Factors influencing participation in collective marketing through organic rice farmer groups in northeast Thailand

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ABSTRACT
Despite the significant roles of farmer groups in collective action for production and marketing of organic paddy, limited literature has studied the farmer-level determinants of participation in collective action in northeast Thailand. This study examined factors associated with participation in collective marketing for three organic rice farmer groups (Nam Om Community Enterprise Network, Na So Farmer Group, and Moral Rice Farmer Group) in Yasothon Province of Thailand, producing organic jasmine rice for export and domestic markets through contract farming. Primary data were collected from 335 farmers and analyzed by descriptive statistics and the two-limit tobit regression method. The descriptive results showed relatively high levels of social, economic, institutional, and environmental benefits arising from the participation in those groups. In particular, environmental benefits were higher than the other types of benefits. The regression analysis found that age and agricultural loan negatively influenced the extent of participation in collective marketing through farmer groups, whereas education, paddy cultivation area size, non-agricultural income, experience in rice farming, experience in organic rice farming, group membership duration, perceived economic benefits, and membership with Na So farmer group were positively associated with the extent of participation. The effect of experience with organic rice farming was relatively small in Na So Farmer Group. The findings suggest that economic benefits from participation in organic farmer groups should be enhanced in order to increase the collective marketing of organic rice produce. Moreover, the government should provide alternative employment opportunities, knowledge-based training, and low-interest credit to support production and collective marketing of organic rice.

1. Introduction
Use of synthetic inputs (e.g., fertilizer, pesticide) in the agriculture sector is a common practice all over the world for increasing productivity and profitability of crop production (Sharma and Singhvi, 2017; Yanakitkul and Aungvaravong, 2020). Agricultural intensification may cause accumulation of toxins in crops, atmosphere, groundwater, and soil. Besides, farmers engaged in non-organic production and consumers consuming non-organic foods are at the risk of various health hazards and developing diseases, such as asthma, autism, physical disabilities, diabetes, Parkinson disease, Alzheimer disease, and cancer (Sumarsono and Widjajanto, 2017; Yanakitkul and Aungvaravong, 2020; Sapbamrer and Thammachai, 2021). Organic farming is one of the solutions to the environmental and health hazards arising from the use of synthetic chemicals (Sharma and Singhvi, 2017; Panpluem et al., 2019; Yanakitkul and Aungvaravong, 2020). With the rising income and health consciousness, there is a growing market demand for organic foods around the world (Ullah et al., 2015; Poapongsakorn et al., 2019). In Thailand, the agriculture sector employed approximately 40% of the total population (7.9 million households) and contributed 8.1% to Thailand’s gross domestic product (GDP) in 2019 (National Statistics Office, 2020). In 2019, Thailand was the second largest rice exporter,
with a total volume of 6.04 million tonnes and the export value of USD 3.74 billion (FAO, 2020). With the global trend of consumption of safe and ecological food, organic farming is an optimal strategy for Thailand to enhance farmers’ livelihoods, reduce poverty, and conserve natural resources (Desai and Rudra, 2019; Poapongsakorn et al., 2019; Salaisook et al., 2020).

Moreover, the farmer groups play a critical role in producing and collectively marketing organic commodities in Thailand (Jayne et al., 2010; Fischer and Qaim, 2012; Kramol et al., 2020). Farmers may gain benefits from farmer groups in forms of inputs supply (seed, fertilizer, pesticide, machines, and tools), credit, training, and collective marketing (Bernard and Spielman, 2009; Markelova and Mwangi, 2010; Mudge et al., 2015). Furthermore, farmers may receive a premium price for producing and selling high-value products (Kramol et al., 2020). Thus, farmer groups are key actors in the agricultural supply chain, significantly contributing to reducing poverty and increasing income among members (Sedana, 2019). Additionally, collective action is a potential instrument to enhance access to credit services, appropriate infrastructure, technical capacity, and to reduce transaction costs for smallholders (Petcho et al., 2019). Hence, it is one of the strategic institutional instruments that enhance smallholder producers’ competitiveness in the value chains (Etwire et al., 2013; Khanal and Maharjan, 2013; Mabuza et al., 2015).

Given the significant contribution of the agriculture sector to Thailand’s economy and the rising demand for organic production driven by human health and ecosystem concerns, there is an urgent need to promote organic production and marketing through collective action by farmer groups (Yanakittkul and Aungvaravong, 2020). In this context, however, it is critical to quantitatively assess what factors influence farmers’ participation in collective marketing. Promme et al. (2017) indicated that external economic incentives, such as a higher selling price was a key factor for rubber farmers in Thailand to join collective action by farmer groups. Hariyanto et al. (2021), on the other hand, pointed out that internal socioeconomic attributes largely affected farmers’ participation in collective marketing. The findings of the current study are expected to help stakeholders and policymakers devise ways to enhance collective marketing and promote a shift to organic production in the northeastern region of Thailand, where paddy production for export markets is common but access to organic markets is still limited, both overseas and domestic.

Keeping in view the research gaps and needs, the objectives of this study were to assess the smallholder farmers’ perceived benefits of participation in collective marketing through organic rice farmer groups, the extent of their participation, and factors influencing their participation in northeast Thailand using the survey method and econometric analysis. The second section provides a literature review, the third section describes materials and methods, the fourth section presents the results and discussion, the fifth section outlines future prospects, and the sixth section offers conclusion and policy implications.

2. Review of related literature
2.1. Participation in collective marketing

The motives for adoption of organic farming include pursuing higher income, preventing health issues by reducing the use of synthetic pesticides, and conservation of environments, which is expected to contribute to sustainable development of the agriculture sector (Ullah et al., 2015; Kramol et al., 2020). Application of biofertilizers to soil helps keep the plants healthy and gradually improves biodiversity on farmland (Yanakittkul and Aungvaravong, 2020; Sapbamrer and Thammachai, 2021). However, meeting the organic standards to access niche markets often requires expensive third-party certification, which is a major barrier to participation by smallholders. Membership with a farmer group may reduce farmers’ costs of purchasing synthetic fertilizer, obtain access to higher-yielding technologies, and improve coordination with community members (Markelova et al., 2009; Fischer and Qaim, 2012; Abdul-Rahaman and Abdulai, 2020). Promme et al. (2017) revealed that experienced rubber farmers in Thailand preferred to sell their produce through farmer groups for gaining bargaining power, fetching higher output prices, and obtaining government support. Economic incentives can drive farmers to participate in farmer groups (Sumarsono and Widijanto, 2017; Kramol et al., 2020; Yanakittkul and Aungvaravong, 2020).

Moreover, working as a group may create mutual trust among farmers and generate social agreements and responsibilities (Danau et al., 2013). As a group, it is easier for external agencies to support and transfer knowledge to members through the farmer group rather than directly to individual farmers (Fischer and Qaim, 2012; Abdul-Rahaman and Abdulai, 2020; Kramol et al., 2020). In a sense, those groups worked as an institutional mechanism to provide access to markets, reduce transaction costs, and minimize market failures, especially in developing countries (Poapongsakorn et al., 2019; Kramol et al., 2020; Kumse et al., 2021). Most of small-scale farmers produce small quantities of outputs for sale, and individually possess little bargaining power with traders and often accept the price in favor of the traders. Collective marketing via farmer groups can thus be an effective means for small-scale farms to compete with larger farms. By collecting products from member farmers, farmer groups combine crops into a larger quantity and sell them to buyers that offer favorable prices (Sarkar et al., 2014; Danau et al., 2015). Farmer groups can simplify long marketing chains by directly connecting smallholders to buyers by dispensing with various intermediaries (Bernard and Spielman, 2009; Markelova and Mwangi, 2010). Therefore, membership with a farmer group can improve farmers’ capability toward sustainable livelihoods (Office of Agricultural Economics [OAE], 2017).

2.2. Factors influencing participation in collective marketing

Numerous studies have assessed different sociodemographic factors affecting farmers’ participation in farmer groups and collective marketing. In Southeast Asian countries (Myanmar, Thailand, Vietnam, Indonesia), farmers with higher levels of education were more likely to participate in farmer groups to obtain various benefits (Panpluem et al., 2019; Vu et al., 2020; Hariyanto et al., 2021). Literature found that farmers’ age, experience in rice farming, and organic rice farming had positive influences on involvement in collective marketing (Petch et al., 2019; Vu et al., 2020; Yanakittkul and Aungvaravong, 2020). As organic farming required more manual labor than conventional farming, household size and family labor had positive effects on participation in organic rice farmer groups for saving explicit production costs (Ullah et al., 2015; Panpluem et al., 2019; Vu et al., 2020). On the other hand, literature suggests a gender gap in participation in collective marketing with mixed results. Some studies found that female farmers played a significant role in the production process of organic rice and had direct contact with extension officers in Thailand, Myanmar, Indonesia, and the Philippines (Akter et al., 2017; Panpluem et al., 2019). Likewise, Digal and Placencia (2019) found that female farmers in North Cotabato, the Philippines were more likely to adopt organic rice farming and marketing than men. In contrast, Blandon et al. (2009) argued that in many parts of the world, small-scale farms were traditionally managed by men, while women were responsible for domestic activities, hindering women’s participation in market-oriented commercial livelihood activities. Bolin (2020) revealed that high-value agriculture in the Philippines was a male-dominated sector with more men engaged in sale and marketing activities due to the traditional belief that female farmers performed worse than male farmers.

To the best of our knowledge, there is scarce literature on collective marketing through organic rice farmer groups in Thailand, with a few exceptions. Panpluem et al. (2019) and Sapbamrer and Thammachai (2021) found that promotion of organic paddy markets at the local level, economic factor, health factor, gender, age, level of education, experience in farming, experience in organic rice production, family labor, farm size, training, extension contact, and off-farm income significantly
affected market participation by organic rice farmers through farmer groups. Kramol et al. (2020) and Yanakittkul and Aungvaravong (2020) revealed that farmers concerned with economic, health, institutional, and environmental benefits were more likely to join organic rice farmer groups in Thailand. Being part of farmer networks, they obtained access to higher-yielding technologies, credit, savings, farm supplies, joint marketing, training, and agricultural extension services.

Yet, there is a dearth of studies capturing multidimensional benefits derived from participation in collective marketing of organic produce through farmer groups, such as environmental, economic, social, and institutional benefits. Given the research gap noted earlier and some mixed results observed in literature, this paper focuses on the benefits of collective marketing and the factors affecting farmers’ participation in collective marketing through organic rice farmer groups in northeast Thailand. Moreover, several new variables were employed for the enrichment of evidence, namely non-rice agricultural income, number of farmer groups joined, group membership duration, and amount of agricultural loan.

3. Materials and methods

3.1. Study area

Yasothon Province, located in N15–16° latitude and E104–105° longitude in the northeastern region of Thailand, has a total area of 416,144 hectares (ha), of which agricultural areas occupy 306,757 ha (74%). Rice farming substantially contributes to the agricultural sector of this Province as 80% of the agricultural areas are planted to paddy (245,558 ha), followed by 31,383 ha to cassava, 14,742 ha to rubber trees, and 7,655 ha to sugarcane (Yasothon Provincial Office, 2015). Yasothon Province was purposively selected since it is the area with intensive organic jasmine rice production for export markets based on collective action through farmer groups (e.g., contract farming, organic certification, collective marketing, among others). Promotion of organic farming is associated with the socioeconomic development of Yasothon Province (Panpluem et al., 2019). In 2018, there were 431 organic rice farmer groups with 10,458 member farmers, mostly producing for domestic markets, while the total area sown to organic paddy was 17,705 ha, 7.2% of the total paddy cultivation area (Hériqué, 2019). The soil in this area is mostly sandy with saltwater marshes and creeks. There are three main seasons: dry season (February to May), rainy season (June to October), and winter season (November to January). Average maximum and minimum temperatures are 40 °C and 14 °C, respectively, and the average rainfall is 1,600 mm per year (Yasothon Provincial Office, 2015).

Three districts (Kut Chum, Pa Tiu, and Kho Wang) were purposively selected (Figure 1) to capture the differences in scale of farmer groups, marketing channels, and end markets. The total organic paddy area of Kut Chum, Pa Tiu, and Kho Wang was 1,208 ha, 650 ha, and 2,359 ha, producing 5,676 tonnes, 3,677 tonnes, and 1,482 tonnes, respectively. There were three farmer groups in Kut Chum district, of which the largest group was selected for the study. Pa Tiu and Kho Wang districts each had one farmer group (Yasothon Provincial Agricultural Extension Office, 2016). Accordingly, three farmer groups were included in the study. Nam Om community enterprise network in Kho Wang district was a large group with 863 members; the total production area was 2,359 ha; the marketing channel was export traders; and the end markets were Europe, USA, Japan, Singapore, and China. Na So farmer group in Kut Chum district was a medium-sized group with 272 members; the total production area was 1,208 ha; the marketing channel was social enterprises; and the end markets were Europe and New Zealand. Moral Rice farmer group in Pa Tiu district was a small group with 131 members; the total production area was 650 ha; the marketing channel was domestic retailers, and the end market was Thailand.

3.2. Sampling and data collection

The research is mainly based on primary data, which is supplemented by some secondary data. Several sets of secondary data regarding the farmer groups, their members, and their marketing channels were collected from Yasothon Provincial Office. The second-
ary data were employed for selecting the study areas and helping interpret the results from the primary data. The primary data were collected through a farm household survey with members of organic rice farmer groups. The sample size was calculated based on population data from the Yasothon Provincial Office (2015). Subjecting the 5% margin of error and the total population of 1,266 households (Yasothon Provincial Development Plan, 2015) into Yamane’s Formula (Yamane, 1967), the minimum suggested sample size was calculated using Eq. (1) as follows:

\[ n = \frac{N}{1 + Ne^2} = \frac{1,266}{1 + 1,266 (0.05)^2} = 304 \]  

where \( n \) is the minimum suggested sample size, \( N \) is the population of member households of the three farmer groups, \( e \) is the margin of error. Table 1 summarizes the sample size for the three farmer groups. Due to the difficulty in meeting rice producers in Nam Om community enterprise network, the actual sample size became 181. Instead, the sample sizes for Na So and Moral farmer groups were expanded to 91 and 63, respectively.

The multistage sampling method was applied to select farmers for the survey. The first three stages were the purposive selection of Yasothon Province, the three districts, and the three organic rice farmer groups. The fourth stage was the proportionate random sampling of member households from each group.

The field survey was conducted from November 2015 to February 2016 by using a semi-structured questionnaire. The gathered data included the profile of the farms, their products, marketing channels, extent of participation in collective marketing, and perceived benefits from participation.

### 3.3. Method of analysis

First, the raw data on perceived benefits were processed into composite indicators (CI) to represent the four dimensions of perceived benefits from membership. The two-sample t-test, Kruskal-Wallis H-test, Dunn’s post-hoc test, and Spearman’s correlation were utilized to examine the bilateral relations among the variables. The two-limit tobit regression was performed to quantify the effects of different factors, including the benefits, on the extent of participation in collective marketing. The following subsections elaborate on the CI and tobit analysis.

#### 3.3.1. Composite indicators

A five-point Likert scale was applied to measure the degree of perceived benefits gained from participation in collective marketing through organic rice farmer groups (Fischer and Qaim, 2014). The collected raw indicators were aggregated into composite indicator (CI) to obtain four indicators representing perceived benefits in social, economic, institutional, and environmental dimensions (Becker et al., 2017; Talukder et al., 2017; Cruz et al., 2018; Seidel et al., 2019). In this study, the CI for each dimension is the arithmetic mean of all the sub-indicator values belonging to that dimension (Talukder et al., 2017):

\[ CI = \frac{1}{j} \sum_{k=1}^{j} y_k \]  

where \( j \) is the number of sub-indicators in each dimension and \( y_k \) is the value of sub-indicator \( k \) in Eq. (2). The aggregate four CI can be regarded as interval-scale variables in further analysis. The CI values were rounded up to the second decimal, and the qualitative description of the CI values is given as follows: “Very Low” if 1.00 ≤ CI ≤ 1.80, “Low” if 1.81 ≤ CI ≤ 2.60, “Moderate” if 2.61 ≤ CI ≤ 3.40, “High” if 3.41 ≤ CI ≤ 4.20, and “Very High” if 4.21 ≤ CI ≤ 5.00.

#### 3.3.2. Two-limit tobit regression

The tobit model is designed to estimate linear relationships between variables when values of the dependent variable are censored, in which case the results from the ordinary least squares (OLS) would suffer from the estimation bias (Tobin, 1958). In this study, the dependent variable was farmers’ extent of collective marketing as expressed in percentage of organic paddy harvest sold collectively through the group, which was censored from both sides at 0 and 100%. Hence, the two-limit tobit regression was employed to minimize the downward bias in the coefficients (Maddala, 1999; Rodthong et al., 2020). The model is defined using Eq. (3) as follows:

\[ Y_i' = \beta_0 + \sum_{k=1}^{k} \beta_k x_{ij} + \epsilon_i \]  

where \( Y_i' \) is the latent variable representing the latent extent of participation in collective marketing for household \( i \), \( \beta_k \) are the coefficients to be estimated (\( j = 1, 2, \ldots, k \)), \( x_{ij} \) are the explanatory variables, and \( \epsilon_i \) is the random error term that is independently and normally distributed, with mean zero and constant variance \( \sigma^2 (\epsilon_i \in N(0, \sigma^2)) \).

The observed variable \( Y_i \) represents the percentage of harvest sold collectively through the group, which is expressed using the latent variable \( Y_i' \) using Eq. (4) as follows:

\[ Y_i = \begin{cases} 100 & \text{if } Y_i' \geq 100 \\ Y_i' & \text{if } 0 < Y_i' < 100 \\ 0 & \text{if } Y_i' \leq 0 \end{cases} \]  

The tobit regression coefficients are interpreted in the similar manner to OLS regression coefficients, except that the linear effect is on the latent variable, not the observed one. In other words, the tobit coefficients represent the marginal effects of independent variables when the dependent variable is in the uncensored range (Greene, 2003). STATA version 16 was employed for quantitative analysis in this study.

Table 2 presents the description of 23 independent variables included in the tobit regression, which consists of 19 standalone variables and four interaction terms. The interaction terms between the group membership dummies and the two independent variables (experience in organic rice farming and perceived economic benefit level) were employed to capture the heterogeneous effects across the three groups. Initially, all combinations were tried and eventually, insignificant interaction terms were dropped for parsimony. Being the largest of the three groups, the Nam Om Community Enterprise Network was set as the base group for the group dummies and was, therefore, not explicitly included in the regression. In view of the moderate sample size and the nature of the data collection method, the alpha value of 0.10 is applied in interpreting the results in Section 4, while the statistical tables indicate three thresholds for statistical significance: 0.01, 0.05, and 0.10.

### 3.4. Ethical clearance

The data collection instrument and plan were reviewed for ethical clearance and approved by the Research Ethics Review Committee of the Asian Institute of Technology. Moreover, informed consent was obtained from all surveyed households before proceeding to each interview session.
4. Results and discussion

4.1. Farmers’ profile

Table 3 presents the profile of the respondents. The p-values of the Kruskal-Wallis H-test and chi-square test show no significant difference in farmers’ age and non-agricultural income between the three farmer groups. The average age of the respondents was 53 years with the youngest farmer being 27 and the oldest being 82. Average household size and household labor were four persons and three persons, respectively. Several households had only one member and obviously that member was the main laborer, whilst several other households had eight household members and six laborers. The average area of paddy field was 3.6 ha, while two farmers did not own any farmland rented land in. Average non-rice agricultural income and non-agricultural income were THB 19,300 and 78,600 per year, respectively. There was a large variation in annual income among farmers in the study area as shown by the standard deviations. Some farmers generated their income exclusively from rice sale and did not engage in any other income source, whilst some farmers engaged in non-agricultural activities to earn extra income in addition to agricultural income. The gap between the mean and median indicates that the income distribution was right skewed, particularly...
for non-rice agricultural income. On average, experience in rice farming was 38 years long, whilst experience in organic rice farming was eight years, where organic farming was practiced by both younger and older farmers. To engage in organic farming, farmers had invested large amounts during the first few years, and thus they preferred to avail of loan provided by the Bank for Agriculture and Agricultural Cooperatives (BAAC) or by a cooperative.

Table 4 shows that more than a half of the respondents were male (53.4%), while female accounted for 46.6%. Two thirds (65.1%) of the respondents were from 41 to 60 years old, while 67.2% of the respondents had less than secondary level of education. A half (51.3%) of the sampled households had 3–4 members and most (95%) of the households had 1–4 family laborers. Almost half (46.6%) of the households had rice field of 2–4 ha and one third (32.3%) of the households had more than 4 ha of landholding, whereas 21.2% of the households owned less than 2 ha. Most households earned between THB 100,000 and 200,000 annually. According to the Office of Agricultural Economics (2019), Thailand was an upper-middle income country, and in 2018 the average farming households earned an annual revenue of THB 197,000, with their spending of THB 123,000. Therefore, their average annual profit per household was THB 74,000. Thus, 31.7% of the households who could not earn more than THB 100,000 per year might have faced difficulty in assuring their living standards. While income from paddy sale significantly contributed to the total income of the households, 65.9% of them received less than THB 100,000 and 54.6% generated less than THB 50,000 from non-agricultural income sources.

### 4.2. Extent of participation in collective marketing

Figure 2 shows the distribution of extent of participation in collective marketing of organic rice produce. For instance, 20% of the farmers in Nam Om sold 25–50% of their paddy produce through collective marketing. The results confirm that the dependent variable was left-censored at zero and right-censored at 100. Almost one quarter (23%) of the farmers did not sell their organic paddy produce through collective marketing, whereas nearly a half (47%) of the farmers were fully involved in collective marketing. On average, 77% of the organic paddy produce was sold via collective marketing. Farmers in Na So group had higher levels of participation in collective marketing, followed by those in Moral Rice group and then Nam Om group.

Table 5 indicates that the average extent of participation was 88.5%, 69.7%, and 48.2% in Na So, Moral Rice, and Nam Om, respectively. The Kruskal-Wallis H-test confirmed that farmers’ extent of participation in collective marketing was statistically significantly different across the three groups (p = 0.000). Subsequently, Dunn’s post-hoc test revealed that the significant difference existed in all the three pairwise comparisons (Table 6).

Table 7 shows that education was positively associated with extent of collective marketing, whereas age was not. Furthermore, age of participating farmers was negatively correlated with education level, indicating that younger farmers tended to be more educated.

#### 4.3. Perceived benefits from participation in organic rice farmer groups

Table 8 shows levels of perceived benefits from participation in organic rice groups. The ANOVA (aggregate indicators) and H-test (sub-indicators) revealed that there were significant differences in perceived benefits in various dimensions across the three groups. In general, high levels of all aggregate indicators were observed, with the highest mean and median for environmental benefits (4.05 and 4.00), followed by economic benefits (3.87 and 3.75), social benefits (3.62 and 3.50), and institutional benefits (3.51 and 3.50). Moral Rice farmer group showed the highest levels of benefits in social, institutional, and environmental aspects. Na So farmer group exhibited the highest levels of economic benefits, whereas Nam Om community enterprise network exhibited the lowest levels in all the four aggregate indicators.

Values of social benefits ranged from 2.00 to 5.00. Moral Rice farmer group showed the highest value (4.01), followed by Na So farmer group (3.71) and Nam Om community enterprise network (3.45). Compared with the other groups, farmers in Moral Rice group reported a higher level of benefits in terms of health (4.30).

Sathapatyano et al. (2018) found that participation in cooperatives reduces the exploitation and opportunistic behavior of traders in Thailand, indicating an improvement in social responsibilities of traders for the development of the whole supply chain. Other studies confirmed that organic farming could protect both farmers’ and consumers’ health, as well as preserve the ecosystems (Pornpratansombat et al., 2011; Costa et al., 2014; Sharma and Singhvi, 2017; Azam and Shaheen, 2018; Yanakitkul and Aungvaravong, 2020).

Values of economic benefits ranged from 2.25 to 5.00. Na So group showed the highest value (4.14), followed by Moral Rice group (3.97) and Nam Om group (3.70). Farmers in Na So group showed a higher agreement to receiving fair prices (4.22). A study conducted in Ubon Ratchatani Province by Kramol et al. (2020) found that farmers could receive a premium price for their organic rice produce in return for the
value added to consumers’ health, the low yields in the first few years of transition period, and the higher investment for producing organic produce, compared with conventional farming. The higher economic benefits can be linked to higher participation in collective marketing by the Na So farmer groups (Figure 2).

Values of institutional benefits ranged from 1.00 to 5.00. Moral Rice farmer group showed the highest value (3.95), followed by Na So farmer group (3.43) and Nam Om community enterprise network (3.39). Farmers of Moral Rice farmer group reported a fairly high level in terms of having access to knowledge and training (4.19). Farmer groups and associations facilitated access to market and technology information (Landini et al., 2017). This is in line with earlier studies by Fischer and Quim (2012), Abdul-Rahaman and Abdulai (2020), and Kramol et al. (2020).

Values of environmental benefit CI ranged from 2.00 to 5.00. Moral Rice group showed the highest benefits (4.53), followed by Na So group (4.12) and Nam Om group (3.85). Farmers of Moral Rice group reported a higher agreement to improved soil quality (4.56). Nam Om community enterprise network showed lower agreement to improvement in soil quality, water quality, and biodiversity on farmland. Azam and Shafeen (2018) and Badu-Gyan et al. (2019) found that the use of agro-chemicals in conventional farming damaged the biodiversity in the long run.

Table 9 presents that the mean aggregate social and institutional benefits did not differ by education level. On the other hand, the mean aggregate economic and environmental benefits were significantly higher among the more educated.

4.4. Factors influencing farmers’ participation in collective marketing

The variance inflation factor (VIF) was calculated for the set of independent variables and the maximum VIF value was 2.206. Therefore, no significant multicollinearity was assumed in the set of variables included in the analysis. Table 10 shows the results of the two-limit tobit regression. Eleven out of the 24 independent variables were found to be statistically significant, namely age, education, rice cultivation area, non-agricultural income, experience in rice farming, experience in organic rice farming, amount of agricultural loan, group membership duration, economic benefits, membership with Na So farmer group, and two interaction terms.

Age was found to have a negative effect on participation in collective marketing of organic paddy, indicating that younger farmers sold higher percentage of harvest collectively through the farmer group. Quantitatively, as age increased by one year, the percentage of collective sale decreased by 1.6% points on average, holding other variables constant. This result conforms to Khanal and Maharjan (2013) and Martey et al. (2014) who found that younger farmers were more willing to participate in collective action in agriculture (Kaba and Masuku, 2013).

Education had positive effects on collective marketing, suggesting that longer formal education led to greater participation in collective action. Those farmers who completed secondary school and above had no significant effect on collective marketing, amount of agricultural loan, group membership duration, economic benefits, membership with Na So farmer group, and two interaction terms.

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Education had positive effects on collective marketing, suggesting that longer formal education led to greater participation in collective action. Those farmers who completed secondary school and above had the collective marketing percentage higher by 30.7% points compared with those who completed primary school or below. The result is consistent with previous findings that education levels influence farmers’
choice of marketing channels (Xaba and Masuku, 2013; Kyaw et al., 2018; Panpluem et al., 2019; Vu et al., 2020). Educated farmers had the ability to receive knowledge transfer from peer farmers in their group or extension agents (Nandi et al., 2017; Nakano et al., 2018; Hariyanto et al., 2021). Moreover, education can enable farmers to obtain market information and opportunities to sell commodities to new markets (Kiprop et al., 2019).

Rice cultivation area had positive effects on collective marketing, indicating that larger farm size led to higher percentage of harvest sold collectively. As rice cultivation area increased by one ha, the percentage of collective marketing increased by 7.6% points on average. This may be because larger farms can harvest more, thereby increasing marketable surplus (Mukundi et al., 2013; Pochanasomboon et al., 2020; Vu et al., 2020; Kumse et al., 2021). Limitation in landholding typically impedes economic performance of a farm due to limited marketable surplus and insufficient ability to meet the standards of agricultural businesses (Khanal and Maharjan, 2013; Pochanasomboon et al., 2020; Vu et al., 2020). Mathenge et al. (2020) found in Western Kenya that larger landholders tended to sell higher amounts of rice seed to markets. Likewise, Ma and Abdulai (2016) found in China that larger farms were more likely to belong to a farmer group compared with smaller farms.

Non-agricultural income had positive effects on collective marketing. An increase in non-agricultural income by THB 100,000 increased the percentage of collective marketing by 10% points. Wollni et al. (2010) found that households with off-farm employment were more likely to produce organic crops due to better access to information on alternative technologies and market opportunities. In addition, extra income from off-farm activities can raise households’ income levels and budget for investment in rice businesses (Sriwichailamphan and Sucharidtham, 2014; Hariyanto et al., 2021; Sapbamrer and Thammachai, 2021).

Experience in rice farming had positive effects on collective marketing. For a one-year increase in experience in rice farming, percentage of collective marketing increased by 2.0% points. Promme et al. (2017) found that smallholders in Thailand with longer experience had positive attitudes toward group activities and were more likely to sell products through the group. Similarly, Mango et al. (2017) pointed out that an increase in farming experience was associated with improved market participation in Malawi.

Experience in organic rice farming had a positive effect on collective marketing. In the study area, for a one-year increase in experience with organic rice production, percentage of collective marketing through the farmer groups rose by 7.0% points. On the other hand, the interaction term indicates that the members of Na So group with experience in

![Figure 2. Distribution of household-level percentage of paddy sold through collective marketing (n = 335).](image)

### Table 5. The descriptive statistics of percentage of paddy sale through collective marketing in the three farmer groups.

| Farmer group | n  | Mean | Median | SD  | Min. | Max. | H-test (p-value) |
|-------------|----|------|--------|-----|------|------|------------------|
| Nam Om      | 181| 48.2 | 45.5   | 41.2| 0    | 100  |                 |
| Na So       | 91 | 88.5 | 100    | 25.4| 0    | 100  | 0.000***         |
| Moral Rice  | 63 | 69.7 | 100    | 42.9| 0    | 100  |                 |
| Total       | 335| 63.2 | 85.7   | 41.6| 0    | 100  |                 |

### Table 6. Dunn’s pairwise comparison of participation in collective marketing across farmer groups: p-values.

| Farmer group | Nam Om | Na So | Moral Rice |
|--------------|--------|-------|------------|
| Nam Om       | -      | 0.000 | -          |
| Na So        | 0.000  | -     | -          |
| Moral Rice   | 0.000  | 0.004 | -          |

### Table 7. Spearman’s correlation among collective marketing, age, and education.

| Variable                  | Percentage of harvest sold collectively | Age | Education level |
|---------------------------|----------------------------------------|-----|-----------------|
| Percentage of harvest     | 1.000                                  | 0.021| 0.283**         |
| sold collectively         |                                        |     | -0.287**        |
| Age                       |                                        | 1.000| 1.000           |
| Education level           |                                        | -0.287**| 1.000           |

***indicates p < 0.01. No asterisk indicates p > 0.10.
Among the positive changes in the Na So group, the changes related to income were the most significant (Table 8). The percentage of collective marketing increased by 29% points on average. There is no doubt that economic incentives play a major part of incentives for participation in collective marketing. According to Kramol et al. (2020), farmers in Thailand perceived that their income limitation was due to markets’ volatility and lack of bargaining power, which incentivized them to participate in organic farmer groups (Vu et al., 2020). This contradicts previous findings from various other places (Sarkar et al., 2014; Ullah et al., 2015; Sumarsono and Widijajanto, 2017; Petcho et al., 2019; Kramol et al., 2020; Vu et al., 2020; Yanakittkul and Aungvaravong, 2020).

Organic rice farming had lower (6.2%) participation in collective marketing than Nam Om and Moral Rice groups. Most (88%) farmers in Na So group had been producing organic rice for over 10 years, which was much longer than those in the other groups. This may have caused the diminishing marginal returns to organic farming experience in Na So. Some members had individual customers who contacted farmers directly at the farm gate. The longer experience may have developed such network of alternative customers to a greater extent in Na So group. Some members had individual customers who contacted farmers directly at the farm gate. The longer experience may have developed such network of alternative customers to a greater extent in Na So group.

Table 8. Different dimensions of perceived benefits from participation in organic rice farmer groups.

| Indicator and sub-indicator                        | Nam Om (n = 181) | Na So (n = 91) | Moral Rice (n = 63) | Average (n = 335) | Median | SD | Min. | Max. | p-value |
|---------------------------------------------------|------------------|----------------|---------------------|-------------------|--------|----|------|------|---------|
| **Social benefits**                               |                  |                |                     |                   |        |    |      |      |         |
| Increased knowledge and skills                    | 3.36             | 3.63           | 3.89                | 3.53              | 3      | 0.64 | 1    | 5    | 0.000*** |
| Created social network                            | 3.43             | 3.64           | 3.95                | 3.58              | 4      | 0.64 | 2    | 5    | 0.000*** |
| Increase social recognition                       | 3.45             | 3.74           | 3.89                | 3.61              | 4      | 0.67 | 1    | 5    | 0.000*** |
| Improved health                                   | 3.55             | 3.84           | 4.30                | 3.77              | 4      | 0.70 | 2    | 5    | 0.000*** |
| **Economic benefits**                             |                  |                |                     |                   |        |    |      |      |         |
| Reduced production costs                          | 3.73             | 4.16           | 4.11                | 3.92              | 4      | 0.76 | 2    | 5    | 0.000*** |
| Improved yield                                    | 3.69             | 4.08           | 3.86                | 3.82              | 4      | 0.75 | 2    | 5    | 0.000*** |
| Increased income                                  | 3.69             | 4.11           | 3.94                | 3.85              | 4      | 0.77 | 1    | 5    | 0.000*** |
| Received fair price                               | 3.70             | 4.22           | 3.98                | 3.90              | 4      | 0.79 | 1    | 5    | 0.000*** |
| **Institutional benefits**                        | 3.39             | 3.43           | 3.95                | 3.51              | 3.50   | 0.74 | 1.00 | 5.00 | 0.000*** |
| Access to knowledge and training                  | 3.43             | 3.64           | 4.19                | 3.63              | 4      | 0.82 | 1    | 5    | 0.000*** |
| Access to loan/credits                            | 3.38             | 3.42           | 3.73                | 3.45              | 3      | 0.93 | 1    | 5    | 0.020**  |
| Access to external support                        | 3.35             | 3.20           | 3.90                | 3.41              | 3      | 0.92 | 1    | 5    | 0.000*** |
| Access to agricultural and market information     | 3.40             | 3.46           | 3.98                | 3.53              | 4      | 0.84 | 1    | 5    | 0.000*** |
| **Environmental benefits**                        | 3.85             | 4.12           | 4.53                | 4.05              | 4.00   | 0.72 | 2.00 | 5.00 | 0.000*** |
| Improved soil quality                             | 3.95             | 4.22           | 4.56                | 4.14              | 4      | 0.72 | 2    | 5    | 0.000*** |
| Improved water quality                            | 3.73             | 3.93           | 4.52                | 3.94              | 4      | 0.83 | 2    | 5    | 0.000*** |
| Improved biodiversity on farmland                 | 3.87             | 4.20           | 4.52                | 4.08              | 4      | 0.75 | 2    | 5    | 0.000*** |

The composite indicator (CI) values range from 1.0 to 5.0 with qualitative descriptions as follows: “Very Low” if 1.00 ≤ CI < 1.80, “Low” if 1.81 ≤ CI ≤ 2.60, “Moderate” if 2.61 ≤ CI ≤ 3.40, “High” if 3.41 ≤ CI ≤ 4.20, and “Very High” if 4.21 ≤ CI ≤ 5.00; p-values are for ANOVA (aggregate indicators) and H-test (sub-indicators); ** and *** refer to statistical significance at the 5% and 1% levels, respectively.

Table 9. The differences in mean aggregate perceived benefits by education level: the two-sample t-test (n = 335).

| Benefit                                      | Primary school or below | Secondary school or above | p-value |
|----------------------------------------------|-------------------------|---------------------------|---------|
| Social benefit                               | 3.800 (0.659)           | 3.840 (0.657)             | 0.574   |
| Economic benefit                             | 3.990 (0.735)           | 4.310 (0.791)             | 0.047   |
| Institutional benefit                        | 3.640 (0.865)           | 3.570 (0.953)             | 0.154   |
| Environmental benefit                        | 4.120 (0.792)           | 4.250 (0.627)             | 0.028   |

Note: Standard deviations are in the parentheses. The p-values are for the two-sample t-test.
Table 10. Two-limit tobit regression analysis of factors influencing the extent of participation in collective marketing of organic rice (n = 335).

| Variables                                      | Coefficient | Standard error | p-value |
|------------------------------------------------|-------------|----------------|---------|
| Gender (1 if female)                           | -10.133     | 8.236          | 0.219   |
| Age (years)                                    | -1.615***   | 0.492          | 0.001   |
| Education level (1 if secondary high school and above) | 30.666***  | 9.781          | 0.002   |
| Household size (members)                       | -1.778      | 2.954          | 0.548   |
| Household laborers (members)                   | 6.971       | 4.342          | 0.109   |
| Rice cultivation area (ha)                     | 7.563***    | 1.981          | 0.000   |
| Agricultural income excludes rice income (Million THB) | -31.3       | 92.800         | 0.736   |
| Non-agricultural income (Million THB)          | 104.000*    | 53.200         | 0.051   |
| Number of groups joined (number)               | -1.687      | 3.207          | 0.599   |
| Experience in rice farming (years)             | 2.011***    | 0.409          | 0.000   |
| Experience in organic rice farming (years)     | 6.967***    | 1.184          | 0.000   |
| Amount of agricultural loan (Million THB)      | -69.800***  | 23.500         | 0.003   |
| Group membership duration (years)              | 2.868***    | 0.872          | 0.001   |
| Social benefits satisfaction level (scale)      | 4.442       | 7.160          | 0.535   |
| Economic benefits satisfaction level (scale)    | 28.525***   | 6.805          | 0.000   |
| Institutional benefits satisfaction level (scale)| -2.854     | 5.426          | 0.599   |
| Environmental benefits satisfaction level (scale)| 2.399      | 5.782          | 0.678   |
| Group dummies: Nam Om is the base group         |             |                |         |
| Member of Na So farmer group (1 if yes)        | 69.811***   | 25.768         | 0.007   |
| Member of Moral Rice farmer group (1 if yes)   | -26.259     | 56.650         | 0.643   |
| Interaction terms                              |             |                |         |
| Member of Na So farmer group and experience in organic rice farming | -6.196*** | 2.040          | 0.003   |
| Member of Moral Rice farmer group and experience in organic rice farming | 1.742     | 2.628          | 0.508   |
| Member of Na So farmer group and economic benefits level | 7.484     | 4.569          | 0.102   |
| Member of Moral Rice farmer group and economic benefits level | 9.754     | 14.020         | 0.487   |
| Constant                                       | -174.784*** | 43.274         | 0.000   |

p-value

\*\*\* refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

be interpreted cautiously. Thorough assessment of various collective actions is called for in further research. Third, the use of the CI to assess the perceived benefits can be misleading and simplistic. Use of weights for different sub-indicators, where the weights are collected through focus group discussions, can be an alternative for constructing the aggregate indicator of perceived benefits. Lastly, the study focused on three farmer groups in one Province in northeast Thailand. There exist many farmer groups across different Provinces in Thailand. It would require more representative and comprehensive studies to draw policy implications with broader relevance.

5. Future prospects

Nowadays, consumers are increasingly concerned with the health, food safety, and environments, while farmers are also conscious of their own health consequence of the use of synthetic pesticides. As the majority of high-value rice (e.g., jasmine rice) in Thailand is produced in the northeastern region, the organic production of rice in this region is expected to grow further to serve the large and rising demand, especially in the export markets, as long as the farmers gain enough revenue that compensates for the cost of organic production. The marketing channels for the three farmer groups in this study are export traders, social enterprises for export, and domestic retailers, respectively. Collective action will continue to be the key to obtaining certificates and accessing marketing channels for farmers according to the performance of the three groups studied. In the future, with the increased penetration of digital technologies, more producers may sell directly to consumers through online marketing and platforms, which implies that farmers may gain bargaining power against traders. Middlemen will likely reduce their roles in the organic rice markets as farmer groups are increasingly strengthened.

6. Conclusion

To strengthen evidence in literature on organic rice farmer groups in Thailand, this study investigated factors affecting farmers’ participation in collective marketing of organic rice through farmer groups with focus on four dimensions of perceived benefits from collective marketing, non-rice agricultural income, number of groups joined, group membership duration, and agricultural loan. It was found that on average the farmers sold 63% of their organic paddy produce via collective marketing. On the whole, farmers perceived high levels of social, economic, institutional, and environmental benefits across the three farmer groups, of which environmental benefits were the best perceived. Group-wise, Na So farmers perceived the highest economic benefits, whereas Moral Rice farmers perceived the highest social and institutional benefits. The tobit regression analysis revealed that age and agricultural loan negatively influenced farmers’ participation in collective marketing through farmer groups, whereas education, rice cultivation area, non-agricultural income, experience in rice farming, experience in organic rice farming,
group membership duration, and perceived economic benefits positively influenced the extent of participation in collective marketing.

Based on the empirical findings, the study provides the following recommendations. First, the government may take measures to motivate younger farmers with high education background to produce organic products by providing information, knowledge, support fund, and subsidies at the initial stage. Second, public financial institutions may provide low-interest credit for farmers through organic rice farmer groups and promote more opportunities for additional income. Third, knowledge-based training for yield enhancement needs to be provided by experts in view of the landholding limitations. Furthermore, agricultural enterprises may operate training about marketing knowledge for major stakeholders in the rice supply chain, which would improve the efficiency of farmer groups’ performance. Finally, economic benefits from participation in farmer groups’ activities can be further enhanced, which will drive farmers toward increasing the extent of collective marketing of organic paddy produce.

Declarations

Author contribution statement

Yupadee Methamontri: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Takuji W. Tsusaka: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Farhad Zulfiqr: Analyzed and interpreted the data; Wrote the paper.

Vamsawan Yukongdi: Analyzed and interpreted the data; Wrote the paper.

Avishek Datta: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

Additional information

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