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Appropriate agricultural system management approach in the area of Land Readjustment and Irrigation for Agriculture, Thailand

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Abstract

The purposes were to study 1) context of farmer's agricultural system management 2) appropriate alternative farming systems, and 3) appropriate agricultural system management approach. The populations were 1) 348, 595, and 567 farmers participated in the land readjustment and irrigation for agriculture project in Chainat, Kalasin, and Phatthalung Provinces, respectively. The samples were determined using Taro Yamane's formula at an error level of 0.1, resulting in a sample of 78, 86, and 85 people, respectively. The simple random sampling was used. Data were collected using an interview form and analyzed using descriptive statistics in the context of farmer's agricultural management. 2) Key informants on appropriate alternative farming systems and appropriate agricultural system management approach consisted of 50 farmers, entrepreneurs, agricultural extension scholars. The purposive sampling was used. Data was collected using focus group and analyzed by content analysis.

The results showed that 1) all farmers managed their agriculture with rice mono-cropping system. The farmers in Chainat and Kalasin province had a loss from rice farming in the amount of 1,326.77 and 256.51 baht per rai respectively whereas the farmers in Phatthalung province earned a profit of 1,160.76 baht per rai. 2) Overall, the appropriate alternative farming systems could be divided into 4 systems: (1) rice mono-cropping system (2) rice-bean rotation system. (3) rice production system in combination with other agricultural activities, and (4) integrated farming system. 3) Overall, the appropriate agricultural system management approach found that (1) Upstream - fertilizer application based on the value of soil analysis, cost reduction by mixing self-use fertilizers, reducing the rate of seed use, use of biologics, and integrated pest management. (2) Midstream - production of agricultural products to standards under the collaborative farm system. (3) Downstream - product price guarantee, pre-sale of goods, direct sales of goods, and online marketing promotion.

Keywords— agricultural system management approach, alternative farming systems, land readjustment, supply chain

I. INTRODUCTION

The area of land readjustment and irrigation for agriculture is considered an agricultural area with more potential and readiness for farming than any other area because the area is well equipped with various agricultural infrastructures such irrigation systems, transport systems, and land leveling. However, the condition of agricultural management of farmers after land readjustment and irrigation for agriculture showed that farmers continued to farm using the traditional production system as in [1]. As a result of traditional farming practices, farmers retain the same returns and are not worth the investment in agricultural infrastructure by the government. In this regard, farmers lack knowledge and indecisiveness about farming in other systems, including lack of appropriate agricultural system management approach in terms of productivity, stability, sustainability, equitability as in [2].

According to the above reasons, it is necessary to study the appropriate agricultural system management approach in the area of land readjustment and irrigation for agriculture, especially in Kalasin, Chainat and Phatthalung provinces. The Royal Irrigation Department has already placed agricultural infrastructure in these model locations and farmers are ready to change from the traditional agricultural system to other alternative farming systems as in [1]. The results of this research can be used as a model for research in other areas in terms of the area of land readjustment and irrigation for agriculture and agricultural areas both in irrigated and non-irrigated areas.

II. RESEARCH OBJECTIVES

This research aimed to study

2.1 the context of the agricultural system management of farmers

2.2 the alternative farming system in the farmer's area

2.3 the agricultural system management approach throughout the supply chain

III. RESEARCH METHODS

This research was a quantitative and qualitative research. It could be divided into 3 steps as follows:

Step 1 - Study on the context of the agricultural system management of farmers

The population was 348, 595, and 567 farmers in the area of land readjustment and irrigation for agriculture. The sample was determined using Taro Yamane's formula at an error level of 0.1. The samples were 78, 86 and 85 people, respectively. The research tool was an interview form. The confidence was tested using Cronbrach's alpha value and was

greater than 0.8. Therefore, it could be used for field data collection. Data were analyzed using descriptive statistics in the context of farmer's agricultural system management, namely farmer's agricultural system, and production costs and returns.

Step 2 - Study of alternative farming systems in the farmer's area was organized into three sub-stages:

2.1 Study of market demand and return on investment of agricultural products

The population was a key informant in the study of the market demand and return on investment of agricultural products, consisting of local agricultural market operators, and local agricultural extension officials. The research tools for data collection were divided into three using a triangular technique: surveys, in-depth interviews, and secondary data collection. Subsequently, the content data was analyzed by content analysis.

2.2 Study of alternative plant/animal species suitable for the area could be classified into two sub-steps:

2.2.1 Alternate plant/animal designation: The population consisted of 10 key informants, including agricultural extension academics, and university agricultural scholars. The purposive sampling was used in the study. The research tool was focus group. The content analysis was analyzed by classification and grouping of alternative plant/animal species that were appropriate for the area.

2.2.2 Alternative plant/animal production potential analysis: The population was 348, 595, and 567 farmers, respectively. The purposive sampling of 50 people was used from farmers who qualified as community leaders and who were ready to make the transition to alternative farming. The research tool was the 4P and 5M alternative plant/animal production potential assessment scales. The confidence was tested using Cronbrach's alpha value and was greater than 0.8. Therefore, it could be used for field data collection. Data were analyzed using descriptive statistics using the following interpretation criteria: 1.00-1.80 means the lowest opinion, 1.81-2.60 means low opinion, 2.61-3.40 means moderate opinion, 3.41-4.20 means high opinion, and 4.21-5.00 means the highest opinion.

2.3 Study of alternative farming systems was divided into two sub-stages:

2.3.1 Analysis of alternative farming systems: The population consisted of 10 key informants, including agricultural extension academics, and university agricultural scholars. The purposive sampling was used in the study. The research tool was focus group. The content analysis was analyzed by categorizing alternative farming systems in the area.

2.3.2 Summary of alternative farming systems in the area: The population was 348, 595 and 567 farmers, respectively. The purposive sampling of 50 people was used from farmers who qualified as community leaders and who were ready to make the transition to alternative farming. The tool was a 3D agricultural system assessment scale:

1) The suitability of the agricultural system could be assessed from yield, income, stability of production and income, sustainability, the ability to adapt the agricultural system to the area, no problems and no conflicts in the community, and self-sufficiency of farmers through the agricultural system.

2) The feasibility of the agricultural system could be assessed from feasibility of area, farmer's knowledge, farmer's operating skills, farmer's readiness in finance, investment, labor, time, technique, practice, market for purchasing produce, and policies and support from various sectors.

3) The benefits of the agricultural system could be assessed from production cost reduction, increase in income, profitability, quick payback period, risk reduction in production, cost-effective use of space and resources, creating ecological balance and preserving the environment, and development of knowledge and techniques.

Step 3 - Study on agricultural system management approach throughout the supply chain

The key informants were farmers who provided information on the agricultural system management approach throughout the supply chain. The purposive sampling of 50 people in each province were used from farmers who qualified as community leaders and who were ready to make the transition to alternative farming. The research tool was focus group in the analysis of agricultural product management throughout the supply chain including upstream, midstream, and downstream management. Subsequently, content analysis was performed by classification, categorization, correlation analysis, and causal analysis of agricultural system management approaches throughout the farmer's supply chain.

The research process and research methods in all 3 steps can be summarized as shown in Figure 1 below.

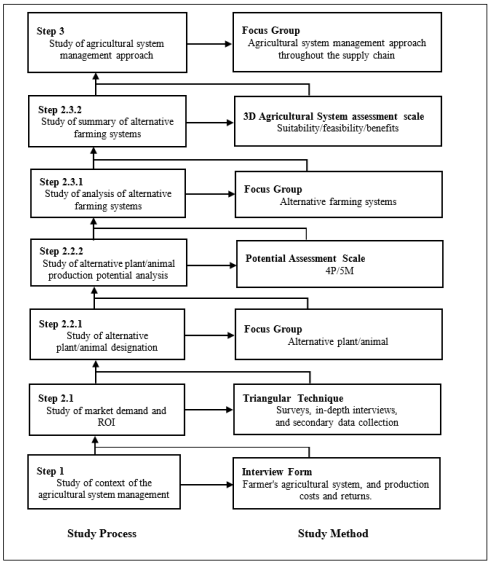

Fig.1 Research process and research method

IV. RESULTS

4.1 Study on context of the agricultural system management of farmers: The results of the study revealed that farmers in all three areas had farming by using the rice mono-cropping system. The total cost of rice production by farmers in Chainat Province was 7,533.90 baht per rai (1 rai=1,600 m^2). It could be divided into cost of production factors of 2,931.94 baht per rai, cost of production labor of 4,029.13 baht per rai and land rental cost of 572.83 baht per rai. The return on rice production amounted to 6,207.13 baht per rai, causing farmers to lose 1,326.77 baht per rai. The total cost of rice production by farmers in Kalasin province was 4,354.88 baht per rai. It could be divided into cost of production inputs of 1,235.34 baht per rai, and labor costs of production 3,119.54 baht per rai. The return on rice production amounted to 4,098.37 baht per rai, causing farmers to lose 256.51 baht per rai. The total cost of rice production by farmers in Phatthalung province was 4,627.70 baht per rai. It could be divided into cost of production factors of 1,753.11 baht per

rai, and labor cost of production of 2,874.59 baht per rai. The return on rice production amounted to 5,788.46 baht per rai, thus making farmers profit 1,160.76 baht per rai. The results of cost and return on rice production of farmers in all three areas could be summarized as shown in Figure 2 below.

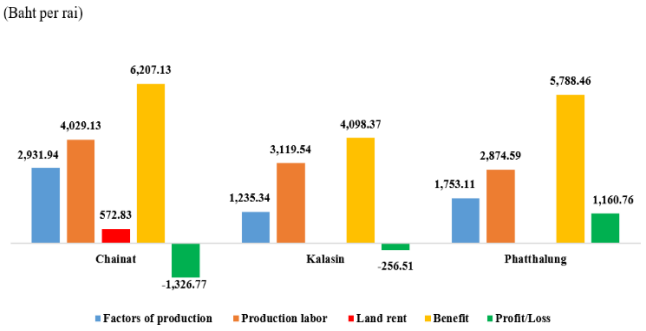

Fig.2 Rice production cost and return

4.2 Study of alternative farming systems in the farmer's area

4.2.1 Studies on the market and the return on investment in agricultural production

1) In terms of the rice market demand, it was found that suitable agricultural products of farmers were still rice production because all 3 areas had a certain source of purchasing products, farmers who had experience in rice production, and suitable area for rice production.

2) Other potential agricultural markets in each area

(1) There were 10 agricultural products with potential for production of Chainat, namely rice, mung bean, chili, long bean, galingale, mushroom, Awak banana, jackfruit, native chicken, and duck breed. According to a secondary study on return on investment (ROI) in agricultural production, it was found that all 10 plants/animals had higher ROI than rice ROI. The top 3 ROI were duck breed, jackfruit, and native chickens. The ROI was 7.78, 6.16, and 4.42 respectively as shown in Figure 3 below.

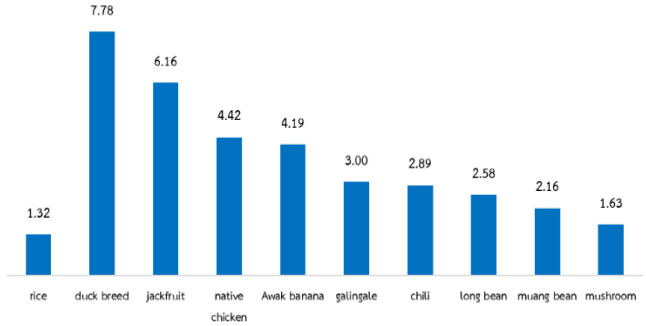

Fig.3 return on investment of potential agricultural products in Chinat

(2) There were 10 agricultural products with potential for production of Kalasin, namely rice, lemongrass, galingale, peanut, Nam Dok Mai mango, Khieo Sawoey mango, Pisang Awak banana, custard apple, native chicken, and beef cattle. According to secondary ROI studies, it was found that all 10 plants/animals had higher ROI than rice ROI. The top 3 ROI was lemongrass, native chicken, and Pisang Awak banana. The ROI was 4.87, 4.42 and 4.19, respectively as shown in Figure 4 below.

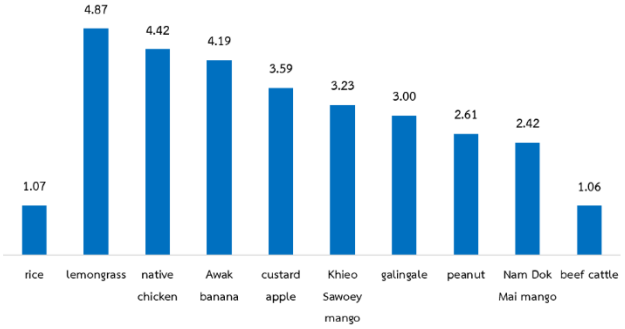

Fig.4 return on investment of potential agricultural products in Kalasin

(3) There were 10 agricultural products with potential for production of Phatthalung, namely rice, holy basil, lemongrass, pepper, butterfly pea, galingale, turmeric, Indian honey bees, Colon chicken, and beef cattle. According to secondary ROI studies, it was found that all 10 plants/animals had higher ROI than rice ROI. The top 3 ROI was holy basil, lemongrass, and Colon chicken. The ROI was 9.09, 4.87, and 4.42, respectively. Other crops had higher ROI than rice ROI as shown in Figure 5 below.

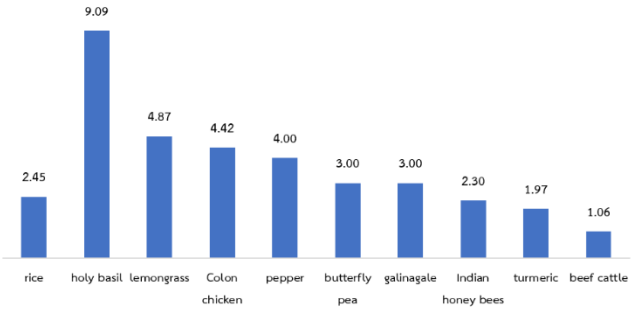

Fig.5 return on investment of potential agricultural products in Phatthalung

4.2.2 Studies of alternative plant/animal species suitable for local cultivation could be divided into two sub-steps:

1) In terms of alternative plant/animal species, it was found that suitable alternative plant/animal species per area as follows:

(1) Chainat Province: rice, green bean, vegetables, herbs, Awak banana, jackfruit, native chicken and duck breed

(2) Kalasin Province: rice, paddy, peanut, vegetables, herbs, Pisang Awak banana, mango, custard apple, native chicken, and beef cattle

(3) Phatthalung Province: rice seed, rice paddy, vegetables, herbs, Indian honey bees, Colon chicken, and beef cattle

2) In terms of the alternative crop/animal production potential analysis, it was found that the opinions of farmers regarding the alternative crop/animal production potential in the 3 provinces under the 4P and 5M principles were as follows:

(1) Chainat province found that farmers agreed on the potential of alternative crops/animal production in terms of marketing mix (4P) at the top three levels: Awak banana, and jackfruit ($\bar{X}$ =5.00), followed by rice and herbs ($\bar{X}$ =4.25). The alternative crop/animal production potential in terms of production management components (5M) found that farmers agreed at the top three levels: Jackfruit ($\bar{X}$ =4.33), followed by Awak banana ($\bar{X}$ =4.18), and herbs ($\bar{X}$ =4.08), respectively, as shown in Figure 6.

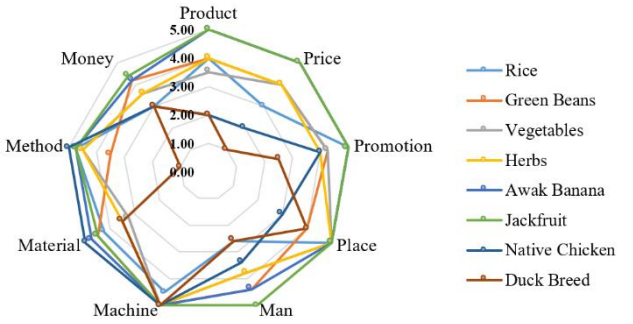

Fig.6 Potential of alternative crop/animal production of farmers in Chainat Province using 4P and 5M principles

(2) Kalasin province found that farmers agreed on the potential of alternative crops/animal production in terms of marketing mix (4P) at the top three levels: beef cattle ($\bar{X}$ =5.00), custard apple ($\bar{X}$ =4.56), and Pisang Awak banana ($\bar{X}$ =4.50). The alternative crop/animal production potential in terms of production management components (5M) found that farmers agreed at the top three levels: Jackfruit ($\bar{X}$ =4.33), followed by Pisang Awak banana ($\bar{X}$ =4.74), followed by beef cattle ($\bar{X}$ =4.48) and herbs ($\bar{X}$ =4.43), respectively, as shown in Figure 7.

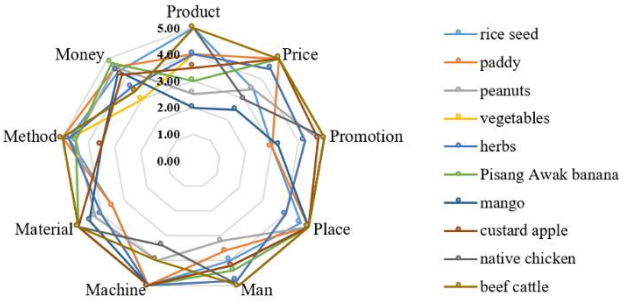

Fig.7 Potential of alternative crops/animals of farmers in Kalasin Province using 4P and 5M principles

(3) Phatthalung province found that farmers agreed on the potential of alternative crops/animal production in terms of marketing mix (4P) at the top three levels: Indian honey bees, Colon chicken, and beef cattle ($\bar{X}$ =5.00). The alternative crop/animal production potential in terms of production management components (5M) found that farmers agreed at the top three levels: Indian honey bees, Colon chicken, and beef cattle ($\bar{X}$ =5.00), respectively, as shown in Figure 8.

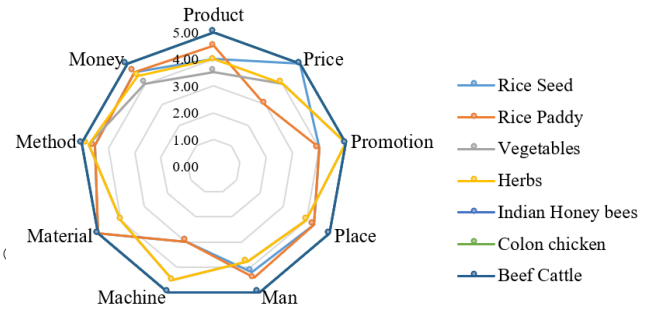

Fig.8 Potential of alternative crop/ animal production of farmers in Phatthalung Province using 4P and 5M principles

4.2.3 Study of alternative farming systems

1) Analysis of alternative farming systems

Based on research data on suitable alternative plant/ animal species in the area, key informants classified local alternative farming systems as summarized in Table 1.

Table 1 analysis of alternative farming system

farming system	Chainat	Kalasin	Phatthalung
Rice mono-cropping system	Paddy	Rice seed and paddy	Rice seed and paddy
Rice-bean rotation system in rotation	Rice+ (Mung Bean)	Rice+ (Peanut)	N.A.
Rice production system in conjunction with other agricultural activities	Rice + 1 other agricultural activities, including vegetables, herbs, bananas, jackfruit, native chicken, and duck breed	Rice + 1 other agricultural activities, including vegetables, herbs, bananas, mangoes, custard apples, native chickens, and beef cattle.	Rice + 1 other agricultural activity, including vegetables, herbs, Indian honey bees, Colon chicken, beef cattle
Integrated farming system	Rice + more than one agricultural activity		

2) Summary of alternative farming systems in the area using classification and grouping in terms of suitability, feasibility, and utility of farming systems, it was found that:

Table 2 Opinion on alternative farming systems in the area

Subjects	Farming system opinion level							
	Rice mono-cropping system		Rice-bean rotation system		Rice production system with other agricultural activities		Integrated farming system	
	$\bar{X}$ (S.D.)	Level	$\bar{X}$ (S.D.)	Level	$\bar{X}$ (S.D.)	Level	$\bar{X}$ (S.D.)	Level
1. Suitability of farming system	3.69 (1.084)	High	3.30 (1.239)	Moderate	3.73 (1.079)	High	4.05 (1.135)	High
2. Feasibility of farming system	4.08 (1.050)	High	3.37 (1.260)	Moderate	3.79 (1.183)	High	3.68 (1.090)	High
3. Utility of farming system	3.73 (1.094)	High	3.41 (1.190)	High	3.65 (1.021)	High	3.93 (1.127)	High

In Table 2, farmers' opinions on alternative agricultural systems in the area were as follows:

1) In terms of the suitability of the farming system, the suitability of the three systems, namely integrated farming system, rice production system with other agricultural activities, and rice mono- cropping, was at a high level. The rice-bean rotation system was at a moderate level.

2) In terms of the feasibility of the farming system, the feasibility of the three systems, namely rice mono- cropping system, rice production system with other agricultural activities, and integrated farming system was at a high level. The rice- bean rotation system was at a moderate level.

3) In terms of the utility of the farming system, the utility of the four systems, namely integrated farming system, rice mono- cropping system, rice production system

with other agricultural activities, and rice-bean rotation system was at a high level.

4.3 Study of agricultural system management approach throughout the supply chain of farmers found that:

4.3.1 Upstream level: Farmers commented that in organizing farming systems, especially crop planting activities, issues should be addressed: 1) Use of fertilizer as a soil analysis value 2) Cost reduction by mixing self-use fertilizer 3) Reducing the rate of seed use 4) Use of biologics, and 5) Integrated pest management.

4.3.2 Midstream level: Farmers commented that with any farming arrangement, farmers should be involved in producing standardized agricultural products under the collaborative farm system.

4.3.3 Downstream level: Farmers commented that the farming system should include product price guarantee, pre-sale of goods, online marketing promotion. The details were as shown in Figure 9 as follows:

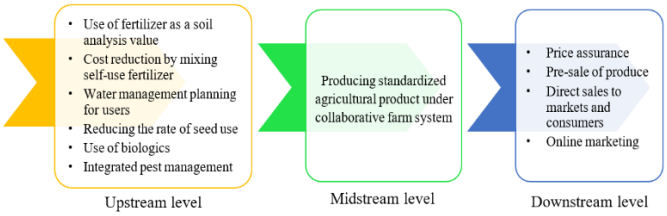

Fig.9 Agricultural system management approach

V. Discussions

5.1 In terms of high cost of rice production factors, it was found that farmers in Chainat and Kalasin provinces lost rice production of 1,326.77 baht per rai and 256.51 baht per rai. On the other hand, Phatthalung province made a profit of only 1,160.76 baht per rai. As a result, the cost of inputs was high, for example, the cost of rice production factors in Chainat, Kalasin, and Phatthalung were 7,533.90, 4,354.88, and 4,627.70 baht per rai, respectively. Meanwhile, [3] suggested that the cost of rice production in the three provinces should be 4,578.04 baht per rai, 3,751.13 baht per rai, 3,745.06 baht per rai respectively. It also further suggested that the cost of rice production could also be used to improve and find ways to reduce the cost of rice production, such as use of fertilizer as a soil analysis value, use of biologics, and use of organic fertilizers instead of chemical fertilizers. Therefore, farmers in the area of land readjustment and irrigation for agriculture should study the cost of rice production in order to find the appropriate cost reduction method for higher rice production yields.

5.2 In terms of the rice mono-cropping system, it was found that farmers in all three areas still focus on rice production. The results could be seen from the farming system analysis and the performance assessment results marketing mix (4P) and production management components (5M). The results of opinions on farming systems in terms of the suitability, feasibility and utility of the overall farming system were at the high to highest level. It could be discussed that the extension of farming systems in the "area of land readjustment and irrigation for agriculture" in all three provinces required a strong focus on rice production because rice production was an agricultural way of farmers, rice was a potential crop for local production and importantly, there was a gap for further development of rice production. This concept was consistent with the agricultural development plans of the three areas, the Agricultural Development Plan continued to focus on the development of rice production as in [4]. It corresponded to the analytical data of "Agri-map Online" that all 3 areas were in zone S1 (S1: suitable area) of rice production as in [5].

5.3 In terms of alternative farming systems in the three provinces, it was found that the plant/animal species in each alternative farming system had different characteristics, depending on the environment. According to an assessment of farmers' opinions on alternative farming systems in the area, the overall suitability of the farming system, feasibility, and utility was moderate to high level, depending on various factors of farmers such as the availability of inputs, knowledge, attitudes, extension and support of relevant agencies and others. Therefore, to extend alternative farming systems, various farming systems should be analyzed to suit the needs of farmers so that they can use them for sustainable livelihoods. According to the concept of sustainability analysis, farming systems could be divided into four dimensions: productivity, stability, sustainability, and equitability as in [2].

5.4 In terms of water use for alternative farming systems, it was found that in the analysis of alternative farming systems in the area of land readjustment (rice mono-cropping system, rice-bean rotation system, rice production system with rotational crops, rice production system with other agricultural activities, or integrated farming system), it was suitable, feasible and useful to all farmers. However, to drive production in various farming systems, water availability was a key consideration as water was the heart of agriculture. Considering the water use rate of some crops, it was found that the water consumption of rice was 1,984 cubic meters per rai, the water consumption of mung bean was 440 cubic meters per rai, the water consumption of various vegetables was 300-600 cubic meters per rai, and the water consumption of bananas was 4,000 cubic meters per rai as in [6]. Therefore, to extension the production of agricultural products in each alternative farming system, it was necessary to consider the amount of water sufficient for each production. The Royal Irrigation Department, Thailand must plan for the release of water from the irrigation system to be sufficient for the farmers' crop/animal production. In addition, farmers should be encouraged to form groups of water users in order to systematically plan water use and production with the Royal Irrigation Department and other relevant government agencies in the area.

VI. Recommendations

6.1 Recommendations for implementation

6.1.1 Recommendations for farmers

1) In terms of reducing the cost of rice production, it was found that farmers agreed with the production in the rice mono-cropping system, which resulted in the problem of high cost of rice production factors. Therefore, farmers should reduce the cost of rice production through methods such as soil inspection and fertilization as a soil analysis value, production of self-use inputs such as organic fertilizers, biological substances, seeds rice, and green manure.

2) In terms of the modification of the farming system, it was found that the alternative farming system in the research area was suitable, feasible and useful to the farmers. Therefore, the modification of the farming system may start

from leading farmers as a model for general farmers to study and adjust accordingly. In addition, farmers should determine the target market of agricultural products in each farming system, starting from focusing on production for household consumption, community markets and extending to markets outside the community.

6.1.2 Recommendations for agencies

1) In terms of extending the transformation of farming systems, several interesting studies had been found in alternative farming systems. Therefore, agencies involved in agricultural extension and development should develop demonstration plots or publicize the prototype plots of farmers who experiment with agricultural production in various farming systems. As a result, interested farmers could come and visit the people and study the work for further decision making.

2) In terms of planning the amount of water to be sufficient for production, it was found that water consumption is important for production in various farming systems. Therefore, the Royal Irrigation Department should plan on the amount of water released to meet the water consumption for agricultural products in various production systems. In addition, water management should be promoted together with members of the water user group for the integration of water consumption in the area.

6.2 Suggestions for the next research

6.2.1 The results of change of farmers obtained from farming system trials should be studied, focusing on studies and changes for sustainability in terms of economic, social, and environmental aspects.

6.2.2 The study on the structure, roles, and functions of relevant agencies in terms of agricultural extension and development in the farming system should be studied.

6. 2. 3 The approaches should be studied to utilize extension of participation of farmers in agricultural management according to the farming system.

CONCLUSION

This research examined the farming system management approach through the analysis of guidelines from farmers. The processes consisted of three main steps: Step 1- A study of the farming context of farmers found that all farmers continued to rice mono-cropping system, most of them suffer losses or lower returns. Step 2- At this stage, plant/animal species suitable for the area were further studied for the design of alternative farming systems in the farmer's area. The study was conducted using a sample population and various tools. At the end of the study, four alternative farming systems could be summarized as follows: rice mono-cropping system, rice- bean rotation system, rice production system with other agricultural activities, or integrated farming system. Step 3-This step was the result of a study on farming system management throughout the supply chain of farmers. The study uncovered a number of farming approaches throughout the supply chain, ranging from upstream, midstream, and downstream management.

REFERENCES

[1] Royal Irrigation Department. (2020). *Minutes of the research meeting on the achievement of the land readjustment fund operation*. on November 27, 2020. Bureau of Central Land Consolidation Royal Irrigation Department

[2] Conway, G. R. (1986). *Agroecosystem analysis for research and development*. Thailand: Winrock international.

[3] Office of Agricultural Economics. (2021). *Alternative future crops management approach using agricultural map for proactive management (Agri-Maps)*. Retrieved from https://www.oae.go.th/assets/portals/1/files/jounal/2564/FutureCrops64.pdf.

[4] Department of Agricultural Extension. (2021). *Agricultural Development Plan*. Retrieved from https://www.doae.go.th/

[5] Department of Land Development. (2564). *Agri-Map*. Retrieved from https://agri-map-online.moac.go.th/

[6] Royal Irrigation Department. (2021). *Water consumption of plants.* Retrieved from http://water.rid.go.th/hwm/cropwater/CWRdata/ET/index.htm.