impact on environmentally friendly production that can reduce the carbon-free more than 10 kg.CO₂e, highlighted the importance of inherited wisdom for learning, and strong networks among government and private sectors. Now the community enterprise is the learning center for other communities and change to be SDGs Localization learning area of Thailand.

Keywords: Glutinous Rice, Sustainable Development Goals, Community

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Introduction

The Mekong region is where most glutinous rice is grown. The biodiversity of glutinous rice varieties in both the Mekong sub-region and Thailand are uniquely important to the communities that exist along the Mekong River. Both sticky and non-sticky rice varieties are widely consumed in Thailand, with the northern and northeastern regions of the country producing and consuming the most glutinous rice (Falvey, 2010). The farmers, the majority of whom are elderly, have been planting glutinous rice for more than 30 years, and typically utilize terrain that primarily relies on rainfall for harvest. While there are many other types of glutinous rice, the most popular cultivar among these farmers is RD6, which they cultivate from seed. However, the farmers don't have a sufficient supply of certified glutinous rice seeds or high-quality seeds, which requires they purchase seed from the government.

Glutinous rice is utilized in the northeast as a regional product for consumption (Suebongsang, Ekasingh, & Cramb, 2020), as well as in traditional ceremonies, including the 'Boon Khao Jee, Boon Jak Khao' ceremony and various other religious and auspicious rituals. However, the majority of glutinous rice products in the community, such as grains, brown rice, Hang Rice, Khao Mao (pounded unripe rice), snacks, and various other rice-based products (Figure 1), do not meet safety standards (Sattaka, 2019).

The aim of this project is to enhance food security, family well-being, and preserve biological and cultural assets. These goals align with the Sustainable Development Goals (SDGs) associated with social, economic, and environmental conservation. This project also seeks to improve seed production and conservation by ensuring that glutinous rice seed meets established standards, that production processes meet Thai FDA standards, and by driving marketing and tourism initiatives in Sakon Nakhon province. This paper will in turn present both the results and lessons learned stemming from this project.



Figure 1: Glutinous rice products

Glutinous Rice in Thailand

Currently, Thailand, Vietnam, and Laos are the top glutinous rice producing countries in the world, producing a total of around 12 million tons. Approximately 6.0 million tons of glutinous rice are produced in Thailand, followed by 3.5 million tons in Vietnam and 3.2 million tons in Laos. The Department of Internal Trade, pursuant to Ministry of Commerce policies, has projected the demand for rice in 2023 to be 27.6 million tons. Therefore, the Rice Department has set the rice production target for 2022/23 at 30 million tons of unmilled rice, divided into 9.1 million tons of jasmine rice, 1.8 million tons of Pathumthani fragrant rice (Thai fragrant rice), 12.9 million tons of white rice (non-waxy rice), 6 million tons of glutinous rice, and 0.2 million tons of niche market rice. Production of Pathum Thani fragrant rice, white rice, sticky rice, and niche market rice is expected to hit 2022/23 targets, except

for jasmine rice, which at 2.3 million tons of rice is expected to exceed its production target (Office of Agricultural Economics, 2022).

Thailand's sticky rice export volume in 2022 was 170,000 tons of milled rice, accounting for 2.2% of the total export volume for that year. The main export market for Thai sticky rice in 2022 was China (42.9%) followed by Laos (11.8%), the United States (10.8%), and Vietnam (6.4%). In 2023, the export volume of Thai sticky rice in the first four months was 0.05 million tons with a value of 32.4 million USD, decreasing -19.8% year over year (YoY) for 2022 and -7.3% (YoY) for 2023. The average export price is 724.5 USD per ton (+15.1% YoY). The main export market for Thai sticky rice in the first four months of 2023 was China (47.1%), followed by the United States (13.1%), Laos (7.6%), Vietnam (5.5%) and Hong Kong (3.3 %) (Sowcharoensuk, 2023).

Glutinous Rice Utilization

For Thai people, glutinous rice is not only a matter of food security but is also a crucial aspect of local culture and daily life (Singanusong & Mingyai, 2019). In rural areas, particularly in the northeastern region of Thailand, the per-person consumption of glutinous rice is approximately 120 kilograms per year, while in Bangkok, it averages just under 80 kilograms per person per year. This difference is notable, especially among those in Bangkok who have migrated for work from the northeastern and northern regions. Glutinous rice is rich in nutrients, approximately 80% of which is starch. Additionally, it contains various beneficial micronutrients, including minerals such as phosphorus, iron, calcium, and vitamins B and E. Moreover, it features active biological ingredients such as phenolic compounds and flavonoids, which possess antioxidant properties (Phanthurat & Thatsanasuwan, 2023). Thus, consuming glutinous rice not only provides energy but also offers high nutritional value.

Glutinous rice has been utilized not just for edible products but for non-edible products as well. Glutinous rice is occasionally used on an industrial scale for products such as rice flour, beverages, and cosmetics. Most local community processing involves primary processing, focusing on the creation of various desserts for household consumption and sale to the public. Farmers, ranging from the household level to the enterprise level, leverage their expert knowledge of glutinous rice cultivation to diversify into other products, such as brown rice, Hang rice, Khaotan (rice cracker), Khao Mao, Khao Tom Mad (bananas with glutinous rice), Khaomak (sweet fermented rice), rice wine, and rice toffee (Sattaka, Muengpak, Xuan, & Mueangkhot, 2020). While some of these products adhere to food safety standards, others do not. Therefore, supporting and encouraging the adoption of glutinous rice production standards, such as GAP (Good Agricultural Practice), Organic, and Food Safety Standards of the Food and Drug Administration, provides an opportunity to expand marketing channels and reduce environmental impacts.

Dao Laum Deuan (DLD) Community Enterprise

DLD, an organic glutinous rice seed community enterprise consisting of 8 communities, is located around the Chalermphrakiat Sakon Nakhon campus of Kasetsart University. Although cultivating rice from certified organic rice seeds is necessary to produce organic rice, for more than 10 years these communities have been producing rice from seed from their own harvests. Because this seed often fails to meet certified health and quality standards, the quality of the rice grown from that seed inevitably suffers, which in turn lowers rice production and results in insufficient rice for local consumption. This situation has

prompted the authorities in Sakon Nakhon province to launch policies to support the local organic rice production in the area. The ultimate goal is to increase production capacity and production yields in order to ensure local food security, encourage job security, and boost the community's income.

Na Yor Community Enterprise

At Na Yor community enterprise, Khao Mao is produced by over 200 households, making it the largest Khao Mao producing community in Sakon Nakhon province. Production involves cultivation of various varieties of glutinous rice. However, the farmers have not conducted soil quality analyses nor have they implemented soil improvement practices for rice cultivation quality. Additionally, the presence of mixed seeds in the paddy fields has negatively impacted production yields. Thus, the researchers initiated a project aimed at enhancing the safety standards of Pounded Unripe Rice in order to boost farmers' income and ensure the sustainability of the quality of life. The research goal is to obtain Thai FDA food safety standard certification for Khao Mao or Pounded Unripe Rice. Thus, the project employs production standards in order to achieve Sustainable Development Goals (SDGs) and to reduce negative environmental impacts. For glutinous rice seed, we adhere to the seed standard of the Ministry of Rice, implement the Good Agricultural Practices (GAP) standard for production management, and follow food safety standards for Kaow Mao production.

Methodology

The participatory action research methodology implemented by the 93 members of the organic rice community enterprises in DLD and Na Yor is in shown in Figure 2. The process is comprised of:

1. Prepare the community to explore the problem and to document relevant economic and social factors.
2. Reflecting on the problems raised in the discussions. This enabled the researchers to discover the actual needs of the community, and to provide the appropriate training.
3. Knowledge transfer to farmers and their descendants related to soil improvement, seed production, rice production management, and glutinous rice processing. This enabled the famers to successfully achieve certifications in seed standards, production standards and Thai FDA standards.
4. Follow-up.

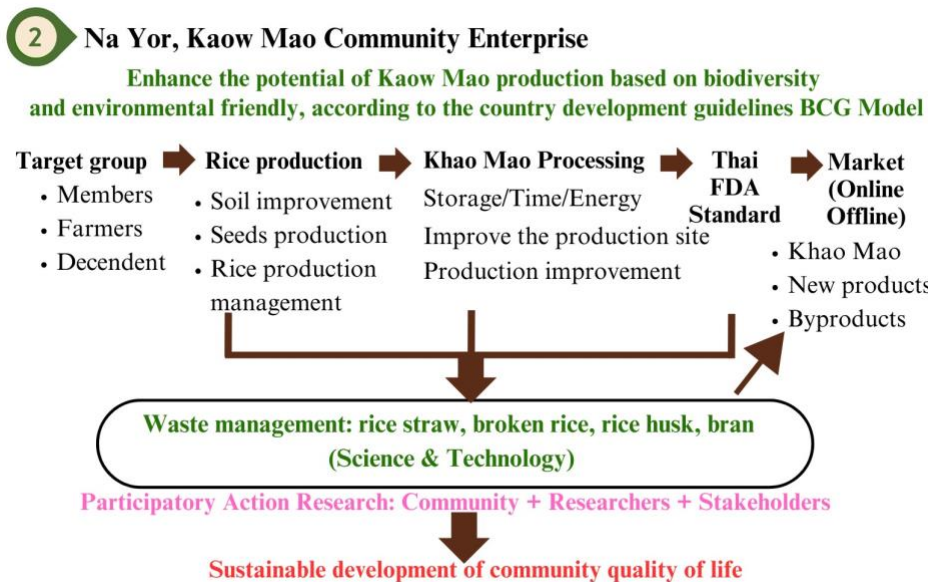


Figure 2: Research methodology of DLD and Na Yor Community Enterprise

Data Collection

The data were collected through a combination of group meetings, lessons learned sessions, observations, and scheduled interviews. The interviews were designed to include baseline socio-economic information and detailed insights into the existing glutinous rice production processes. It also covered knowledge about Rice Department, adherence to organic rice standards and Good Agricultural Practices (GAP) for rice production management, and compliance with glutinous rice food safety standards.

Data Analysis

Descriptive analysis was employed, drawing insights from group meetings, lessons learned sessions, observations, and interviews. The knowledge gathered from the research, combined with community input, was subsequently synthesized. Descriptive statistics, including percentages, averages, standard deviations, and statistical references such as social and

economic background, encouragement in glutinous rice production, and knowledge of glutinous rice production and organic rice production/GAP, were utilized. This comprehensive analysis aimed to assess the glutinous rice community learned with regards to achieving sustainable development goals.

Result

1. DLD, Organic Glutinous Rice Seed Community Enterprise

In the process of producing organic glutinous rice seeds that meet both seed and organic standards, participants not only acquire knowledge through expert training but also benefit from the experience and success of seed producers. This learning approach instills motivation among members of the glutinous rice production community to meet production standards. This is particularly crucial in group production, where the formulation of clear goals and agreements is essential for the collective strength and stability of the group. The organic rice field has been identified as a complex and challenging system, evolving over time under the ongoing influence of technology and environment. Its performance is contingent upon the intricate interplay of numerous interacting elements (Orlando et al., 2020). Drawing insights from the lessons learned by the DLD Organic Rice Seed Community Enterprise Group (Figure 3), the project aims to:

- Establish shared goals and communicate operational procedures to all members.
- Evaluate operational outcomes, and identify challenges and obstacles.
- Facilitate the exchange of information and knowledge to devise effective solutions for overcoming obstacles and ensuring success in seed production.
- Strategically plan and coordinate overall production operations.



Figure 3: Meeting of DLD Organic Rice Seed Community Enterprise

The DLD members share a common goal of producing organic glutinous rice seeds to enhance sustainability in agriculture. The production process for agricultural glutinous rice relies on a rainfed system, emphasizing the dependence on natural rainfall rather than irrigation for cultivation. Most farmers, with an average age of over 50, have a basic level of education. Most agricultural areas consist of small land plots, approximately 2 hectares in size, with glutinous rice production falling below the national average for rice production. By promoting the production of organic glutinous rice seeds through participatory learning and training methods, every farmer involved in the project gains a deeper understanding. Most farmers understand the necessity of avoiding the mixing of seeds with chemicals, and that the cultivation of off-season rice should be conducted in areas with ample water sources. Farmers have acquired increased knowledge, particularly with regards to rice seeds, soil preparation, weed prevention, and disease and pest prevention. Additionally, there is an emphasis on proper storage practices. This enables them to plan their production in accordance with both

non-organic and organic rice seed standards. The study revealed that farmers effectively applied their knowledge by adhering to the principles of producing organic rice seeds. This aligns with the findings of the study by Issahaku *et al.*, which reported that the training resulted in benefits leading to changes in participants' socio-economic statuses and cognitive improvements (Issahaku, Obeng, Akudugu, & Yeboah, 2022). Over 95% of farmers placed significant emphasis on crucial practices, including the use of seeds free from chemical mixtures, avoiding growth promoters and chemical fertilizers, ensuring thorough drying of rice before storage, and selecting storage locations with proper ventilation. However, 28% of farmers did not follow the recommended practice of cutting mixed rice during the tillering and flowering stages. Additionally, 23% of farmers showed a tendency to neglect the use of green manure for soil improvement and the regular weed removal.

By participating in the project, farmers acquired enhanced knowledge and skills, specifically in regards to adhering to both organic and non-organic rice seed standards. Despite this progress, members found it necessary to fine-tune their practices further to achieve optimal production results for food security and job security. Glutinous rice seeds that do not meet seed standards, and sticky rice produced in excess of farmers' needs, are offered for sale, which creates jobs and additional income for farmers. This led to an increase in revenue (Figure 4) and reinforced food safety standards set by the Thai FDA. As a result, the DLD has become a learning center for glutinous rice product development, and a model for other communities.



Figure 4: Glutinous rice seeds of DLD Organic Rice Seed Community Enterprise

2. Na Yor Community Enterprise

The aim is to enhance the potential of Khao Mao production in Figure 5 to meet safety standards, thereby fostering sustainable increases in income and the quality of life. This is achieved through participatory research processes that involve preparing communities and collaborating with network partners. The approach includes problem analysis, the establishment of action plans, the transfer of operational knowledge, and the exchange of information in the area. The process is closely monitored, and collaborative efforts are directed accordingly. The operations are structured into three crucial components, each adhering to specific standards: the quality of native glutinous rice seeds used in Khao Mao production with seed standard of Thai Ministry of Rice, the management of the rice production system with GAP standards, and the production of Khao Mao per Thai FDA standards, ensuring environmental friendliness.



Figure 5: Khao Mao or Pounded Unripe Rice

The operational results revealed that the Nar Yor Community has over 30 varieties of native glutinous rice (Figure 6). After the seed production knowledge transfer gained from training and hands-on field experience, farmers were able to produce seed with a remarkable purity range of 97-100%. Contamination from other rice varieties was minimal, accounting for less than 3%, while the germination percentage ranged between 97-100%. Additionally, the humidity level was maintained at 10-14%.

In the rice production management, soil quality is analyzed before applying the appropriate amount of fertilizer. In addition, the emphasis is on not burning stubble, which produces pollutants dangerous to both humans and the environment and destroys soil fertility, but rather on plowing it down and utilizing it as fertilizer to mitigate environmental impact. Therefore, properly managed crop stubbles have the potential to offer significant economic benefits to farmers while also serving as a means to protect the environment from severe pollution (Abdurrahman, Chaki, & Saini, 2020).



Figure 6: Biodiversity of native glutinous rice for Khao Mao production

In the effort to enhance the production efficiency of Khao Mao to meet safety standards, it was discovered that farmers engaged in Khao Mao production lacked knowledge about food safety standards and did not know how to apply Thai FDA standards. Subsequently, the research conducted an assessment of farmers' knowledge before transferring information on rice production to meet safety standards, yielding an average pre-test score of 19. Following the knowledge transfer, the farmers' average knowledge score significantly increased to 19.24 out of a possible full score of 25. The most common misunderstanding among farmers pertains to the cleaning of machine tools in rice production, emphasizing the necessity to clean them both before and after each use. Additionally, it's crucial to ensure that livestock

pens or animal-raising areas are not located near the rice production site. During work, it is mandatory to wear a hair covering, and the use of jewelry is prohibited while making Khao Mao.

Developing the production of Khao Mao to Thai FDA standards has led to significant improvements in the area and production process in Figure 7. The main points include refraining from activities that create dust and smoke, installing a wastewater treatment tank, and adjusting the production process to align with environmental standards. By shifting from firewood to liquid propane gas for energy in Khao Mao production, the quality of the rice has been maintained, and dust and smoke reduced. This has resulted in a notable reduction of about 19% in production costs while meeting the stringent standards set by the Thai FDA. Additionally, the carbon footprint associated with Khao Mao production has substantially decreased, dropping from 10 kg of CO₂ per 1 kg of Khao Mao to just 0.12 kg CO₂ after the improvements.



Figure 7: Developing the production of Khao Mao to Thai FDA standards

Conclusions: Learning of Community Achieves SDGs

In the pursuit of achieving the SDGs, we employ the Bio, Circular, and Green Economy Model (BCG Model). Our focus is on preserving the biodiversity of rice species, enhancing the production process to meet established standards, and utilizing waste efficiently. Glutinous rice community development aims to establish career stability and generate incomes to achieve SDGs. For the lessons learned from the project, we must:

- Develop primarily based on the needs of the community.
- Encourage participation at every stage of development with farmers in the community.
- Develop production from upstream, middle stream, downstream to meet production standards and environmental criteria.
- Select and adapt technology to the local context, considering available resources and biodiversity.
- Transfer relevant knowledge into practical application in the area.
- Transfer appropriate knowledge to upskill and reskill the community.
- Continue development with people of all ages to achieve sustainable development in the community.
- Elevate production to meet safety and environmentally friendly standards.
- Implement strong community enterprise management practices.
- Establish a robust network of partners to support ongoing development.
- Share, develop a network, and expand results to create a learning society.

Furthermore, the acquisition of agricultural knowledge and information, crucial for achieving the SDGs, is positively correlated with farmers' perceptions. Researchers recommend enhancing farmers' access to education, training, and information, as well as fostering collaboration with stakeholders. These measures are proposed to have a positive impact and increase the utilization of agricultural knowledge and information (Maldayo, Senapathy, & Bojago, 2024). Additionally, positive impacts on socioeconomic factors were found to be significantly associated with the learning methods employed by extension agents and the participatory monitoring and evaluation of smallholder farmer extension activities (Odongo, Opiyo, Mwesigye, & Bariyo, 2023).

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References

- Abdurrahman, M. I., Chaki, S., & Saini, G. (2020). Stubble burning: Effects on health & environment, regulations and management practices. *Environmental Advances*, 2, 100011. <https://doi.org/10.1016/j.envadv.2020.100011>
- Issahaku, A., Obeng, F. K., Akudugu, A., & Yeboah, R. W. N. (2022). Training of Rice Farmers and Its Effect on Socio-Economic Assets Acquisition and Change in Status. *Business Management and Strategy*, 13(2), 1. <https://doi.org/10.5296/bms.v13i2.19973>
- Maldayo, E., Senapathy, M., & Bojago, E. (2024). Determinants of agricultural knowledge and information usage to achieve SDGs: Misrak Badawacho district, Southern Ethiopia. *Journal of Agriculture and Food Research*, 15, 100912. <https://doi.org/10.1016/j.jafr.2023.100912>
- Odongo, H. J., Opiyo, A., Mwesigye, A., & Bariyo, R. (2023). Contribution of Pluralistic Agriculture Extension Service Provision to Smallholder Farmer Resilience. *Journal of Sustainable Development*, 16(6), 79. <https://doi.org/10.5539/jsd.v16n6p79>
- Orlando, F., Alali, S., Vaglia, V., Pagliarino, E., Bacenetti, J., Bocchi, S., & Bocchi, S. (2020). Participatory approach for developing knowledge on organic rice farming: Management strategies and productive performance. *Agricultural Systems*, 178, 102739. <https://doi.org/10.1016/j.agsy.2019.102739>
- Phanthurat, N., & Thatsanasuwan, N. (2023). A comparative study regrading traditional cooking processes in Northern Thailand influence phytochemical content, antioxidant capacity and inhibition of key enzyme activity in glutinous rice. *Journal of Agriculture and Food Research*, 14, 100820. <https://doi.org/10.1016/j.jafr.2023.100820>
- Sattaka, P. (2019). Potential development of glutinous rice community towards new agricultural tourism in upper northeastern Thailand. *Journal of the International Society for Southeast Asian Agricultural Sciences*, 25(1), 92–103. <http://issaasphil.org/wp-content/uploads/2019/06/9.-Sattaka-2019-Potential-Development-of-Glutinous-Rice-Community-FINAL.pdf>
- Sattaka, P., Muengpak, S., Xuan, H. P., & Mueangkhot, T. (2020). Comparison of glutinous rice production systems for sustainable development in Sakon Nakhon Province. *Journal of the International Society for Southeast Asian Agricultural Sciences*, 26(1), 54–62. <http://issaasphil.org/wp-content/uploads/2020/06/5.-Sattaka-et-al-2020-Comparison-of-Glutinous-rice-Production-System-FINAL.pdf>
- Singanusong, R & Mingyai, S. (2019). Value creation and addition of rice and its significance to Thai culture. *Journal of Nutritional Science and Vitaminology*, 65, S75-S79. <https://doi.org/10.3177/jnsv.65.S75>

Sowcharoensuk, C. (2023). *Trend of Business/Industry 2023-2025: Rice Industry*.
<https://www.krungsri.com/th/research/industry/industry-outlook/agriculture/rice/io/io-rice-2023-2025>

Suebpongsang, P., Ekasingh, B., & Cramb, R. (2020). *White Gold: The Commercialization of Rice Farming in the Lower Mekong Basin* (pp. 39–68).

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