International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EESs)
Available online on: http://ijasrt.iau-shoushtar.ac.ir
ISSN: 2251-7588 Print
ISSN: 2251-7596 Online
2025: 15(3): 151-159
[10.71505/ijasrt.2025.1209792](https://doi.org/10.71505/ijasrt.2025.1209792)

Received: 13 June 2025
Reviewed: 10 July 2025
Revised: 18 July 2025
Accepted: 07 August 2025

Sustainable Agriculture Network of Organic Rice Production: The Model of Community Enterprise in Phayao Province, Thailand

Wasna Pithakpol[1], Bungon Sawatsuk[2*], Somchart Tana[1], Yodsawat Khamsamut[1], and Chitnarong Sirisathitkul[3]

[1]School of Agriculture and Natural Resources, The University of Phayao. Muang District, Phayao Province 56000, Thailand
[2]School of Business and Communication Arts, The University of Phayao, Muang District, Phayao Province 56000, Thailand
[3]School of Science, Walailak University, Thasala District, Nakhon Si Thammarat Province 89160, Thailand
**Corresponding author's email: bungon.sa@up.ac.th*

Keywords
Organic Farming, Rice Production, Community Enterprise, Sustainable Agriculture

Abstract

Organic rice farming faces challenges of rising input costs and limited scalability. This study investigates a sustainable solution through the Dok Kham Tai Community Enterprise Model in Phayao Province, Thailand, which promotes a networked, community-based approach to organic jasmine rice production. The model emphasizes collective action and knowledge sharing among local farmers. Using field observations, in-depth interviews with 15 community members, and quantitative assessments, the study evaluates the impact of shifting from individual to group-based organic farming. Results show that the integration of technology and shared resource management led to an 11.10% increase in rice yields, while production costs rose by 10.89%, resulting in an overall net economic benefit for participating farmers. Additionally, collective marketing strategies improved product value and strengthened community identity. The findings underscore the potential of community enterprise models to enhance sustainability, reduce chemical usage, and improve livelihoods, offering a replicable framework for organic agriculture in similar rural contexts.

1. Introduction

Global rice (paddy) production trends since 1961 have witnessed a remarkable increase, surpassing threefold from 215 million tons to 755 million tons. Most of this production originated from Asia. Notably, seven Asian countries—China, India, Indonesia, Bangladesh, Vietnam, Myanmar, and Thailand—contribute significantly, collectively representing over 80% of the world's rice production. Additionally, there has been a substantial rise in rice production in Africa, experiencing an almost ninefold increase. Key producers in this region include Egypt, Nigeria, and Madagascar. Bin Rahman & Zhang (2023) revealed the trend in global rice consumption that per capita rice consumption in Asia surpasses that of all other regions, with an annual average exceeding 77 kg per person. From 2018 to 2020, the rice consumption per capita in Latin America and the Caribbean, Africa, Europe, Oceania, and North America ranged from 6.3 to 28.0 kg. In Asia, rice consumption in high-income countries, like Japan and South Korea, is witnessing a decline. For instance, South Korea's per capita rice consumption dropped from 106 kg in 1975–1977 to 60kg in 2020 and is anticipated to further decrease to 53 kg by 2030. On the contrary, per capita rice consumption is on the rise in certain low-income Asian countries, including Indonesia, the Philippines, Bangladesh, and Vietnam. In the Philippines, rice consumption per capita increased from 85kg in 1975–1977 to 122 kg in 2020 and is projected to further increase to 129kg by 2030 (OECD-FAO, 2021).

Thailand, recognized as one of the world's leading producers and exporters of rice, concentrates its major rice cultivation areas in the northeast region, as well as in the lower north and central plains of the Chao Phraya River basin. Approximately 70% of Thailand's rice cultivation is rainfed, while the irrigated area, primarily situated in the

Chao Phraya river basin, contributes to 49% of the total annual rice production (Kupkanchanakul, 2000; USDA-FAS, 2015). During the 2020–2021 rice crop season, the Office of Agricultural Economics (2023) estimated a total planting area of 24.802 million acres. This resulted in a paddy production of 27.013 million tons, with an average yield of 0.2681 kilograms per square meter. In comparison, the 2022–2023 crop season recorded a slightly smaller planting area of approximately 24.7 million acres. Despite the reduction in area, paddy production reached 26.703 million tons, with an average yield of 424 kilograms per 0.394 acres (equivalent to 0.2689 kilograms per square meter). Overall, the planting area declined by just 0.03%, while production and yield increased by 1.16% and 1.18%, respectively. The reduction in the planting area is mainly attributed to farmers switching some of their paddy fields to cultivate other crops with lower production costs, such as cassava. However, the decrease in the planting area is not substantial, as farmers still anticipate government support like in previous years. For production and yield, the increase is attributed to sufficient rainfall promoting rice growth. Thus, the overall rice production in the country is expected to increase. From April to June 2023, there is projected to be a planting area of approximately 9.04 million acres for the 2022 to 2023 rice crop, accounting for 36.45% of the total rice planting area. Additionally, from April to June 2023, the planting area for the 2022 to 2023 rice crop is projected to be approximately 17.30 acres, making up 69.82% of the total rice planting area (Office of Agricultural Economics, 2023).

The sustainability of Thailand's rice industry has been under increasing pressure from multiple challenges. In 2014, rice farmers faced a dramatic 50% drop in farm gate prices due to a fall in domestic rice prices and the termination of the government's rice-pledging scheme. Moreover, Thailand's rice export market is losing ground to competitors who continually develop high-yield, low-cost rice varieties. Farmers in Thailand's intensively cultivated lowland irrigated areas now grapple with rising input and labor costs, falling farmgate prices, water scarcity, and the overuse of agricultural inputs that harm the environment (Stuart et al., 2019). In response to these growing concerns, organic farming has emerged as a promising path forward. Driven by increasing global demand for organic products (Ministry of Agriculture and Cooperatives, 2018), Thailand has seen a steady rise in the adoption of organic agricultural practices, particularly in rice cultivation. The organic farming movement not only offers environmental benefits through reduced chemical input and improved soil health, but also provides economic advantages by meeting the premium market demand. Organic jasmine rice, in particular, has gained substantial traction both domestically and internationally. From the fiscal year 2017 to 2018, exports of organic jasmine rice surged by more than 40%. Key markets for Thailand's organic agricultural exports now include Europe, the United States, and Asia (Pithawat, 2019), reflecting the growing confidence in and demand for sustainable Thai rice products.

Organic rice farming provides consumers with environmental and health benefits, yet it presents unique production and marketing challenges. Unlike conventional rice, organic rice must meet stringent standards that prohibit synthetic chemicals, requiring farmers to adopt alternative methods for pest control, weed management, and soil fertility. These practices often demand more manual labor and technical knowledge, making organic cultivation more labor-intensive and complex. Marketing organic rice is also more nuanced (Ruaykijakarn et al., 2018). While it is generally assumed that organic rice fetches higher prices, this is not always the case. The premium depends on consumer awareness, market access, certification, and branding. Thus, farmers may face uncertainty in securing consistent financial returns. Although organic farming emphasizes cost reduction by minimizing external inputs, its operational expenses can still be high. Several research studies have investigated and compared the cost and profit structures of organic and conventional rice farming. Notably, studies conducted by Tashi and Wangchuk (2016) found that organic farming generally entails higher production costs when compared to conventional farming. Regarding crop yield, Offermann & Nieberg (2000) observed that organic crop production typically results in significantly lower yields compared to conventional farming practices. However, it is important to note that contradictory conclusions were reached in studies by Tashi and Wangchuk (2016), which suggested that organic rice productivity could be relatively higher than conventional methods. When assessing net revenues, Suwannakit & Prempree (2016) documented higher net returns coupled with lower production costs for organic rice farming. Successful organic rice farming requires specialized knowledge and skills in field management and production, making training and further education vital (Bello, 2008). To support sustainable rice cultivation in Thailand, efforts are needed to create a market and increase understanding of organic rice production (Chaiubon, et al., 2020; Methamontri et al., 2022; Patra et al., 2025).

This study addresses critical cost-related challenges in organic rice farming by introducing both process and administrative innovations within a participatory framework. It complements recent literature on the environmental dimension (Martínez-Megías et al., 2025) and the role of social and human capital (Nisak et al., 2025) in decisions to adopt organic rice farming. Process innovation includes enhancements throughout the production cycle—from seed preparation and cultivation to post-harvest activities such as drying, cleaning, and storage (Patra et al., 2025). In parallel, administrative innovation refers to novel strategies for group-based decision-making, resource sharing, and organizational management among organic rice farmers (Methamontri et al., 2022). The research focuses on the Khao Hom Dok Kham Tai group in Dok Khamtai District, Phayao Province of Thailand. Comprising 15 certified members under the Sustainable Development Goals Participatory Guarantee System (SDGsPGS) by the Sustainable Agriculture

Network of Phayao Province, this community enterprise cultivates organic jasmine rice on collectively managed land. A significant issue identified is the high labor costs at every production stage, as most members hire external workers for tasks ranging from land preparation to harvesting. Motivated by the need to support rice as Thailand's primary crop, this study highlights how group-based organic farming reduces dependency on chemicals, promotes environmental sustainability, and enhances self-reliance through natural farming practices. It compares the production costs of conventional, individual organic, and group-based organic methods, demonstrating how collective models reduce costs, improve efficiency, and better meet market demand. The study also underscores the role of strong leadership and external mentorship in ensuring quality certification and long-term sustainability in organic rice production.

2. Materials and Methods

2.1 Study area and sample size

Phayao Province in northern Thailand encompasses 592,682 acres of agricultural land, representing 37.98% of the province's total area of 1.56 million acres. Among these, 287,526 acres are allocated for rice cultivation, 120,658 acres for upland crops, and 142,082 acres for orchards. Of the total agricultural land, 246,250 acres lie within irrigation zones and 345,812 acres outside them. During the 2021–2022 planting season, 252,212 acres were devoted to rice cultivation, slightly decreasing to 250,912 acres in 2022–2023. In 2022, organic agriculture in Phayao Province covered 1,577 acres, with 648 farmers certified under the SDGs Participatory Guarantee System (SDGsPGS). Of this, 858 acres were farmed individually (by 45 farmers), while group farming covered 717.188 acres, consisting of 299 farmers, including 26.792 acres of certified organic group farming (Ministry of Agriculture and Cooperatives, 2023).

This study was conducted within the Khao Hom Dok Kham Tai community enterprise, selected purposively from the Organic Agriculture Community Network in Phayao Province. The group was chosen based on demonstrated potential in sustainable organic practices, including leadership, commitment, and resource-sharing. The 15 farmers included in the study comprised all current active members of the group. These members collectively manage the organic rice farming cycle using shared machinery for seedling cultivation, seedling preparation, and transplantation (Figure 1).

Figure 1. Germinated rice seeds (A), Rice seedlings (B, C) Rice seedling transplanter (D), and Rice field (E, F) of organic rice farming by Khao Hom Dok Kham Tai group

2.2 Data collection and analysis

A Participatory Action Research (PAR) approach was adopted to foster collaborative knowledge exchange and empower farmers throughout the study. The data collection relied on in-depth interviews conducted with all 15 active group members. The interviews were guided by a semi-structured protocol focusing on the full life cycle of organic jasmine rice production—from pre-planting to post-harvest stages. The interview guide comprised the following thematic areas

- Pre-planting: seed selection, nursery setup, and seedling preparation
- During planting: transplanting methods, irrigation, weed control, and mixed rice variety issues
- Post-harvest: harvesting, moisture reduction, seed cleaning, grading, purity testing, and storage

Respondents were also prompted to compare organic practices with conventional methods to elicit insights on cost differences, labor input, and sustainability outcomes. Data were analyzed using thematic analysis, coding responses to identify recurrent patterns in practices, costs, and challenges. Particular attention was paid to innovations that reduced production costs or chemical use, and to collaborative mechanisms that enhanced group resilience. This methodological design aimed to uncover not only the practical dimensions of organic rice farming in the selected community but also the social dynamics of shared innovation, cost-sharing, and knowledge exchange within the group setting (Figure 2).

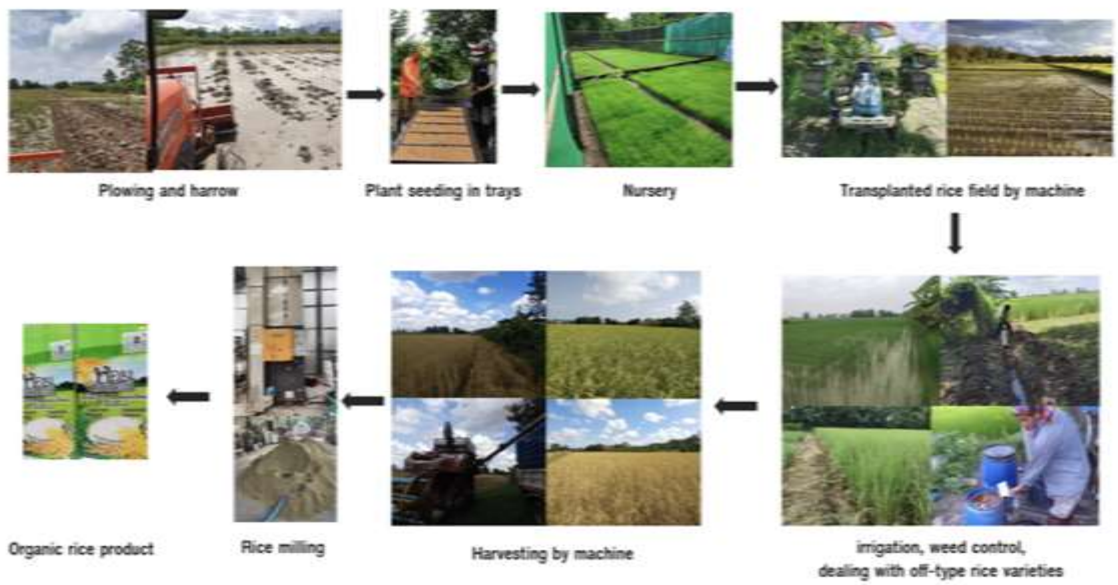

Figure 2. The cycle of organic rice production of organic rice farming belonging to Khao Hom Dok Kham Tai group

3. Results and Discussion

The study conducted within the *Khao Hom Dok Kham Tai group* has revealed notable distinctions between chemical rice farming (conventional) and organic rice farming (Table 1). The study found that the transition from individual farming to collective management, specifically adopting the *Dok Kham Tai Community Enterprise Model*, resulted in a transformation of organic rice production processes. Incorporating technology into cultivation and harvesting further contributed to increased production costs, rising from the initial 361.01 USD per acre to 400.39 USD per acre (Table 2). However, this shift positively impacted the community enterprise, leading to an augmentation in organic rice production. The yield increased from 1,139.24 kg per acre to 1,265.82 kg per acre. The quality of the rice husks also improved, resulting in a higher market value for the unhusked rice, which rose from the initial 535.44 USD per acre to 594.94 USD per acre (Table 3).

Table 1. The difference between chemical rice farming and organic rice farming in the *Khao Hom Dok Kham Tai* community enterprise group.

Process	Chemical rice farming or Conventional rice farming	Organic rice farming in *Khao Hom Dok Kham Tai* community enterprise group
1. Pre-planting soil enrichment	- Burn rice stubble	- Plough up rice stubble - Sowing sunn hemp for manure - Fill dolomite
2. Process of preparing the soil	- Plow and harrow	- Plow and harrow
3. Rice seed preparation process	- Use certified seed from the Rice Department	- Use certified seed from the Rice Department
4. Sowing process	- Seed sowing in the field	- Use *Trichoderma* spp. coating seed before sowing - Sowing in trays rather than seedling transplanting by rice transplanter
5. Agricultural management	- Use chemical fertilizer - Use pesticides - Apply manual labour or an unmanned aircraft (drone) - Use water from outside	- Use manure compost - Use microbial pesticide - Apply manual labour or an unmanned aircraft (drone) - Use water only from groundwater or natural pools
6. Harvest	- Harvest by machine - Use labour	- Harvest by machine
7. Post harvest	- Reduce moisture by solar drying	- Reduce moisture by solar drying and dryers - Seed cleaning - Threshing - Storage

Table 2. Comparative cost per acre for conventional and organic rice cultivation.

Procedures	Cost (USD/acre)		
	Conventional Rice Cultivation	Organic Rice Cultivation (Individual/ Non-Group)	Organic Rice Cultivation (Group)
-Plowing for sunn hemp cultivation	19.62	19.62	15.70
-Plow in (sunn hemp)	19.62	19.62	15.70
-Plow the rice field	70.63	70.63	70.63
-Cost of fuel for pumping water and grass-cutting	39.24	78.48	39.24
-Herbicide	23.54	0.00	0.00
-Rice seed cost, rice seedling cost	26.35	15.70	15.70
-Cost of seedling trays	0.00	0.00	66.84
-Cost of sowing rice	7.85	0.00	7.85
-Rice planting machine	54.94	11.77	23.54
-Fertilizer (46-0-0)	83.24	0.00	0.00
-Herbicide spraying cost	23.54	15.70	15.70
-Fertilizer (16-20-0)	70.63	0.00	0.00
-Hormone spraying cost	23.54	0.00	0.00
-Cost of biopesticides	0.00	3.92	3.92
-Organic fertilizer cost	0.00	47.09	47.09
-Expense for controlling weed and off-type rice	0.00	31.39	31.39
-Rice harvester cost	47.09	47.09	47.09
Total	509.83	361.01	400.39

Table 3. Comparison of conventional rice cultivation, individual/non-group organic rice cultivation, and group-based organic rice cultivation.

Procedures	Conventional Rice Cultivation	Organic Rice Cultivation (Individual/ Non-Group)	Organic Rice Cultivation (Group)
-Yield (fresh unhusked rice, kg/acre)	1,518.99	1,139.24	1,265.82
-Selling price (fresh unhusked rice (USD/kg)	0.32	0.47	0.47
- Income (fresh unhusked rice, USD/acre)	485.01	529.75	588.61
-Unhusked rice drying cost (USD/kg)	0.06	0.06	0.05
-Seed sorting cost (USD/kg)	0.06	0.06	0.06
-Management expenses (USD/acre)	188.35	141.27	137.34
-Yield (milled rice, kg/acre)	1,215.19	962.03	1,075.95

Discussion: Insights from interviews with group leaders and members reveal that participants have opportunities to connect with organic agriculture networks at both the community and provincial levels. They also engage with educational institutions and government agencies at the district and provincial levels through the Sustainable Agriculture Network of Phayao Province. Support is provided in areas of organic farming knowledge at various stages of production, namely at the upstream level (production), midstream level (product processing), and downstream level (marketing management). Beiranvand et al. (2024) identified and prioritized key challenges to organic farming development among farmers in Lorestan Province, Iran, including a lack of technical knowledge and skills, weak information and advertising networks, and inadequate financial resources for training. In addition, the community enterprise has been designated as a learning centre for organic farming production and processing by the Sustainable Agriculture Association of Phayao Province. It welcomes students, farmers, local government units, and the public to come and learn. At the same time, group members could also engage in local research projects with researchers from educational institutions in Phayao Province. This emphasis on peer learning and knowledge dissemination aligns with successful agricultural extension models observed globally. For instance, the Lead Farmer Approach (LFA), as studied by Matemba and Njera (2023) in Malawi, has shown significant positive impacts on follower farmers' knowledge and practice of conservation agriculture, highlighting the effectiveness of farmer-to-farmer knowledge transfer in promoting sustainable practices.

Research by Safavian et al. (2023) on farmers'risk management strategies in Khuzestan Province, Iran, identified a broad spectrum of influential factors, including economic uncertainties, market fluctuations, and resource access. The *Dok Kham Tai Community Enterprise Model* offers significant direct and indirect economic benefits to participating jasmine rice farmers, mitigating various risks inherent in agricultural production. Key advantages of this approach include practical knowledge exchange, enhanced production efficiency, and improved access to higher-quality inputs through group negotiation. These collective practices foster resilience in organic rice farming by promoting resourcefulness and ensuring adequate financial capacity to adapt to change, as highlighted by Panpakdee and Khanbut (2025). Moreover, the adoption of technology, such as replacing manual labor with machinery, has further contributed to reducing production costs and chemical inputs, ultimately leading to increased yields. This aligns with Nguyen et al. (2022), who found that farm productivity is influenced by factors such as technical assistance, regional practices, and input utilization. Likewise, Er et al. (2021) reported that agroecological rice farming in Malaysia yielded higher net profits due to reduced input costs, despite higher expenses for organic materials. This community enterprise model further amplifies the advantage of reducing per-unit costs through shared resources and bulk purchasing.

Participation in the *Khao Hom Dok Kham Tai group* has enabled farmers to obtain organic certification through the SDGsPGS, as endorsed by the Sustainable Agriculture Network in Phayao Province. This certification elevates the credibility and value of their products, allowing farmers to command higher selling prices for rice. Unlike previous practices—where individual farmers sold high-moisture unhusked rice immediately after harvest—the enterprise model supports proper drying. The group has added value to their products by processing husked rice into organic Hom Mali white rice and organic Hom Mali brown rice, which are packaged in vacuum-sealed bags bearing the trademark of *Khao Hom Dok Kham Tai* in 1-kilogram packages. These products are sold online and offline under the name of the local community enterprise, and through a sustainable agriculture network at the provincial and national levels. They are also produced according to orders from customers such as hospitals, hotels, restaurants, and local community stores in Phayao and neighboring provinces, increasing market access and income for the group.

Evidence from the Phayao Province network underscores the financial viability of organic farming over conventional methods. Suwannakit and Prempree (2016) found that the average net profit from organic rice production was approximately 125.37 USD per acre—significantly higher than the 82.55 USD per acre profit from conventional rice farming. Although organic farming may require different inputs and practices, it avoids costly synthetic chemicals and benefits from higher market prices. The study demonstrates that adopting the *Dok Kham Tai Community Enterprise Model* leads to measurable improvements in production and revenue. Specifically, organic jasmine rice yields increased by 11.10%, while revenues rose by 11.85%, owing to better product quality and higher market value. These outcomes support earlier research by Stuart et al. (2018), who highlighted how best management practices can improve the economic and sustainability profiles of rice farming. Mungkung et al. (2022) similarly validated the Sustainable Rice Platform standard as a useful framework for tracking sustainability in rice cultivation. Taken together, the evidence from this study reinforces the model's potential for replication and suggests that with continued support from researchers and policymakers, this approach could be scaled to other regions seeking to balance sustainability, profitability, and community resilience.

4. Limitations and Policy Implications

While the findings highlight the effectiveness of the Dok Kham Tai Community Enterprise Model in promoting sustainable organic jasmine rice production, certain limitations must be acknowledged. The study focuses on a single community within Phayao Province and involves a relatively small sample size of 15 members. As such, the insights gained may not fully represent the diversity of organic farming practices or outcomes in other regions. Seasonal variability—such as rainfall patterns and pest outbreaks—may also influence the replicability of results across different cultivation cycles. Moreover, the study's qualitative emphasis, while rich in contextual detail, may limit the generalizability of the findings to broader populations or different agricultural settings.

The results of this study offer valuable implications for policymakers and development agencies aiming to support smallholder farmers and promote sustainable agriculture. First, the demonstrated benefits of group-based organic farming suggest the need for public support in facilitating cooperative structures, such as training programs and legal frameworks that ease group formation and certification processes. Second, machinery subsidies and shared equipment centers could further reduce production costs for community enterprises transitioning from conventional to organic practices. Third, policies encouraging collective marketing, branding, and digital platforms for community-based agricultural products can enhance value addition and market reach. Local governments and agricultural extension services also play a critical role in scaling up successful models by integrating them into provincial development plans and SDG-aligned sustainability agendas.

5. Conclusion and Recommendations

The Dok Kham Tai Community Enterprise Model exemplifies a successful approach to group-based organic rice production by uniting local farmers in a shared mission. Through cooperative efforts, members exchange practical knowledge and adopt sustainable agricultural practices to develop a collective production plan. This model enhances the quality and market value of organic jasmine rice, aligning with increasing consumer demand. In addition to improving product standards, the reduction in chemical inputs lowers production costs, promotes environmental sustainability, and enhances the health and safety of farmers involved.

The shift from individual to group-based production focuses on the organic cultivation of Hom Mali rice following the participatory organic agriculture standards known as SDGsPGS, established by the Sustainable Agriculture Network in Phayao province, Thailand. The approach includes knowledge-sharing on production techniques, collective use of machinery and equipment among group members, and efforts to enhance the post-harvest quality of rice. Despite increased production costs, this has resulted in a higher selling price for organic Hom Mali rice than conventional varieties. As seen in the Khao Hom Dok Kham Tai group, choosing innovative organic rice production practices may be a good option for farmers looking to achieve high-quality yields and effective production management.

Future studies should examine the replication of this community enterprise model in different regions with varying ecological and socioeconomic contexts. The successful implementation of organic farming requires cooperation among farmers, researchers, policymakers, and agricultural extension services to ensure widespread and sustainable results over the long term. Additionally, longitudinal research could assess long-term environmental, health, and economic outcomes of organic rice networks. To support scalability, pilot initiatives involving cross-community collaborations, supply chain integration, and policy support mechanisms should be explored. These efforts will strengthen the foundation for national-level strategies in promoting organic agriculture aligned with the SDGs.

References:

1. Beiranvand, J., Ommani, A. R., Noorivandi, A. N., & Ardakani, M. (2024). Identifying and prioritizing the challenges of organic farming development among farmers in Lorestan Province. International Journal of Agricultural Science, Research and Technology in Extension and Education Systems, 14(1), 25–35. https://sanad.iau.ir/Journal/ijasrt/Article/1033757

2. Bello, W. B. (2008). Problems and prospects of organic farming in developing countries. Ethiopian Journal of Environmental Studies and Management, 1(1), 36–43. https://www.ajol.info/index.php/ejesm/article/view/41568

3. Bin Rahman, A. N. M., & Zhang, J. (2023). Trends in rice research: 2030 and beyond. Food and Energy Security, 12(2), e390. https://doi.org/10.1002/fes3.390

4. Chaiubon, A., Wiseansat, A., & Pensuk, V. (2020). Factors influencing the decision-making process among farmers in Ban Nong-Sok-Dao subdistrict, Nunsung district, Udon Thani province: Organic farming, good agricultural practices, or chemical rice cultivation. Udon Thani Rajabhat University Journal of Sciences and Technology, 8(2), 201–215. https://ph01.tci-thaijo.org/index.php/scudru/article/view/243226

5. Er, A. C., Ahmad, H., & Manaf, A. A. (2021). Comparative cost benefit analysis of conventional farming and agroecological farming for paddy cultivation in Bachok, Kelantan. International Journal of Environmental Science and Development, 12(6), 181–187. https://doi.org/10.18178/ijesd.2021.12.6.1338

6. Kupkanchanakul, K. (2000). Bridging the rice yield gap in Thailand. In M. K. Papademetriou, F. J. Dent, & E. M. Herath (Eds.), Bridging the Rice Yield Gap in the Asia-Pacific Region (pp. 146–156). FAO Regional Office for Asia and the Pacific. https://openknowledge.fao.org/items/13c8a592-c184-4766-b3e6-fd2b7d43ad4e

7. Martínez-Megías, C., Pascual-March, C., Moratalla, J., Rochera, C., Picazo, A., Morant, D., Camacho, A., & Rico, A. (2025). Influence of conventional and organic rice farming on aquatic biodiversity and greenhouse gas emissions in a protected Mediterranean wetland. Agriculture, Ecosystems & Environment, 393, 109835. https://doi.org/10.1016/j.agee.2025.10983

8. Matemba, D. D., & Njera, D. (2023). Examining the impact of lead farmer approach on follower farmers' knowledge and practice of conservation agriculture: A case study in Kalira extension planning area, Ntchisi District, Malawi. International Journal of Agricultural Science, Research and Technology in Extension and Education Systems, 13(4), 203–208. https://sanad.iau.ir/Journal/ijasrt/Article/1033734

9. Methamontri, Y., Tsusaka, T. W., Zulfiqar, F., Yukongdi, V., & Datta, A. (2022). Factors influencing participation in collective marketing through organic rice farmer groups in northeast Thailand. Heliyon, 8(11), e11421. https://doi.org/10.1016/j.heliyon.2022.e11421

10. Ministry of Agriculture and Cooperatives. (2018). Summary of the project in accordance with the important policy (agenda) 15 projects: Conceptual project. Retrieved from https://bit.ly/36I0oef

11. Ministry of Agriculture and Cooperatives. (2023). Basic Information of Phayao Province, January 2023. Retrieved from https://www.opsmoac.go.th/phayao-dwl-files-451991791163

12. Mungkung, R., Sitthikipanya, S., Chaichana, R., Bamrungwong, K., Santitaweeroek, Y., Jakrawatana, N., Silalertruksa, T., & Gheewala, S. H. (2022). Measuring sustainability performance of rice cultivation in Thailand using Sustainable Rice Platform indicators. International Journal of Agricultural Sustainability, 22(7), 1278–1293. https://doi.org/10.1080/14735903.2022.2105008

13. Nisak, F. F., Prayitno, G., Ari, I. R. D., Hidayat, Ar. R. T., Waloejo, B. S., Usman, F., Wijayati, W. P., & Onishi, M. (2025). Quantifying the synergistic effects of social and human capital in farmers' decisions to adopt organic rice farming: A case study of Lombok Kulon village, Indonesia. Environmental Challenges, 20, 101204. https://doi.org/10.1016/j.envc.2025.101204

14. Nguyen, L. T., Nanseki, T., Ogawa, S., & Chomei, Y. (2022). Determination of paddy rice yield in the context of farmers' adoption of multiple technologies in Colombia. International Journal of Plant Production, 16, 93–104. https://doi.org/10.1007/s42106-021-00173-1

15. OECD-FAO. (2021). OECD-FAO Agricultural Outlook 2021-2030. OECD Publishing. https://doi.org/10.1787/19428846-en

16. Office of Agricultural Economics. (2023). Agricultural Economic Data: Production and Market Situation Details. https://oae.go.th/uploads/files/2025/05/20/c37d15eee7d25aea.pdf

17. Offermann, F., & Nieberg, H. (2000). Economic performance of organic farms in Europe (Organic Farming in Europe: Economics and Policy; No. 5). University of Hohenheim. https://projekte.uni-hohenheim.de/i410a/ofeurope/organicfarmingineurope-vol5.pdf

18. Panpakdee, C., & Khanbut, K. (2025). Definitions of resilience in organic rice farming in northeastern Thailand: Adaptation, diversification, resourcefulness, and adequate financial resources. Discover Sustainability, 6, 377. https://doi.org/10.1007/s43621-025-01200-1

19. Patra, S., Saha, A., Pal, S. C., Islam, A. R. Md. T., Halder, K., Srivastava, A. K., Pande, C. B., Islam, A., Costache, R., Alam, E., & Islam, Md. K. (2025). Highlighting the role of traditional paddy for sustainable agriculture

and livelihood: Issues, policy intervention and the pathways. Discover Sustainability, 6, 181. https://doi.org/10.1007/s43621-025-00989-1

20. Pithawat, E. (2019). Sustainable Development and Competitive Advantage in the Agricultural Food Industry: A Case Study of Organic Jasmine Rice: (Research Report). National Science, Research, and Innovation Policy Office.

21. Ruaykijakarn, N., Suwanmaneepong, S., & Kuhaswonvetch, S. (2018). Knowledge and attitudes towards marketing innovation of organic rice farmers in Sanam Chai Khet organic agriculture group, Chachoengsao province, Thailand. International Journal of Agricultural Technology, 14(7), 1829–1842. http://www.ijat-aatsea.com/past_v14_n7sp.html

22. Safavian, R., Moosaei, M., & Rahimi Bagmalek, J. (2023). Investigating the effectiveness of farmers' risk management strategies (Case study: Khuzestan Province). International Journal of Agricultural Science, Research and Technology in Extension and Education Systems, 13(4), 269–286. https://sanad.iau.ir/Journal/ijasrt/Article/1033841

23. Stuart, A. M., Pame, A. R. P., Vithoonjit, D., Viriyangkura, L., Pithuncharurnlap, J., Meesang, N., Suksiri, P., Grant R. Singleton, G. R., & Lampayan. R. M. (2018). The application of best management practices increases the profitability and sustainability of rice farming in the central plains of Thailand. Field Crops Research, 220, 78–87. https://doi.org/10.1016/j.fcr.2017.02.005

24. Suwannakit, C. & Prempree, K. (2016). The comparison of costs and returns between organic rice farming and chemical rice farming. Veridian E-Journal, Silpakorn University, 9(2), 519–526. https://he02.tci-thaijo.org/index.php/Veridian-E-Journal/article/view/66930/54660

25. Tashi, S., & Wangchuk, K. (2016). Organic vs. conventional rice production: comparative assessment under farmers' conditions in Bhutan. Organic Agriculture, 6(4), 255–265. https://doi.org/10.1007/s13165-015-0132-4

26. USDA-FAS. (2015). THAILAND 2014/15 Dry Season Rice Area and Production Forecast to Decline (Commodity Intelligence Report). USDA-Foreign Agricultural Service. https://ipad.fas.usda.gov/highlights/2015/02/Thailand/index.htm