 DOI: 10.35382/TVUJS.14.2.2024.3767

EXTENSION MODEL DEVELOPMENT OF COMMERCIAL RICE PRODUCTION IN SAVANNAKHET PROVINCE, LAOS

Inta Chanthavong[1*], Weena Nilawonk[2],
Somphong Chanthavong[3], Phoudthavong Sengsouriya[4]

Abstract – *The government of Laos conducted the climate-friendly agribusiness value chains sector project in the year 2019 to encourage the improvement of competitiveness in rice production and to develop production according to meet the needs and production programs of the government. However, the number of farmers who participated in this project is an insignificant proportion compared to the number of total rice farmers. This study aims: 1) to find the problems and suggestions about commercial rice production, and 2) to develop an extension model for commercial rice production. Using a mixed methods research design, data were gathered from a) structured interviews (n = 177) and b) workshops with extension agents (n = 21). The data was analyzed using such statistics as frequency and percentage. The findings showed that most respondents were concerned with 16 problems and eight suggestions about commercial rice production. The extension model of commercial rice production comprised four main components: developing knowledge and understanding of the farmers; approaches for strengthening attitudes; encouraging the use of modern technology; and government supporting factors that could support commercial rice production. Therefore, all concerned organizations should set a clear policy to increase the capacity of the farmers and continue to develop the market system for increasing competitiveness that the farmers can sell their rice products at a satisfactory price as a result, farmers who do not participate in the commercial rice production extension project will turn to participate in the project more in the future.*

Keywords: agribusiness value chain, agricultural extension, commercial rice farmers, commercial rice production, Laos.

I. INTRODUCTION

Rice is the staple food of the people in the Lao PDR [1]. In the year 2023, the area planting rice was approximately 909,267 hectares, representing about 80% of the total crop production in the country or about 4.12 million tons of rice. Rice is also recognized as an important export commodity that can generate national revenue. The revenue in the rice market amounts to US$262.70 million in 2024 and the market is expected to grow annually by 5.78% [2]. The political party and government of Laos have determined agriculture production as one of the economic pillars based on the fact that agriculture is the basis for industry and services as well as the basis of the national economy. Their vision of the agriculture sector's total rice production is for domestic sale and export to reach 1.5 million tons (paddy rice) in 2025 by promotion of cultivation of rice that has high potential in each local and suitable area in parallel with the new improved variety and quality rice that has high market demand in plain areas. They also hope to increase the proportion of regular (non-glutinous) rice cultivation to cover 30% of total production. This includes the production of rice for export in line with good agriculture practice (GAP) aiming at regional and international markets. In the large plains of middle and southern provinces, they plan for rice production to focus on export to China and other neighboring countries by using rice seeds that have market demand [3].

[1,3,4]Savannakhet University, Laos
[2]Maejo University, Thailand
*Corresponding author: inta.sku2009@gmail.com

Received date: 21st February 2024; Revised date: 19th May 2024; Accepted date: 20th May 2024

One of the challenges for the Ministry of Agriculture and Forestry (MAF) is to improve Lao farmers and other agricultural value chain stakeholders' ability to take advantage of commercial high-value commodity production opportunities while also improving food security and nutrition for rural communities and the country. Spurred by policy design and benign forces of socio-economic and technological progress, Lao PDR has embarked on a path to promote the dominance of commercial, productivity, and profit-driven agriculture over traditional, less productivity-oriented, and less market-driven agriculture. Subsistence systems of farming and food systems during the ensuing transition, potentially millions of hectares and hundreds of thousands of farmers are moving from subsistence to for-cash commodity production. In the process, different resource-use, commodity ownership, management strategies, and new investment schemes are being promoted, introduced, and adopted. With increased commoditization of production, entire communities are changing their livelihood strategies and ways of life and are becoming more integrated with the expanding market economy. At the same time, Laos continues to have some of the most adverse and intransigent food insecurity and malnutrition indicators in Southeast Asia [4].

At present, the quantity of rice exports in Laos to foreign markets is still low. The government Lao PDR has a plan for rice production which is targeted at not lower than 5 million tons of paddy, with 70% glutinous rice and 30% non-glutinous rice. Among the production, 2.5 million tons are targeted for food security (consumption: 2,1 million tons of paddy and stock: 400,000 tons of paddy or 240,000 tons of milled rice that the stock can last for 2–3 months). Further efforts are given to the production of rice seeds by 100,000 tons (in which 50,000 tons of rice seeds are planned to be produced in Khammouan and Savannakhet Provinces). More efforts are given to the production of paddy for local markets by 500,000–600,000 tons and for export by 1.5 million tons. [5]. Savannakhet Province has the policy to produce 814,369 tons of rice per year for consumption to meet the demand of people with an average consumption rate of 631 kg/person/year [6]. This includes planning to expand production capacity so that volume is in line with the country's policy to increase exports of rice to be sold to foreign markets in order to generate income for farmers and the country. The government conducted a Climate-Friendly Agribusiness Value Chains Sector Project to support the implementation of the agriculture and forestry strategic plan until 2025 and vision to 2030 to become successful. The proposed project supports the implementation of the government's Agriculture Development Strategy to 2025 (ADS) by boosting the competitiveness of rice value chains in Khammouane, Saravan, and Savannakhet provinces. The project will improve the climate resilience of agricultural infrastructure, and enhance crop productivity, diversification, and commercialization. It will help improve the capacity for storage, processing, quality, and safety testing, and promote the use of biofertilizers and organic farming. It will strengthen the capacity of farmers and agribusinesses for climate-smart agriculture (CSA), and create an enabling environment for climate-friendly agribusinesses to promote sustainability along the value [7]. But until now, only 314 farmers (0.228%) participated in the climate-friendly agribusiness value chains sector project, which is a very small proportion compared to the number of farmers in Savannakhet Province (137,222 farmers) [8].

The problems that can be directly addressed by agricultural extension include the low educational level of farmers including a lack of basic scientific concepts that are relevant to agriculture; inadequate access to appropriate technology and, in particular, limited knowledge of productive techniques and the skills to implement them; lack of exposure to examples of successful farmers, which might improve confidence and enthusiasm for change; limited organizational development among farmers and a lack of collective action; insufficient market information, including knowledge of prices and standards; and lack of

knowledge about policies and regulations relating to agriculture. Based on the problems and government policies mentioned above, the past agricultural extension program has been a systematic operation emphasizing the transfer of technology by bringing data, information, and knowledge to farmers in order to create acceptance and change behavior in their occupation. This extension model has been applied in the same way throughout the country, which is not truly caused by the needs of farmers. As a result, farmers do not attach importance to the commercial rice quality management system as they should. Therefore, there is a study on developing a model for commercial rice production to develop commercial rice production of Lao farmers to their highest potential along with creating stability in the occupation of Lao farmers to help the majority of the country's population have happiness and a sustainable quality of life. The objectives of this study were to find the problems and suggestions about commercial rice production, and to develop an extension model of commercial rice production to help future development of rice production.

II. LITERATURE REVIEW

FAO [9] reports that in the Lao PDR, there is no comprehensive rice policy that cuts across different government institutions, but rather numerous policies stemming from different government sectors that affect the rice sector through a mix of regulations, and recurrent and investment programs. The resulting policy mix plays a crucial role in determining the incentive structure of the different rice value chain agents (from producers to millers and exporters). It is, therefore, important to understand (1) what the effects of such policies are on the welfare and decisions taken by agents in the rice value chain and (2) whether the agents' decisions are compatible with achieving the targets and policy objectives of the government of the Lao PDR. Understanding how the policy mix impacts rice value chain agents requires the mapping of policy objectives and key beneficiaries with the policy instruments used, and understanding the actual support to the rice sector. Traditionally, rice-related policies are directly the responsibility of (1) MAF for all support and regulations that affect producers or on-farm issues (including mainly research and extension, and irrigation development); and (2) the Ministry of Industry and Commerce (MoIC) for trade policies and the rice reserve program or, more simply put, all post-farm sections of the rice supply chain. Other ministries such as the Ministry of Finance (MoF) and the Ministry of Planning and Investment (MPI) also indirectly have an important role in the country's overall macro-economic balance and budgetary decisions (both for central and decentralized levels). The Ministry of Labour and Social Welfare (MLSW) is responsible for issues regarding social programs that target very poor communities (also in relation to the national rice reserve) and for labour market issues in general.

Oladele [10] study on features of agricultural extension models and policy in selected sub-Saharan Africa countries. This paper reviews the features of agricultural extension models and policy in selected sub-Saharan Africa countries. This is based on the premise that the discussion of extension policy in SSA countries can not be isolated from the extension models that are applied in these countries. While the models are direct products of the type of policy that has been adopted, the policy dictates the models to be used in each country. A major problem of organizing agricultural extension in developing countries is the absence of a legal and policy framework for providing the service. Putting in place a legal and policy framework is one basic new and indispensable way of conducting extension in the developing countries. It will help streamline the confusion currently existing in the effort to transfer agricultural knowledge to farmers, particularly in the areas of service provision, programme development and funding. In literature, the present forms of extension policy are Provisional Extension Policies, decrees and proclamations, and legislated extension policies. Factors driving extension policy are population,

natural resources, and environment. The increasing population will demand more resources from extension in forms of skills, training, diversification of livelihoods, and pressure on natural resources. The paper recommends that SSA countries adopt the legislated extension policies option for the improvement of extension service delivery and reduce the contradictions in extension models. The models are direct products of the type of policy that has been adopted, as the policy dictates the models to be used in each country. A major problem in organizing agricultural extension in developing countries is the absence of a legal and policy framework for providing the service. Putting in place a legal and policy framework is one basic new and indispensable way of conducting extension in developing countries. It will help streamline the confusion currently existing in the effort to transfer agricultural knowledge to farmers, particularly in the areas of service provision, program development, and funding. In literature, the present forms of extension policy are Provisional Extension Policies, decrees and proclamations, and legislated extension policies. Factors driving extension policy are population, natural resources, and environment. The increasing population will demand more resources from extension in the form of skills, training, diversification of livelihoods, and pressure on natural resources. The paper recommends that SSA countries adopt the legislated extension policies option for the improvement of extension service delivery and reduce the contradictions in extension models.

Worth's study [11] proposes the Agri-flection extension model, which arises out of fundamental changes in thinking about extension. Incorporating elements of livelihoods approaches and learning theory, Agri-flection is a learning model that shifts i) the context and locus of learning, ii) what is learned, and iii) the learning process. The model fosters a culture of continuous reflective learning that is submitted as the highest purpose of extension. The model suggests that prosperity can be realised through engaging smallholder farmers in scientific discovery, innovation, and technology development based not on what they lack, but on what they have.

Surudhi et al. [12] studied utilization patterns of extension tools and methods by agricultural extension agents. The findings revealed that the extension functionaries frequently used individual contact methods including telephone, office calls, and farm and home visits in the process of transfer of technology. At least efforts were made to send SMS-based communication. Meetings were the common and frequently adopted group contact method. Demonstrations, farmer field schools, farmer interest groups, field trips, and farmer training programs were moderately adopted. Posters, leaflets, and pre-season campaigns were the widely adopted mass contact methods. They possess the least skill in utilizing farm magazines and presenting television and radio programs.

Ekasari et al. [13] study on communication patterns and conflict in agricultural extension. The results of the study show that (i) the social process among actors in an agricultural extension based on social engineering is more project-oriented (dissociative), while the social process in a social learning-based extension tends to be cooperation-oriented due to the same interest in achieving the goal of programs, especially skill and knowledge improvement (associative), (ii) communication in social engineering-based extension is a linear pattern (top-down), while communication in social learning-based extension is using a convergent (participatory) pattern, (iii) conflict in an agricultural extension based on social engineering is generally latent (hidden) and will eventually explode and impede extension, negatively impacting group solidarity, while in extension based on social learning, conflict generally is on the surface (manifest), and the accommodation is one way to solve. A major implication of these findings is the stepping up of agricultural extension (based on the social learning process) which becomes a push factor towards independency groups in finding innovation. The research suggests that social learning-based extension should be developed as a poten-

tial way to sustain an important role of extension in agricultural and rural development.

Sirisatidkit [14] carried out a study on the model development of farmer adaptation sustainability in the Songkhla basin area. The finding of this research demonstrates that the model development of farmer adaptation is sustainable in the Songkhla basin area. Named 'self-manage model' it consists of 10 major significant performances: 1) self-sufficiency, 2) enterprise group, 3) learning procedure, 4) flexible adaptation, 5) marketing, 6) agricultural diversity, 7) networks, 8) added value, 9) government extension, and 10) environmental conservation. Additionally, this model evaluation is expertized at an excellent level and certified by a public hearing. To clarify the extension model of commercial rice production, based on the above review, extension approaches that just concentrate on technical production techniques and market skills will not adequately equip the farmers to meet the challenges of the evolving complex environment. The extension approach needs to be a more comprehensive and innovative to enable farmers to learn the skills to manage their farming systems so that they are profitable, sustainable, and resilient.

III. RESEARCH METHODS

This research was conducted in six districts (Xaybouly, Champhone, Songkhone, Xayphouthong, Atsaphangthong, and Xonnabouly) of Savannakhet Province, Lao PDR. These districts have projects to encourage farmers to produce commercial rice in Savannakhet province. The research used the research and development model by using mixed methods research, which combines quantitative research and qualitative research methods.

The data was collected through questionnaires and focus group discussions during June to December 2023. The data collection in this study was divided into two phases:

Phase 1: Studying the problems and suggestions about commercial rice production in Savannakhet Province. The sample was 177, randomly selected from the total number of farmers who have participated in the commercial rice production extension project in 13 villages, 06 districts, and 317 farmers.

Phase 2: Developing an extension model of commercial rice production. Focus group was used for data collection by invited representatives of rice farmers who participated in commercial rice production projects, one farmer per village; and agricultural extension staff who were responsible for rice extension at district and province levels. A total of 21 participants have developed an extension model of commercial rice production.

The data was analyzed using such statistics as frequency and percentage; the qualitative analysis descriptive methods were used by using Statistical Packages for the Social Sciences (SPSS).

First objective: To analyse problems and suggestions about commercial rice production of the farmers were used descriptive statistics: frequency and percentage.

Second objective: To develop an extension model of commercial rice production. Content analysis is a descriptive research technique that will be used. The content of the message or document has three main characteristics: systematic use of quantitative methods and focus on objectivity and based on the theoretical framework.

IV. RESULT AND DISCUSSION

A. Problems and suggestions about commercial rice production

Regarding the empirical results, Table 2 reports most of the respondents had the problem in infertile soil (93.79%). This was followed by low productivity per hectare (91.53%); high production costs (85.88%); lack of credit (85.88%); labor shortage (85.88%); not enough water for rice production (85.88%); many diseases and insect infestations, knowledge and experience about commercial rice production are at a low level (84.75%); lack of modern technology (84.18%); no monitoring from relevant agencies (84.18%); natural calamities (83.62%); lack of marketing information (83.05%); low profitable (80.23%); unstable price of rice production (76.84%); lack

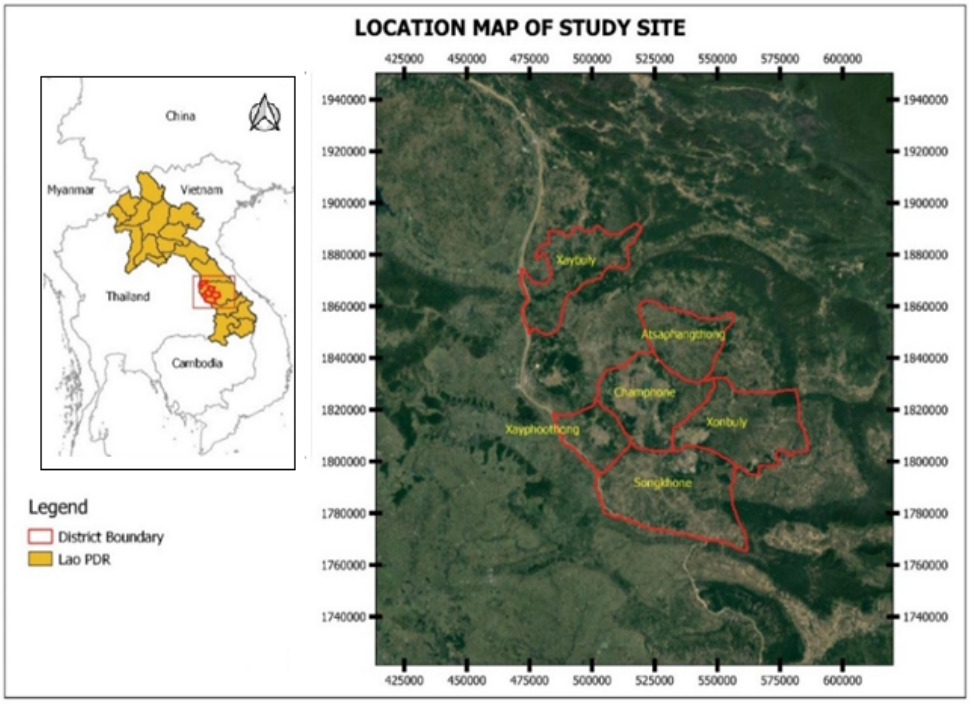

Fig. 1: The location map of the study area [15]

Table 1: Population and sample size

No.	District	Village	Population	Sample
1	Xaybouly	Hatxaisoung	27	15
2	Xaybouly	Kangpa-Phonthan	25	14
3	Xaybouly	Buengxe	27	15
4	Champhone	Phalaeng	24	13
5	Champhone	Thouad	25	14
6	Songkhone	Dongsawang	25	14
7	Songkhone	Nongdeune	25	14
8	Xonnabouly	Thakhamleum	25	14
9	Xonnabouly	Kongpathoumvanh	25	14
10	Xonnabouly	Xienghom	25	14
11	Atsaphangthong	Pongna	11	6
12	Xayphouthong	Mouangkhai	28	16
13	Xayphouthong	Khanthachan	25	14
Total			**317**	**177**

of knowledge about rice production management (75.71%); and difficult maintenance (75.14%).

The findings of the study reveal that most of the respondents faced the infertile soil problem. Hence, this implied that they still lacked knowledge and understanding about soil improvement and management. Although commercial rice production had requirements to follow, the respondents seemed not to understand many issues, resulting in poor-quality output. In the case of the rice yield per hectare was low due to many factors such as infertile soil and lack of funding source to purchase production inputs. In addition, the low profitability of rice production, caused the respondents to sell their rice at low prices, and production costs were so high.

Farmers' suggestions about commercial rice production are presented, arranged from most important to least important as follows:

1. Agricultural extension staff should make regular home or field visits to give advice or solve problems about commercial rice production.

2. The government should provide credit or loan sources with a low-interest rate for commercial rice production.

3. Concerned agencies should provide low-cost inputs and supply sources for the convenience of commercial rice farmers.

4. Enough water sources for farming throughout the year such as an irrigation system.

Table 2: Farmers' problems with commercial rice production (n = 177)

Issues	A problem		Not a problem	
	No. of persons	%	No. of persons	%
1. Infertile soil	166	93.79	11	6.21
2. Low productivity per hectare	162	91.53	15	8.47
3. High production costs	153	86.44	24	13.56
4. Lack of credit	152	85.88	25	14.12
5. Labor shortage	152	85.88	25	14.12
6. Not enough water for rice production	152	85.88	25	14.12
7. Many diseases and insect infestations	152	85.88	25	14.12
8. Knowledge and experience in commercial rice production are at a low level	150	84.75	27	15.25
9. Lack of modern technology	149	84.18	28	15.82
10. No monitoring from relevant agencies	149	84.18	28	15.82
11. Natural calamities	148	83.62	29	16.38
12. Lack of marketing information	147	83.05	30	16.95
13. Low profitable	142	80.23	35	19.77
14. Unstable price of rice production	136	76.84	41	23.16
15. Lack of knowledge about rice production management	134	75.71	43	24.29
16. Difficult maintenance	133	75.14	44	24.86

Source: Field survey, 2023

5. Concerned agencies should prepare readiness for farmers to cope with natural calamities such as drought and flood.

6. Concerned agencies should advise on how to properly prevent diseases and pests from damaging rice production.

7. Government agencies should form production groups in the community to strengthen negotiation power.

8. The government should encourage people to perceive the importance of local or domestic rice consumption.

B. Extension model development of commercial rice production in Savannakhet Province

This was divided into two steps as follows:

Step 1: Applying results of an analysis of the main problems encountered to find problem management direction for commercial rice production.

According to a focus group discussion to find extension guidelines for commercial rice production, it was found that there were 16 approaches to manage problems in the production as follows: 1) encourage soil fertility management to have sufficient nutrients for commercial rice cultivation. Then, land should be appropriately allocated to farmers for production; 2) encourage the farmers to form agricultural production groups for increased access to inputs by supporting them to have access to quality seeds or materials at affordable prices; 3) encourage farmers to cooperate with the government to form agricultural production groups in the community to strengthen negotiation power and encourage the use of existing local resources such as manure to save costs; 4) find sources of credits with low interest rates for commercial rice production; 5) encourage youths to return to the agricultural sector by supporting access to modern technology and farm machinery, as well as production techniques; 6) develop irrigation system, supplementary irrigation of rainfed lowland rice, reducing water use for land preparation, changing the crop planting date and making more effective use of rainfall, changing rice planting practices; 7) extend of knowledge about prevention of diseases and insect pests in both commercial rice production and general rice production systems; 8) organize training or study visits related to commercial rice production; 9) encourage young people to return to the agricultural sector by supporting access to modern technology and farm machinery suitable for the planting area and support credit sources to buy modern technology with low interest rates; 10) build capacity in monitoring and assessment project activities with the development of the project monitoring information system to the extension staff, and support budgets for project monitoring; 11) restore forests, grasslands and natural wetlands, reconnecting rivers to floodplains, creating buffers of vegetation along water courses, essentially involve the management of vegetation, soils and/or wetlands, including rivers and stream; 12) extend of knowledge of marketing and selling, increasing channels for

receiving agricultural information, organize seminars among related agencies on rice market, and provide ongoing publicity; 13) add value to rice production, encourage integrated cropping or crop rotation in conjunction with the cultivation of commercial rice; 14) sell price guarantee measures; 15) extend knowledge about quality rice production process, transfer knowledge on rice harvesting and post-harvesting management; and 16) organize training to educate farmers in rice production, from land preparation stage until post-harvest management (Table 3). This finding similar to the research result of Thanasack [16]. To improve the quality of agricultural extension services, so needs to be improved in terms of enhancing rice farmers access to information via the provision of better agricultural extension services including: training programs; assisting farmers to solve problems such as outbreak of pest and diseases, selecting seed variety and managing rice production. Agricultural extension staff and services should improve their contents, methods of trainings and services. Raising a number of visiting farmers is an important task to be considered. At the same time, more rice farmers are encouraged to participate in the extension service's activities through different mass Medias such as television radio programs, newspapers, magazines, posters, leaflets and so on. The policy implications may propose to strengthen the extension services, bridge the gap between efficient farmers and inefficient farmers because rice farmers can only obtain agricultural knowledge and skills through this service. Therefore, improvement of this sector has to be taken into an account.

Step 2: Developing an extension model for commercial rice production in Savannakhet Province. According to related literature and other documentary reviews to define the theoretical framework in this study, the researcher analyzed and synthesized them to create a connection idea for developing a research model. The researcher employed related concepts and theories of Foley et al., Lien et al., and Wan et al. [17–19].

In addition, the researcher has applied the model concept and commercial rice model of Phonekeo [20] and Keeves [21] as a textual format. It was a type of using a language as a means of communication or explaining the phenomena to see the conceptual structure, elements, and relationships. From the foregoing, this was why the researcher had taken this concept as a basis for developing a model for commercial rice production of the farmers in Savannakhet Province. The extension model of commercial rice production in Savannakhet Province, Lao PDR. It was found that the extension model consisted of four main components: Component 1: developing knowledge of commercial rice production; Component 2: strengthening attitudes towards commercial rice production; Component 3: encouraging to use of modern technologies; and Component 4: supporting from the government (Figure 2).

Component 1: Developing knowledge of commercial rice production, consisting of five development approaches namely:

1. Organize training or study visits related to commercial rice production.
2. Extend knowledge on quality rice production process.
3. Extend knowledge about prevention of diseases and insect pests in both commercial rice production and general rice production systems.
4. Extend knowledge on rice harvesting and post-harvesting management.
5. Extend knowledge of marketing and selling.

Component 2: Strengthening attitudes towards commercial rice production, consisting of two approaches for enhancement, namely:

1. Encourage people to perceive the importance of consuming rice produced within the country.
2. Encourage youths to return to agricultural sector by supporting access to modern technology and machinery.

Component 3: Government supporting, there were six support factors mentioned above that could support commercial rice production, namely:

1. Empower elderly farmers.

Table 3: Guidelines for model developing the commercial rice production in Savannakhet Province

Problems encountered	Guidelines for model developing commercial rice production in Savannakhet Province
Production factors	
Soil lack of fertility	Encourage soil fertility management to have sufficient nutrients for commercial rice cultivation. Land should be appropriately allocated to farmers for production.
Lack of credit	Find sources of credits with low interest rates for commercial rice production.
Labor shortage	Encourage youths to return to the agricultural sector by supporting access to modern technology and farm machinery, as well as production techniques.
Not enough water for rice production	Irrigation system development, supplementary irrigation system of rainfed area, reducing water use for land preparation, changing the crop planting calendar and making more effective use of rainfall, changing the method of rice planting.
Cost and return factors	
High production cost	Encourage farmers to cooperate with the government to form agricultural production groups in the community to strengthen negotiation power. Encourage the use of existing local resources such as manure to save costs.
Low productivity per hectare	Encourage the farmers to form agricultural production groups for increased access to inputs by supporting them to have access to quality seeds or materials at affordable prices.
Low profitable	Add value to rice production, and encourage integrated cropping or crop rotation in conjunction with the cultivation of commercial rice.
Affecting factors	
Many diseases and pests	Extension of knowledge about the prevention of diseases and insect pests in both commercial rice production and general rice production systems.
Knowledge and experience in commercial rice production are low	Organize training or study visits related to commercial rice production
Lack of modern technology	Encourage young people to return to the agricultural sector by supporting access to modern technology and farm machinery suitable for the planting area. And support credit sources to buy modern technology with low interest rates.
Natural calamities	Forest restoration, planting cover crops, land use planning, develop a new national preparedness system and disaster management and security system, including maintaining the stability of the natural resource base and environment, development and awareness of various types of natural calamities, and development of forecasting and warning systems.
Supporting factors	
Monitoring from concerned agencies	Capacity building in monitoring and assessment of project activities with the development of the project monitoring information system for the extension staff, and support budgets for project monitoring.
Lack of marketing information	Extension of knowledge of marketing and selling, increasing channels for receiving agricultural information, organizing seminars among related agencies on the rice market, and providing ongoing publicity.
The price of commercial rice production is not stable.	Sell price guarantee measures.
Lack of knowledge in rice production management	Extension of knowledge about quality rice production process, transfer knowledge on rice harvesting and post-harvesting management.
Difficult maintenance	Organize training to educate farmers in rice production, from the land preparation stage until post-harvest management.

2. Develop irrigation system.

3. Increase value of rice production under the food safety system.

4. Expand commercial planting areas.

5. Increase channels for receiving agricultural information.

6. Develop the domestic and international rice market.

Component 4: Important technology for commercial rice production, consisting of five equipment and tools to support rice production, namely:

1. Promote the forming of rice production groups of farmers to sale rice both domestically and internationally.

2. Increase soil fertility with sufficient nutrients for growing commercial rice.

3. Encourage technique of growing commercial rice by using less labor.

4. Encourage the use of existing manure to save

costs.

5. Encourage integrated cropping or crop rotation in conjunction with the cultivation of commercial rice.

This similar findings were remarked by Atthawit et al. [22] that the farmers received training regarding sustainable rice production through learning activities with extension officers including attending direct training sessions and special workshops. After participating, using the existing farmers' group structure of mega-farm projects, benchmarking with current practices and receiving additional sustainable rice production knowledge, the respondents were able to produce rice sustainably. In addition, the area-based management extension should involve more farmers. When farmers are introduced to a new technology, machine and service provider management should be taken into account. Furthermore, market linkage management in terms of economy of scale between market capacity (especially drying capacity of the miller) and cultivated size under area-based management extension were determined as key success factors for farmers to link with the market and develop a new sustainable rice supply chain.

V. CONCLUSION

This finding showed that most of the respondents faced infertile soil problems. This was followed by low productivity per hectare; high production costs; lack of credit; labor shortage; not enough water for rice production; many diseases and insect infestations; low knowledge and experience about commercial rice production; lack of modern technology; no monitoring from relevant agencies; natural calamities; lack of marketing information; low profitable; unstable price of rice production; lack of knowledge about rice production management; and difficult maintenance. The suggestions of the farmers that should be done include: 1) Agricultural extension staff should make regular home or field visits to give advice or solve problems about commercial rice production; 2) The government should provide credits or loan sources with low interest rates for commercial rice production; 3) Concerned agencies should provide low-cost inputs and supply sources for the convenience of commercial rice farmers; 4) Water sources should be ensured for farming throughout the year such as from irrigation systems; 5) Concerned agencies should support readiness for farmers to cope with natural calamities such as drought and flood; 6) Concerned agencies should give advice about how to properly prevent diseases and pests from damaging rice production; 7) Government agencies should form production groups in the community to strengthen negotiation power; and 8) The government should encourage people to perceive the importance of local or domestic rice consumption. Extension model of commercial rice production in Savannakhet Province, Lao PDR was comprised of four main components: 1) developing knowledge and understanding of the farmers about commercial rice production; 2) implementing approaches for strengthening attitudes towards commercial rice production; 3) encouraging use of modern technology of commercial rice production; and 4) providing government supporting factors that could support the commercial rice production. Therefore, based on the main results of this study, all concerned organizations including the non-governmental organization should set a clear policy to increase the capacity to promote good quality rice production and continue to develop the market system to increase competitiveness. The farmers can sell their rice at a satisfactory price and are able to create a stable farming career with honor and dignity. This can improve the livelihoods of the farmers. As a result, farmers who do not participate in the commercial rice production extension project will turn to participate in the project more in the future.

VI. RECOMMENDATIONS

This study has key policy implications for policymakers, including 1) encouraging soil fertility management to have sufficient nutrients for commercial rice cultivation; 2) encouraging the farmers to form agricultural production groups

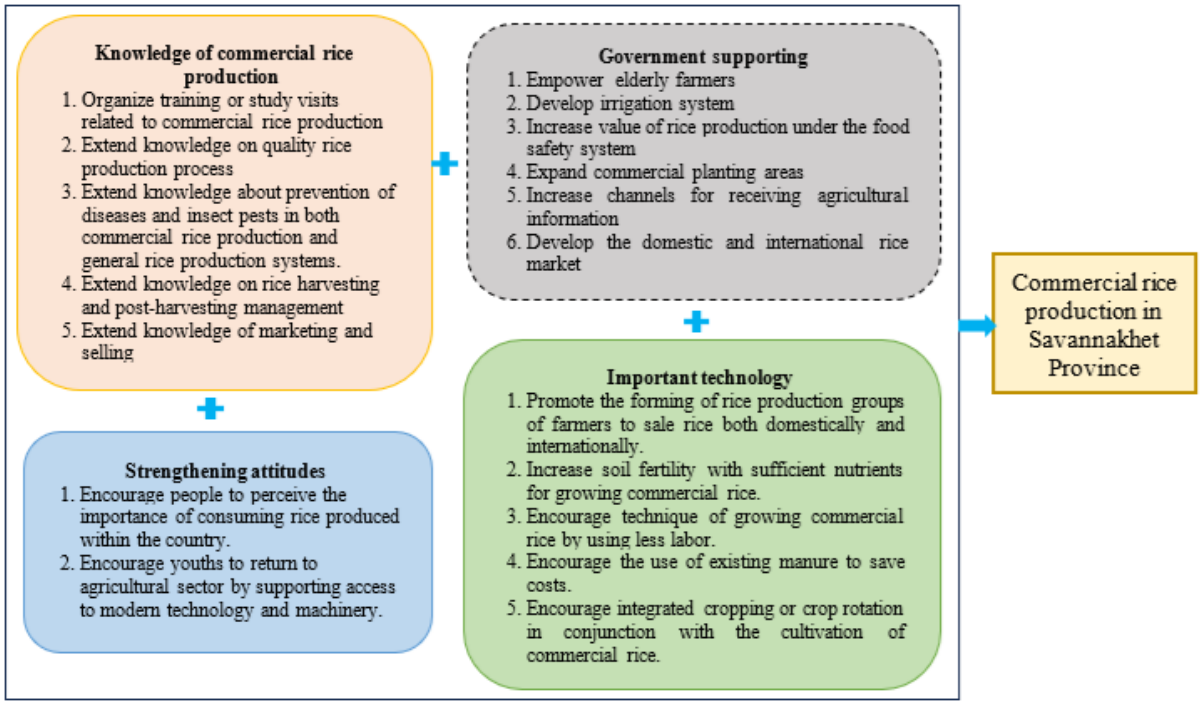

Fig. 2: Extension model for commercial rice production in Savannakhet Province

for increased access to inputs by supporting them to have access to quality seeds or materials at affordable prices; 3) encouraging farmers to cooperate with the government to form agricultural production groups in the community to strengthen negotiation power and encouraging the use of existing local resources such as manure to save costs; 4) finding sources of credits with low interest rates to support commercial rice production; and 5) encouraging youths to return to the agricultural sector by supporting access to modern technology and farm machinery, as well as production techniques.

REFERENCES

[1] Douangsila K. *Rice production in Lao PDR*. Vientiane: National Agriculture and Forestry Research Institute, Ministry of Agriculture and Forestry; 2002.

[2] Ministry of Agriculture and Forestry. *Agricultural statistics year book 2020*. Lao PDR: Ministry of Agriculture and Forestry; 2020.

[3] Ministry of Agriculture and Forestry. *Agriculture development strategy to 2025 and vision to the year 2030*. Lao PDR: Ministry of Agriculture and Forestry; 2015.

[4] Musoke S. *Increasing agricultural commercialisation and enhancing food security and nutrition in Lao PDR: A framework for balanced policy analysis, planning and programming*. Lao PDR: Ministry of Agriculture and Forestry of Laos; 2020.

[5] Ministry of Agriculture and Forestry. *Development strategy of the crop sector 2025 and Vision 2030*. Lao PDR: Ministry of Agriculture and Forestry; 2015.

[6] Somphong C, Bounmy P, Outhevy V, Inta C, Souvanthone D. *Study on potential products identification in three provinces: Savannakhet, Khammouane and Bolikhamxai*. Research report. Lao PDR: Savannakhet University; 2021.

[7] Ministry of Agriculture and Forestry. *Lao People's Democratic Republic: climate-friendly agribusiness value chains sector project*. Lao PDR: Ministry of Agriculture and Forestry; 2022.

[8] Chanthavong I, Nilawonk W, Kongtanajaruarun R, Areesrisom P, Muakyod P. Factors affecting the farmers' adoption of commercial rice production in Savannakhet Province, Laos. *Journal of Applied Economics and Management Strategy*. 2023;10(2): 91–105.

[9] Food and Agriculture Organization of United Nation. *Lao People's Democratic Republic rice policy study*.

Food and Agriculture Organization of United Nation; 2012.

[10] Oladele OI. Features of agricultural extension models and policy in selected sub - Saharan Africa countries. *Journal of Agriculture and Environment for International Development (JAEID)*. 2011;105(1): 35–44.

[11] Worth SH. Agriflection: A learning model for agricultural extension in South Africa. *Journal of Agricultural Education and Extension*. 2006;12(3): 179–93.

[12] Surudhi M, Asokhan M, Arunachalam R. Utilization pattern of extension tools and methods by Agricultural Extension Agents. *Journal of Extension Education*. 2017;29(2). https://doi.org/10.26725/JEE.2017.2.29.5838-5849.

[13] Ekasari ZK, Saleh SAM, Jusoff K, Salman D, Kasirang A, Arsyad M, et al. Communication pattern and conflict in agricultural extension. *Asian Social Science*. 2013;9: 27.

[14] Sirisatidkit P. *The model development of farmer adaptation sustainable of Songkhla basin area*. Graduation thesis. Thailand: Silpakorn University; 2014.

[15] Department of Agricultural Land Management, Ministry of Agriculture and Forestry. *Agriculture cover map for Lao PDR. 1: 20 000*. Lao PDR: Ministry of Agriculture and Forestry; 2019.

[16] Thanasack P. *The role of agricultural extension services on rice production efficiency in Laos, a case study on Bolikhanh District, Bolikhamxai Province*. Master's thesis. Japan: Kyushu University; 2012.

[17] Foley JM. Howard H. Kendler (1919–2011). *American Psychologist*. 2012;67(6): 490–491. https://doi.org/10.1037/a0028360.

[18] Lien AS, Jiang Y. Integration of diffusion of innovation theory into diabetes care. *Journal of Diabetes Investigation*. 2017;8(3): 259. https://doi.org/10.1111/jdi.12568.

[19] Wan L, Ding F. Decomposition-and gradient-based iterative identification algorithms for multivariable systems using the multi-innovation theory. *Circuits, Systems, and Signal Processing*. 2019;38: 2971–2991. https://doi.org/10.1007/s00034-018-1014-2.

[20] Phonekeo A. *The development of kai noi rice production model according to the local culture of Kai Noi rice farmers in Xieng Khouang, Lao PDR*. Doctoral dissertation. Thailand: Maejo University; 2022.

[21] Keeves JP. *Educational research, methodology, and measurement: An international handbook*. Oxford: Pergamon Press; 1990.

[22] Atthawit W, Benchamas Y, Bumpen K. Area based management extension for sustainable rice production: lessons learned from sustainable rice farmers groups in Det Udom District, Ubon Ratchathani Province. *International Journal of Environmental and Rural Development*. 2018;9(1): 1–6.