Article

Reconfiguring Farming Systems of Smallholders with Market-Led Approach: A Case Study in Northeast Thailand

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Abstract: Agricultural research and development organizations are under pressure to shift from increasing productivity of crops to increasing the profitability and competitiveness of smallholders and linking small-scale farmers to profitable markets. This paper discusses the efforts to assist small-scale farmers to become more sustainable and market oriented. Data were taken from a 5-year participatory action project in a village in Northeast Thailand during 2014–2018. We found that a market-led extension approach can enable farmers to optimize their returns from farming by selecting farm enterprises based on market opportunities for both existing and new products. Farmers need to apply post-harvesting management, including processing, grading, standardization of produce, value adding, packaging, branding, and certification in the process. Collaboration and long-term commitments on the part of scientists, local stakeholders, policymakers, and funding organizations need to be further strengthened.

Keywords: agricultural development; co-innovation; market-led extension; agrarian development; value creation; market-led farming system design

1. Introduction

Agricultural research and development organizations are under pressure to shift from increasing productivity of crops to increasing the profitability and competitiveness of smallholders and linking small-scale farmers to profitable markets [1]. Market orientation must also prioritize community development, human empowerment in the transformation of local resources, and increased opportunities to introduce new practices and products. These changes must be achieved while sustaining the environment and including smallholders who are distant from or not included in rural power centers. Few methods currently exist for assisting small-scale farmers to become more sustainable and market oriented [2]. This paper discusses our efforts to solve these problems.

In rural areas of Thailand, the concern of farmers is not only agricultural production for household consumption but also increased income. This is particularly true for farmers in northeast Thailand where, in 2018, gross income from agriculture accounted for only 37% of the total cash household income, compared to the national average of 52% for farm households [3]. Linking farmers to diverse markets and changing farming systems to be compatible with farmers’ specific physical environments and household characteristics may help increase incomes.

Many recent government initiatives have tried to link smallholders to markets, but these efforts have lacked processes for developing community learning, building capacity for competitiveness, and empowering local people. These initiatives included (a) “OTOP”
(One Tambon One Product) which is Thailand’s version of OVOP (One village One Product) derived from Japan and initiated in 2001; (b) “Farmers’ market” established in 2014; and (c) the “Market-led production” campaign established in 2017. This project aimed to link farmers with supermarkets or hyper markets. These initiatives produced mixed results. Smallholders rarely benefitted from them because the high-end markets that they cater to tend to be more competitive and specialized with rigorous quality standards that can be challenging for many small-scale farmers, particularly farmers who are not within the power structures of their communities. The pro-winner approach of the OTOP which supports four-star or five-star awardees to achieve a better chance of obtaining public subsidies or of being sent overseas indicates continued support for the advantaged producers and overlooking the disadvantaged ones. By linking farmers to hyper markets, a few large-scale commercial farmers were able to seize market opportunities [4,5].

With today’s growing urban population, domestic or local markets represent a large and growing opportunity for small-scale farmers to diversify into higher value products for domestic and regional demands. These markets can link rural and urban residents by creating food supply chains within local areas. This can help support the stability of rural incomes while increasing access to safe and fresh food for urban consumers. It can also increase community solidarity and support for each other while at the same time shortening the supply chain and reducing transportation and environmental costs.

Farmers have a holistic viewpoint developed through their experience managing complex interactions and through operational and local knowledge. Enhancing the capacity of rural people to adapt to a changing environment by empowering farmers to identify and solve their own problems with help from researchers who have access to information and technologies, and encouraging farmers’ active participation have proven to be effective methods for improving local livelihoods [6].

Linking small-holder farmers to markets can increase the adoption and innovation of technology and consequently can improve their incomes. However, it requires a continual learning process for small-scale farmers to adapt their production and market strategies from growing the same products in mass volume to becoming more market-oriented and competitive. Therefore, building the capacity of farmers to identify and develop new market opportunities and experiments through the application of innovative participatory approaches is important for advancing the capacity of farmers to try new innovations and identify alternative products.

This paper proposes an approach built on participatory action research emphasizing farmer-led methods for identifying and evaluating market opportunities and innovating new farming systems and practices that are suitable for meeting new market opportunities. The approach also involves developing distinctive agricultural products that capture local cultural richness and resources in a sustainable manner. The approach focuses on integrating scientific expertise with farmer knowledge, empowering and strengthening social capital, and building entrepreneurial skills to build new markets.

This paper is based on empirical results and lessons learned from implementing the “Poverty Alleviation” project in one village and later extending it to two villages in Khon Kaen province, northeast Thailand between 2014 and 2018. The paper starts with outlining key steps in the implementation process. These include: (1) finding participants and building trust, (2) identifying market opportunities, and (3) selecting appropriate enterprises. This paper will discuss our experiences with farmers’ ability to experiment, to identify and create unique and value-added products, and to form social capital between less-developed farmers and advanced farmers. The paper will also address participatory monitoring and evaluation for improving and scaling up farm enterprises. We believe these initiatives can be used as a model for developing small entrepreneurs in rural areas and can be a baseline for the further development of farmers into community based agro-enterprises that create jobs and income for other residents.
2. Research Methodology

2.1. Study Site

This project was undertaken by The Office of Northeastern Research and Development Cooperation, a program at Khon Kaen University entitled “Public Health and Education Problem Solving Program to Reduce Social Inequality in the Northeast”. Researchers from different university faculties worked with government officials and activists from social organizations to apply knowledge and technology from the university to local problems.

We used Participatory Rural Appraisal (PRA) methods [7] to identify a study area that is representative of the dryland agro-ecosystem covering approximately 85% of the northeast region [3]. We located the project in Phon District, Khon Kaen Province because it is in a “rain shadow” frequently affected by drought (Figure 1). Characteristics of the studied village are described in Table 1. We used PRA to understand the community. And we used farmer-led techniques to identify market opportunities and to apply scientific knowledge to the local environment. We used active participatory approaches to identify and test new practices.

![Figure 1. Location of selected villages (yellow star) in the study.](image)

Table 1. Socio-physical and economic characteristics of the village in 2014.

<table>
<thead>
<tr>
<th>Items</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual rainfall</td>
<td>(average 2014–2018) 710.9 mm</td>
</tr>
<tr>
<td>Provincial rainfall</td>
<td>(average 2014–2018) 1214.4 mm</td>
</tr>
<tr>
<td>Soil types</td>
<td>South: mostly sandy soil</td>
</tr>
<tr>
<td></td>
<td>North: topsoil are sandy loam and loam soil; lower part are Sandy clay loam and clay loam</td>
</tr>
<tr>
<td>Public area</td>
<td>- Community forests (rai) 250</td>
</tr>
<tr>
<td></td>
<td>- Community reservoirs (rai) 77</td>
</tr>
<tr>
<td>Land use</td>
<td></td>
</tr>
</tbody>
</table>

2.2. Overview of Project Steps

The steps applied in the project are briefly shown in Figure 2. The details of each step are described as follows:

2.2.1. Step 1 Identify Interested Farmers and Building Trust

Most participatory development projects apply PRA methods. We also applied that approach at an early stage. However, later we shifted to work with interested farmers and kinship groups. Building trust between farmers and researchers is critical for obtaining real cooperation from farmers.

2.2.2. Step 2 Analysis of Farm Characteristics and Household Goals

Differences in availability of land, labor, capital, and local agro-ecological conditions among participants directly affect the specific options different farm households can pursue in diversifying their farming and marketing systems. We helped farmers to analyze their household capital (natural, economic, human, and social capital) to identify their own strengths and weaknesses. The main questions asked were (a) what do you have or what does the community have? And (b) what is the current situation of that enterprise?
Table 1. Socio-physical and economic characteristics of the village in 2014.

<table>
<thead>
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<th>Items</th>
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<tbody>
<tr>
<td>Annual rainfall (average 2014–2018) (mm) (^a)</td>
<td>710.9</td>
</tr>
<tr>
<td>Provincial annual rainfall (average 2014–2018) (mm) (^a)</td>
<td>1214.4</td>
</tr>
</tbody>
</table>
| Soil types \(^b\) | South: mostly sandy soil  
North: topsoil are sandy loam and loam soil; lower part are Sandy clay loam and clay loam |
| Public area \(^c\) | - Community forests (rai) 250  
- Community reservoirs (rai) 77 |
| Land use \(^c\) | - Total land (rai) 4700  
- Household area (rai) 73  
- Rice (rai) 3550  
- Cassava (rai) 350  
- Sugarcane (rai) 400  
- Households with cattle and buffalo 94 |
| Total population \(^c\) | 1224  
- Man 555  
- Women 569  
- Total number of households 244 |
| Groups in the village \(^c\) | - Village fund, village saving fund, village cremation welfare groups and other related groups 8  
- Occupation groups such as cotton weaving group, reed weaving group etc. 5 |
| Community shop \(^c\) | 1 |

\(^a\), \(^b\), and \(^c\) refer to source of data taken from Meteorological Department, Land Development Department, and key informants’ interview, respectively. 1 ha = 6.25 rai.

2.2.3. Step 3 Evaluate Market Opportunities

In this step, we aimed to identify opportunities and threats to participants. The activity was totally led by the farmers and sought to gather ideas and possibilities from all participants. At the start of the project, the target was nearby markets. Therefore, farmers were asked to identify the types of market, days of selling per week, distances from the village, types of products they could sell, and the number of possible consumers.

2.2.4. Step 4 Identify Farm Enterprises

After steps 2 and 3, farmers were asked to prioritize and identify agro-enterprises based on market opportunities. Enterprise had to be agronomically feasible within the constraints of the local agroecosystem. Farmers and researchers chose activities based on their scientific knowledge and existing innovations from research, review and experienced pioneer farmers. Farmers and researchers compared possible activities using ex ante assessment of selected activities based on local context; soil, climate, water, labor, lag time before generating income, and market. We also identified market competitiveness by simply observing how many farmers we saw selling similar products. Farmers sought to identify market gaps that they could fulfill. The final goal of this step was to identify what farming strategies farmers could use to produce the targeted products.
2.2.5. Step 5 Farms’ Experimentation and Innovation

After identifying what farming activities and farming systems fit their goals, farmers started to do a cycle of designing, planning, testing, monitoring, and evaluating their activities. The researchers then asked them to share in both formal (group) and informal (farm visit or social network sharing) discussions. These steps were repeated until fresh products’ quantity or qualities were stable or satisfied the standards farmers set.

2.2.6. Step 6 Develop Farm Products

The objective of the project was to empower farmers to create unique agricultural products. The main criteria were to produce high quality products, clearly communicate goals, and identify local consumers. We graded the products and set different prices according to the quality of the products. We sought to add value by branding and packaging or primary processing the products developed for the farmer’s market organized by the project.

2.2.7. Step 7 Marketing

In this step, farmers and researchers sought to set prices and calculate cost-profit margins. Building trust with consumers is crucial during this step. We built farmer profiles and developed social media communication and other activities. At the same time, farmers sought to interact with consumers, and develop better selling technique and product displays.

2.2.8. Step 8 Analyzing Consumers’ Feedback

We used feedback from customers to develop better products and, in some cases, to design new farming systems.

2.3. Data Collection and Analysis

We recorded our observations of farmer behavior and practices on the farm and in the markets. We took pictures to describe project results. All quantitative data were collected from short questionnaire interviews or household record data. Data were then grouped and described according to the topics presented. Statistical analysis to test the difference of incomes of farmers before and after joining the project was done through Paired-Sample t-test using the Microsoft Excel program.
3. Results and Discussion

The results are presented in three sections. The first concerns the processes we implemented to identify market-driven opportunities and agricultural enterprise developments; the second part offers an evaluation of the ability of the projects to involve disadvantaged farmers; and the third is an assessment the economic and environmental impacts of the enterprises.

3.1. Implemented Process and Agricultural Enterprise Development

3.1.1. Identify Participants and Trust Building

As mentioned above, we began by applying PRA methods to identify problems, constraints, and participants. In the first and second years, 73 farmers participated in many activities, including integrated farming, tending hens, raising native chickens, planting fruit trees, rearing frogs, and building handicrafts. However, previous experiences with PRA had warned us of how easy it was to fall into the trap of “tyranny of participation” [8]. Most activities became concentrated among the power group surrounding the village headman. Therefore, others farmers could not get access to the support. Hence, we decided to shift to the opposite concept for selecting participants. We identified interested farmers and worked with them. Because of strong kinship ties in the village, it was decided to work with a group of related farmers and to focus on two main activities, organic rice and fruit tree production. In the end, we identified 11 farmers who continued to participate until the end of the project.

We sought to build collegial relationships between farmers and researchers that could yield synergies by combining indigenous and scientific knowledge, provide quicker solutions to real problems at the local level, and strengthen the development of local innovations. In order to build trust, the lead researcher and research assistant joined farmers in work activities, ate with them, and shared ideas as peers rather than teachers. The research team worked in the village for 2 years before giving or sharing ideas or conducting collective activities on the farms.

We learned that to initiate new practices we could not engage every household but had to select farmers with similar interests and then organize them into groups for learning and sharing information and ideas.

3.1.2. SWOT Analysis of Farm Household and Identify Goals

All farmers decided to pursue market-driven production. However, given their different household characteristics, we began with assisting households to conduct a self-analysis of their strengths and weaknesses. The activities that farmers wanted to support were diverse across households. From the total of eleven households, we divided farmers into four groups based on their capital and household strategies before joining the project. However, to develop a clearer picture of the household characteristics, we also assessed households in terms of family life cycle [9]. Table 2 summarizes the data we collected. In general, due to agro-ecological and climatic conditions, the natural capital of participants was upland for field crops and lowlands for rice or field crops. Most households also maintained farm ponds. The main difference among households was the land area of the farm and the amount of lowlands or uplands the farmer had access to.
Table 2. Household characteristics and capital of participants in the project.

<table>
<thead>
<tr>
<th>Type of Households</th>
<th>No. of Farmers</th>
<th>Natural Capital</th>
<th>Economic Capital</th>
<th>Human Capital</th>
<th>Social Capital</th>
<th>Stages in Family Life Cycle</th>
<th>Household Strategy before Joining the Project</th>
</tr>
</thead>
</table>
| Type A             | 2              | - Having land > 60 rai *
                                           - Having both upland crops and rice
                                           - Having farm ponds |
|                    |                | - Having farm equipment (4-wheel tractors, pickup truck)
                                           - Having credit and cash saving
                                           - 50% having savings as in cattle |
|                    |                | - Young (early 40s) and 2 active fulltime farm laborers
                                           - Having marketing experience or crafting skills |
|                    |                | - Wider social networks both vertical and horizontal networks
                                           - Getting access to local political persons |
|                    |                | Families with school-age children |
|                    |                | - Extensive farm activities
                                           - Giving service from farm equipment
                                           - No remittance |
| Type B             | 4              | - Having land 20–30 rai |
                                           - Having both upland crops and rice
                                           - Having farm ponds |
|                    |                | - No big farm equipment such as pickups
                                           - 25% having 4-wheel tractors
                                           - Having cash savings
                                           - 50% have savings as in cattle |
|                    |                | - Relatively young (late 40s-early 50s) but not active
                                           - 75% has only one active full-time laborer and no special skills
                                           - 25% having marketing experience |
|                    |                | - 50% are members of a village community enterprise
                                           - Active in horizontal networks within the village |
|                    |                | - 75% Families just starting
                                           - 25% Families with school-age children |
|                    |                | - Extensive farm activities
                                           - Rely on migration for farm investment and household consumption |
| Type C             | 3              | - Having land 20–30 rai |
                                           - Having both upland crops and rice
                                           - Having farm ponds |
|                    |                | - 66% having 4-wheel tractors and trucks
                                           - Having cash savings
                                           - Having savings as in cattle |
|                    |                | - Old labor (late 50s-early 60s) with 2 active farm laborers
                                           - Having no special skills
                                           - 33% having marketing experience |
|                    |                | Horizontal networks within the village and strong connection with relatives across the provinces |
|                    |                | Aged |
|                    |                | - Extensive farm activities
                                           - No remittance |
| Type D             | 2              | - Having land 10–20 rai |
                                           - Having only lowland rice or unproductive upland due to shortage of labor
                                           - Having farm ponds |
|                    |                | - 50% having 4-wheel tractors and trucks
                                           - 50% having savings as in cattle |
|                    |                | - 50% aged labor (early 60s)
                                           - 50% health problems (early 50s) with one woman active on farm
                                           - Having no special skills
                                           - 50% having marketing experience |
|                    |                | Horizontal networks within the village |
|                    |                | - 50% Families with school age children
                                           - 50% Aged |
|                    |                | - Extensive farm activities with mainly for home consumption and sell the surplus
                                           - Farm wage labor
                                           - Collecting wild products for consumption and sell
                                           - Rely on remittance |

* 1 ha = 6.25 rai.
The analysis showed that most farmers produced lowland rice for home consumption, and rice surpluses were sold in the market (Table 2). Large farmers (Type A) grew rice largely for the market. Farmers having upland fields grew cassava and sugarcane and sold directly to the factory. Farmers that owned mechanized farm equipment such as 4-wheel tractors or pickup trucks earned most of their income from their farm activities and from renting out their equipment. These farmers were not dependent on remittances or money sent from relatives working elsewhere (see [10]). Large farmers (Type A) had more social networks than smaller farmers, and these networks reached beyond the village to higher political and administrative levels and to local political leaders and organizations. Within the village, they maintained social networks with relatives (see [11]). They also had marketing skills or special skills gained from being migrant labors in factories or other activities in the eastern seaboard and in Bangkok. They were young laborers. Both households were in the school-age child family life cycle.

Two groups of medium size farm households (Types B and C) had similar land holdings and were alike in other ways but differed in age (40s/50s vs. 50s/60s). Type B households (40s age group) relied on remittances for farm investments and household consumption. These households had at least one family member working in another province or country both historically and currently. Young people in the northeast often migrate because of limited income earning opportunities nearby. The older farmers (Type C) were classified as retired adults working on farms for both consumption and market.

There were two Type D households. These households had access to less land; one household was composed of elderly farmers with health problems, and the other household was headed by a single parent with teenage children. This farmer had farm equipment, upland land, and teenage family members but lacked enough labor to effectively farm their land. They diversified their income by working as farm laborers for others in the village and sometimes collecting forest products to sell in the market. Their major farm activity was growing rice for home consumption and selling the surplus. The elderly household relied on remittances (money) from relatives.

Table 3 shows a SWOT analysis of each type of household, farm activity, and market choice. Large farmers (Type A) had more choices than others due to their greater strengths, particularly in labor (number and skill), land, capital (money and vehicles), and networks. This allowed them to link to various distant markets. Medium size farm households (Types B and C) had land and labor to invest in new farming systems and to produce new products for the market but had less access to markets than Type A. Type D households had less land and access to labor but were good at making a local dessert called “Khoa Tom Mat” or boiled sticky rice wrapped in banana leaves. Their strategy was to produce this dessert from organic rice for the market. However, due to lack of labor, these farmers relied on Type A and Type B farmers to sell their products in the markets.

3.1.3. Evaluate Market Opportunities

In the first stage of the project, our main objective was to increase farm income through a more market-driven extension strategy that would enable farmers to intensify and diversify their farming systems based on local market demands and farm characteristics. An analysis of the local market was done simply through group discussion. We found that there were many local markets almost every day within a 20 km radius of the village. There were two main large district markets and green markets (selling organic products) where one of the project members used to go. Some villagers also sold their products in the nearby local markets. Analysis showed that these markets sold agricultural products such as local and imported vegetables, rice, local and imported fruits, ready to eat foods, and other household goods by both local and outsider merchants. Farmers identified products that were rarely found in the local markets such as straw mushrooms.
Table 3. SWOT analysis of each type of households, farm activities and market choices in the project.

<table>
<thead>
<tr>
<th>Family Type</th>
<th>Strengths</th>
<th>Weaknesses</th>
<th>Farm Enterprises and Market Choices</th>
</tr>
</thead>
</table>
| Type A      | - two active labors per households  
- large land holding  
- high investment capacity  
- own farm equipment reduced farm labor usage  
- high risk taking due to savings and diversified household incomes  
- having marketing experiences and crafting skills  
- having truck or pickup referring to mobilization to distant markets  
- having digital skills  
- wider social networks  
- high expense on children education  
- time-bounded with childcare  
- low soil fertility  
- insufficient water for the whole growing season for crops  | - organic rice production in large parts of the land with new and high nutrition varieties for city customers  
- processed rice as Khao Lam for nearby and city markets  
- handicrafts from reeds  
- certified organic and pesticide free fruit trees tolerant to drought, short duration vegetables and mushroom production for nearby and city markets | |
| Opportunities | - new demand of organic products  
- many markets both within the district and in the downtown  
- poverty project supported partial inputs, knowledge and network  
- new organic and pesticide free markets supports from NGO and government  
- government support certification of organic rice  | - insufficient and irregular rain  
- similar agricultural products in the market | |
| Threats | - insufficient and irregular rain  
- similar agricultural products in the market | | |
### Table 3. Cont.

<table>
<thead>
<tr>
<th>Family Type</th>
<th>Type B and Type C</th>
<th>Weaknesses</th>
<th>Farm Enterprises and Market Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 1–2 relative active labor per household</td>
<td>- aged and farm-bounded laborers</td>
<td>- organic rice production in some parts of the land with new and high nutrition varieties for city customers by relying on Type A vehicles *</td>
</tr>
<tr>
<td></td>
<td>- medium to low investment capacity</td>
<td>- no and low marketing skills</td>
<td>- processed rice as crispy rice crackers for nearby and city markets</td>
</tr>
<tr>
<td></td>
<td>- medium risk taking</td>
<td>- low soil fertility</td>
<td>- certified organic and pesticide free fruit trees tolerant to drought, short duration vegetables and mushroom production for nearby and city markets by relying on Type A vehicle</td>
</tr>
<tr>
<td></td>
<td>- medium land holding</td>
<td>- insufficient water for the whole growing season for crops</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- no vehicles for distant markets</td>
<td></td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- new demand of organic products</td>
<td>- insufficient and irregular rain</td>
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<td>- many markets both within the district and in the downtown</td>
<td>- similar agricultural products in the market</td>
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<td></td>
<td>- government support certification of organic rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weaknesses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- one older farmer and few laborers</td>
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<tr>
<td></td>
<td>- no capital for investment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- no marketing skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- low social capital and network</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Farm Enterprises and Market Choices</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>- organic rice production in some parts of the land with new and high nutrition varieties for city customers by relying on Type A and Type B farmers **</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- processed organic rice to local desserts and sell in the city relying on Type A and Type B farmers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* farmers commute to the markets with Type A vehicles; ** farmers rarely go to the markets by themselves, most of the time relying on Type A and Type B farmers to sell their products in the markets.
3.1.4. Identify Farm Enterprises and Strategic Planning

The lack of rainfall in the area limited the crops that could be grown. Consequently, working with the farmers we had to identify agricultural products that could be grown and marketed in rainfed areas. We used two approaches (Figure 3) to identify possible products. The first approach was to look for new market demands for existing crops (rice). The second approach was to identify new crops that fit the economic and climatological constraints and met market demand (mangos).

![Diagram](Figure 3. Steps for identification of farm enterprises and strategic planning for innovative production systems.)

For the first approach, one farmer with marketing experience noticed that in the local market there was a seller who sold brown rice at a higher price than white rice and, hence, he could set his own price. The farmer who noticed this decided to sell brown rice in the market as well instead of selling paddy rice to rice mills where she had no ability to negotiate the price. This idea fit well with the project’s objective of empowering farmers by getting them organized into groups (social capital) based on common interests. Such groups could gain more efficient access to both inputs and markets and could promote sustainable natural resource management practices. This idea also met the need to sell products that fit the local farming systems and that were already being produced by farmers.

We initiated group discussions with farmers to learn their opinions. After much dialog we jointly decided to produce organic rice. The market analyses we conducted showed that to be competitive in this market, the products had to be diverse and distinct since only a few types of rice varieties were sold locally. In order to gain the trust of consumers, we also had to have the rice certified as organic. Fortunately, this idea fit in with the government’s policy to support organic rice production by giving subsidies to farmers. However, government subsidies were also a threat because they encouraged many farmers to grow organic rice to sell directly in the market. Organic rice takes advantage of consumers’ concerns for health and environmental sustainability.
The second approach comes from problems associated with conventional enterprises in the upland areas with limited rainfall. Over the last few decades, farmers have grown cassava and sugarcane in the upland areas. Farmers were concerned that prices of these products fluctuated greatly between years while inputs and labor costs kept increasing. This led farmers in some years to suffer losses or very low profits. This was particularly true among farmers who lacked mechanical equipment to lower production costs. Farmers also reported the problem of soil degradation and the intensive use of herbicides when growing these crops. Farmers felt that they needed to change their upland cropping systems.

Participating farmers and researchers searched for innovative cropping systems by examining other local existing cropping systems in the area. They found that in nearby areas, some farmers grew mangos without irrigation for export. After further analyses of the opportunities and constraints of mango production, farmers decided that mangos fit well with their soil and climatic conditions. In addition, while fruit trees require a big investment at the beginning, they can be harvested for 20 years. Mango production requires less labor to manage when farmers get older compared to cassava and sugarcane. However, mango production requires the use of a lot of pesticides including herbicides, insecticides, and fungicides. It also requires at least 10 rai or more to make a profit. So, farmers decided to produce mangos for local rather than international markets.

Farmers in Thailand grow numerous varieties of mangos for the market. Project participants and researchers conducted an analysis of local demand and opportunities and the fruiting potential of each variety, particularly under drought conditions. Buyers in the local market demonstrated a growing demand for green mangos with an internal yellow texture and high vitamin A or vitamin C content. Hence, our participants selected a variety called “Keaw Kha Min” which means “Turmeric mango” that originated in Cambodia. Pioneer farmers growing this variety confirmed its high yield under drought conditions.

Growing mangos requires at least 3 years before a producing marketable. Participants developed systems for intercropping alternative crops among the mango trees and outside the mango plots according to each household’s labor capability and land suitability. Some mangos were planted in uplands or after the rice was harvested in lowland plots. Participants and researchers conducted an ex-ante analysis of alternative intercropping systems to determine their suitability based on length of growing season, input costs, labor productivity, marketability in the local market, and impact on soil fertility. This step was important in order to reduce the risks to the new enterprise both in terms of household income and food production.

3.1.5. Farms’ Experimentation and Innovation

During this stage, farmers tested the strategic plans developed in the previous stage. Testing provided an opportunity for the farmers to adapt and innovate their production technologies or crop choices to fit their household labor, economic resources, and farm conditions and market opportunities. This group of farmers were risk takers with the new approach and the unreliability of rainfall. The project therefore subsidized half the cost of inputs in order to reduce the overall risk and to encourage farmers to try, test, and develop farm technologies appropriate for their household and farm conditions.

This is a cyclic process from planning, implementing, evaluating, getting feedback, and revising the plan and then repeating the cycle again as shown in Figure 2. We used methods appropriate both for individuals and for collective activities in selected farmer’s plot and then applied in their own fields. The activities included workshops and training by experts in the communities as well as farm visits by researchers and research assistants. Problems and constraints were shared among the members both formally in focus group and informally by discussion via social media using “Line”. Best practices were shared by inviting farmers who undertook the same activities to visit the best practice plot. The output was compared with the average output of the best practice farmers or with similar activities in other areas. Production process analysis by both farmers and researchers was applied to identify farming steps that could be improved. This process refers to co-innovation among
farmers, researchers, and customers where information, knowledge, resources, and skill are shared to generate new practices, new products, and new business models as shown below [12].

We found during this step that farmers adapted and invented many farming practices and processes to find those that best fit their conditions and market demands and standards. Most of their strategies were based on understanding their capacities and climatic risks in the area. For example, one organic rice farm applied organic fertilizer after heavy rains. This was the opposite of the recommended practices. Diversified portfolios support northeastern farmers to survive unpredicted and uneven distribution of rainfall, unproductive natural resources, or social system. Before the 1960s, most of diversification relied on natural resources and the local community. However, diversification beyond the farm and local communities to regional, national, and international settings were gradually developed [10,13–15]. The production technologies adapted and invented by the farmers are shown in Table 4.

Table 4. Farmers’ adoption, adaptation, and innovation in production practices.

<table>
<thead>
<tr>
<th>Selected Enterprise</th>
<th>Farmers’ Adoption, Adaptation and Innovation</th>
<th>Traditional or Recommendation Practices</th>
<th>Farmers’ Reason/Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic rice</td>
<td>No basal organic fertilizer application but apply organic fertilizer after the rain</td>
<td>Basal application of organic fertilizer</td>
<td>Climate risk management and input efficiency</td>
</tr>
<tr>
<td></td>
<td>Growing green manure crops before and after rice (Crotalaria and jack bean)</td>
<td>Fallow</td>
<td>- Soil fertility improvement</td>
</tr>
<tr>
<td></td>
<td>Rice variety testing and evaluation: 1 local abandoned sticky rice variety with low amylose content, potential for diabetic consumers 2 new colored rice varieties (red and purple pericarp color) 1 local purple sticky rice variety 1 new high yielding sticky rice variety 1 new high yielding and good cooking quality rice variety</td>
<td>Two variety of rice RD6 for home consumption and Jasmin rice for sale</td>
<td>- Product diversification</td>
</tr>
<tr>
<td></td>
<td>Joining rice organic certification standard of Rice Department</td>
<td>-</td>
<td>- Risk diversification</td>
</tr>
<tr>
<td>Mango production</td>
<td>Diversification of mango varieties for each type of household</td>
<td>One variety</td>
<td>- Preservation of local rice varieties</td>
</tr>
<tr>
<td></td>
<td>Diversify type of fruit in the plots into tamarind, banana, guava, pomelo, new bamboo varieties</td>
<td>Only mango</td>
<td>- Finding the best fit variety</td>
</tr>
<tr>
<td></td>
<td>Intercropping in mango or fruit plots with sticky corn, pumpkin, peanut, indigenous vegetable</td>
<td>-</td>
<td>- Market diversification</td>
</tr>
<tr>
<td></td>
<td>Raised-bed straw mushroom to generate income during the lag period of mango</td>
<td>-</td>
<td>- Consumption preference</td>
</tr>
<tr>
<td></td>
<td>Quality improvement of guava fruit</td>
<td>Using potassium fertilizer</td>
<td>- Increase income and food for household</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Bio-fertilizer from trainings and information from internet</td>
</tr>
</tbody>
</table>
We were surprised that the methods applied from step 1 to step 5 were similar to those used by [6] to improve market production opportunities for poor people in rural Africa.

3.1.6. Develop Farm Products

Given that this project sought to promote unique and competitive farm products that farmers could sell directly to consumers, this was an important step for meeting consumers’ preferences. This step involved post-harvest management including processing, grading, standardization of produce, packaging, storage, and certification. For example, after the organic rice was milled, we strained it to get rid of any broken rice. Then, unwanted particles such as paddy rice, wrong colored rice, and weeds were removed. Milled rice was wrapped in 0.5, 1, and 5 kg packages according to market demand. We developed a brand name that represented the local identity of the farmers, “Khao Luem Laeng”, which means “drought forgotten rice”. Organic rice with this brand includes all types of rice farmers grew using organic methods. The package and different sizes of packages are presented in Figure 4.

![Organic rice branding label](A)

![Packaging](B, C, D)

**Figure 4.** Organic rice branding label in the project, front side with information of main rice varieties and “Khao Luem Laeng” or “drought forgotten rice” branding (A), packaging of organic rice in different styles for 1 kg (non-vacuum (B) and vacuum (C) packed) and size 5 kg non-vacuum packed (D).

In the fruit project, only guava produced fruits during the data collection period. We graded guava according to the quality favored by customers, including size (not too big or too small and round), fruit color (white or pale green), and skin texture (smooth and no pest or disease symptoms). All fruit sold at the farmers market got the agricultural production standard of Good Agricultural Practices (GAP) certificate. We set the price according to this grading system with higher prices for grade A and lower prices for Grade B fruit.

3.1.7. Marketing Strategies

In their local home markets, farmers displayed their products to show the quantity and quality of the goods and the packaging designed to attract customers. In markets outside their villages, farmers used different strategies but with the same goal of providing...
information about the product to customers. For organic rice, for example, farmers built a Facebook page to advertise their product. The Facebook page provided information about each farmer, their farm, as well as data about the quality of different rice varieties they grew, about the methods of production and post-harvest processes, product sizes, and at what markets their products were available. The Facebook page helped to build a relationship between the farmers and consumers; it also allowed customers to provide feedback to each farmer. At the market, price tags and product displays were used. New products were labeled (Figure 5).

![Facebook page with rice products](A) ![Product display](B)

**Figure 5.** Information about the farmers and products shown in Facebook indicating story telling of the “Khao Luem Laeng” or “drought forgotten rice” branding (A) and rice processed products “Khao Taen” (crispy rice crackers) at the market (B).

### 3.1.8. Analysis of Consumers’ Feedback and Plans for Development

The project supported participating farmers by opening a market near Khon Kaen University. This motivated farmers to add value to their products so as to respond to market opportunities and compete better with farmers both within and outside their immediate area. The main constraint farmers faced was that they were all selling the same rice product. Therefore, each participating farmer had to find at least one unique food or beverage to sell. The unique rice products included “Khao Larm” (sticky rice in bamboo tubes), “Khao Niew Ping” (sweet baked rice in banana leaves), “Khao Taen” (crispy rice crackers) and “Nam Khoa Klong Ngork” (germinated brown rice drink). Ready to eat fruits were also prepared that met customers’ preferences. Farmers could sell these unique products at higher prices than products made from milled rice alone, particularly the sticky rice in bamboo tubes, a popular traditional food for local people.

Feedback and interaction with customers provided information on customers’ preference which allowed the farmers to adjust their recipes. It also provided information for the farmers allowing them to adjust their farming systems. For example, one farmer started growing roselle in order to use its flower to produce a roselle herbal drink. Another farmer increased the planting area for mangos in order to meet the demand from consumers.

We learned that having a market and support from the project allowed the farmers to develop entrepreneurial skills for selling both raw and processed products in different markets, not just the closest local market. Of the eleven farmers who participated until the end of the project, seven were able to continue selling their products. Three participants had prior marketing experience. One farmer with prior market experience was able to join niche markets organized by government, private sector, and non-government organizations.
Four other participating farmers dropped out of this market. These farmers were in groups C and D. Where farmers from D type completely stopped selling farm products, two households from type C were still selling their products in the village market. The lack of laborers and aged farmers was the main problem for farmers in Type D. Aged farmers not being as cash-oriented may explain why Type C farmers continued selling farm products.

3.2. Impact of the Project


3.2.1. Social Capital Empowerment

Evidence suggests that high social capital is related to improved economic and social wellbeing, particularly in participatory projects. High social capital reduces the transaction costs of working together and facilitates cooperation. Social capital stimulates people to invest in collective activities by knowing that others will do the same. It can also restrain people from private actions linked to negative outcomes. Social capital focuses on trust, reciprocity and exchange, common rules, norms, and sanctions by using three types of connectedness (bonding, bridging, and linking). Connectedness is important for building networks within, between, and beyond communities [11].

The project helped bond members with different activities that reflected trust, reciprocity and exchange, and common rules and norms. Such cooperative activities included selling other farmers’ products who were not able to join the market or exchanging labor for rice transplanting, harvesting and grading, or setting rules for farmers with advanced orders for Khao Larm to buy rice from other farmers, particularly from farmers who could not access the higher priced markets. Bridging means the capacity of groups to make links with others who have similar or different views, and linking means the ability of groups to engage with external agencies either to influence their policies or to draw on useful resources. We found that farmers had strong bridging or linking skills, but seldom had both skills. However, this group of farmers had ‘links’ that gave them greater bargaining power to buy organic fertilizer at lower prices.

The aim of the project was also to empower farmers to innovate and adapt and use new information to meet their own needs [16]. We found that the project could provide a platform for farmers to build autonomous decision-making processes in agricultural systems and to communicate their knowledge with other farmers and researchers. Farmers were able to test, adapt, and innovate many new farming techniques that fit with their household conditions and markets. We also found that many farmers had enough self-confidence to participate in official organizations in order to gain access to money and knowledge. Two examples included a handicraft group whose members were able to obtain government funding to continue their project and a group of organic rice farmers chosen by Subdistrict Administrative Organization to be trainers for using bio-fertilizer. The project tried to enable participating farmers to discuss, plan and interact with local authorities in order to run the village market. However, due to many bureaucratic problems in the village, this activity ultimately failed.

3.2.2. Increase Farmers’ Income

Researchers assisted farmers to record economic data throughout the third year of the project. Farmers later complained that this was a burdensome task, and thus, they abandoned it. We discuss results from the third year of the project below. The economic data suggest that after participating in the project, farmers earned higher incomes. In general, statistical analysis showed that there were significant differences in income before and after joining the project (significant at the 10% level). We also found that different types of households had statistically different income increases after joining the project. Type B farmers and Type D farmers had significantly higher incomes after joining the project.
We found two main sources of increased incomes. First, diversifying farm activities from a single endeavor such as rice, field crops, or wage labor to more varied activities provided a source of additional income. Second, adding value to the main crop by further processing it (i.e., making “Khao Lam” from rice) provided another source of additional income. Some farmers, of course, encountered losses, such as a farmer who lost income when she changed from cassava to mangos. Even this farmer received more income from guava and crops grown after rice, but the income was still less than from cassava.

The main objective of the project, however, was not just to increase the total annual income of the farmers but also to ensure a sustainable income throughout the year (Figure 6). Farmers generally earn income only after harvesting and marketing a crop. Crops such as cassava, sugarcane, and rice that are usually harvested once per year make it difficult for farmers to obtain income throughout the year. By adding fruit trees such as guava, banana, and mango to the crops grown, farmers can earn income during the rainy season. The farmers’ market gave farmers an outlet to earn income throughout the year from processed products such as ‘Khao Lam’ and seasonal vegetables and fruits. Our findings confirm those of the “Farmer market” project of the government initiated in 2014 that local outlets for farm products can increase farmers’ income. However, we have no data on how much a family farm earned during and from the project.

Table 5. Household income of farmers before and after participating in the project (data from the third year).

<table>
<thead>
<tr>
<th>Type of farmers</th>
<th>Household Income (Baht/Year)</th>
<th>Before joining the project</th>
<th>After joining the project</th>
<th>p-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Min.</td>
<td>Max.</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>All Farmers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before joining</td>
<td>234,157</td>
<td>77,400</td>
<td>557,500</td>
<td>151,768</td>
<td>0.09 §</td>
</tr>
<tr>
<td>(10 hh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>§</td>
</tr>
<tr>
<td>After joining</td>
<td>293,377</td>
<td>85,100</td>
<td>663,600</td>
<td>198,609</td>
<td>0.09 §</td>
</tr>
<tr>
<td>(10 hh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>§</td>
</tr>
<tr>
<td>Type of farmers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type A farmers (2 hh)</td>
<td>Average</td>
<td>371,800</td>
<td>557,550</td>
<td></td>
<td>0.41 ns</td>
</tr>
<tr>
<td></td>
<td>Min.</td>
<td>340,200</td>
<td>451,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max.</td>
<td>403,400</td>
<td>663,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>44,689</td>
<td>149,977</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type B farmers (3 hh)</td>
<td>Average</td>
<td>174,099</td>
<td>241,812</td>
<td></td>
<td>0.01 **</td>
</tr>
<tr>
<td></td>
<td>Min.</td>
<td>123,600</td>
<td>202,380</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max.</td>
<td>216,447</td>
<td>274,072</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>46,957</td>
<td>36,380</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type C farmers (3 hh)</td>
<td>Average</td>
<td>287,757</td>
<td>287,858</td>
<td></td>
<td>0.99 ns</td>
</tr>
<tr>
<td></td>
<td>Min.</td>
<td>150,100</td>
<td>115,179</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max.</td>
<td>557,500</td>
<td>563,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>233,621</td>
<td>241,559</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type D farmers (2 hh)</td>
<td>Average</td>
<td>106,200</td>
<td>114,830</td>
<td></td>
<td>0.07 §</td>
</tr>
<tr>
<td></td>
<td>Min.</td>
<td>77,400</td>
<td>85,100</td>
<td></td>
<td>§</td>
</tr>
<tr>
<td></td>
<td>Max.</td>
<td>135,000</td>
<td>144,560</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>40,729</td>
<td>42,045</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

hh = household, SD = standard deviation, 1 USD = 35 baht; §, ** = statistically significant at the 10 and 1% level, respectively and ns = not significant.

We found that changing upland fields from field crops to fruit tree produced higher economic returns. Data collected from one farmer showed that two years after planting
guava, the farmer earned about 66,180 baht per rai (1 USD = 35 Baht), with labor productivity of 838.0 baht per laborer per year. Labor productivity under sugarcane and cassava was 273.4 and 319.6 baht per laborer per year, respectively.

Figure 6. Annual distribution of income of participating farmers in the third year of the project.

3.2.3. Improve Natural Resources

Growing organic rice and fruit for the market required farmers to practice more sustainable environmental practices. Many actors (government, academic, NGOs) supported farmers in switching from using chemical inputs to using organic methods to grow rice and fruit products. Farmers used little or no chemical fertilizers, herbicides and pesticides under organic rice and fruit GAP standards. After turning rice production to organic production, farmers reported that more natural foods had returned to their paddy fields. This benefit may encourage changes in farmer behavior. However, in the longer term, farmers will face challenges using environmentally friendly crop production methods, but we believe that this goal is a learning process that needs to be supported by research, economic incentives, and regulations.

Ledo et al. [17] reported that changing land use from annual to perennial crops increases soil organic carbon through time. We hope that this change will mitigate soil degradation problems throughout the area.

4. Conclusions

This study shows that a market-led extension approach can enable farmers to optimize their returns from farming by focusing not only on producing existing crops but by selecting farm enterprises based on market opportunities for both existing and new products. The study also demonstrated a learning process for testing and innovating farming practices to produce farm products that fit with the preferences of consumers in the market. Farmers need to apply post-harvesting management, including processing, grading, standardization of produce, value adding, packaging, branding, and certification in the process. Farmers need to respond to demand, to the needs of the consumer, and to feedback from consumers. They need to use these mechanisms to improve their production techniques and their farming system.
For researchers, the key step is identifying and selecting interested farmers to participate in the project to ensure active participation. At each step, it is important to share information and knowledge between the farmers and researchers in order to reflect and give feedback based on trust to facilitate the learning process among participating members. This process is like the “Farmer market” initiated by the government in 2014. The data from the Department of Agricultural Extension showed that in 2019 farmer markets in 77 provinces within the country had 144,866 shops or a 52% increase compared to 2018. Total farmers market sales were 327,909,224 baht or a 46% increase from 2018. This increasing trend indicates that local markets can generate income for farmers. However, the government has not yet reported on how many farmers are involved in this project, and farmers markets are the only policy the government currently has for improving farmer livelihoods. The long-term sustainability of farmers’ markets is therefore not known. Farmers’ markets can be organized not only by government agencies but also by groups of farmers or consumers interested in sustainable and environmentally friendly products.

For government agencies and researchers to shift from production-led extension to market-led extension requires institutional changes and new skill sets as well as changes in the attitudes of extension agents and researchers alike. The need to change also extends to the universities that train the agents and to the government institutions that implement the projects.

This project is just the beginning for each activity in the area. We found that new research questions emerged during the project. We also found that not all farmers gain benefits from market-led extension approaches. Collaboration and long-term commitments on the part of scientists, local stakeholders, policymakers, and funding organizations need to be furthered strengthened. Collaboration with International Cooperative Alliances which support smallholders’ access to the market with sustainable production approaches can also sustain and ensure the long-term operation in the area.

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