ASEAN Journal of Management & Innovation
Vol. 7. No. 1, 119 - 132

DOI: 10.14456/ajmi.2020.9
ajmi.stamford.edu
Received: January 21, 2020
Revised: April 2, 2020
Accepted: April 3, 2020

The Development of Smart Farmer Training Course for Agricultural Extension

Kanlayanee Prasertkhorawong
Research Scholar, Interdisciplinary Agriculture Program, Maejo University, Thailand
dkd.prasertkhorawong@gmail.com
Paisarn Kanchanawong, Ph.D.
Assistant Professor, Interdisciplinary Agriculture Program, Maejo University, Thailand
paisarn77@gmail.com
Chalinda Ariyadet, Ph.D.
Assistant Professor, Interdisciplinary Agriculture Program, Maejo University, Thailand
Chalinda.bio@gmail.com
Sathaporn Saengsupho, Ph.D.
Assistant Professor, School of Administrative Studies, Maejo University, Thailand
drsathaporn@gmail.com

Abstract
The purpose of this mixed methodology research was to generate a training curriculum for farmers that met their needs. The sample group was farmers from the Phrae province located in Northern Thailand, most of them between 46-60 years old. 400 of them took a proficiency test and another 28 of them were submitted to pre- and post-learning performance analyses. Some farmers and experts in smart farming were also interviewed. The proficiency test indicated that most of the farmers did not meet the required qualifications as smart farmers and needed specific training (or retraining for some of them). At a 95% confidence level, the performance of the 28 post-learners ranged from 34 to 9 points out of a maximum of 35 points. The average score was 24.79 points, indicating that the training substantially increased their level of smart farming competency as the curriculum contents dealt with modern technology and issues of much relevance to them. The data from the tests and the various discussions and interviews was used as a guideline for generating the curriculum outline. One issue that kept surfacing was the lack of smart phones, which given the need for farmers to use information technology to access valuable data was problematic. Given the increasing digital orientation of today's economy, farmers' access to affordable smart phones should be a priority as it will help cement the content of the trainig courses.

Keywords: Curriculum Development, Smart Farming, Smart Farmers, Training Course, Agricultural Extension Department.

1. Introduction

Thailand's agricultural sector faces a number of problems due to both domestic and international factors. Domestic constraints include natural disasters, deteriorated agricultural resources, and a lack of knowledge in agricultural resource management, machinery, marketing, and innovative technology. There are also constraints in terms of price intervention, overcapacity, and decreasing prices of agricultural commodities. Another issue likely to become more worrisome in the future is the imbalanced farming population structure as many people working the land are part of the elderly society, which may create deficiency in the number of agricultural operators. According to the Department of Agricultural Extension, in 2018, there were approximately 12,401,600 farmers in Thailand;

1,700 of them were under the age of 20 (0.01%). 2,549,400 were between 20-45 years old (20.56%), 5,754,400 between 46-60 years old (46.40%), and 4,096,100 over 61 years old (33.03%). In short, the vast majority of farmers, and thus a large proportion of those to be trained to become Smart Farmers, are over 46 years old, which means they have well-entrenched farming techniques, which may be a real challenge to change. Farmers also have to contend with a number of challenges from abroad (Srimuk, 2015). These include importing agricultural commodities from neighboring countries that are competing with domestic products, the entry of new players in the global agricultural market, the lowering of trade barriers, and the expansion of free trade zones, most notably the soon-to-be-concluded 15-member Regional Comprehensive Economic Partenership (RCEP) (Office of Agricultural Economics Ministry of Agriculture and Cooperatives, 2016; Prasertkhorawong, 2014). In response to all these challenges, the Ministry of Agriculture and Cooperatives, the main bureau in charge of improving the agricultural sector in Thailand, has been seeking concrete solutions and, starting in 2012, has issued a series of explicit policies and guidelines for the administrators and officers of the Ministry to implement (Office of Agricultural Economics Ministry of Agriculture and Cooperatives, 2016). They are seen as essential steps toward the improvement of the sector.

One concept that has emerged as part of the endevaors undertaken to be better prepared to face all the challenges ahead is that of "Smart Thai Farmer" with a "Smart Officer" as a partner. In a nutshell, a Smart Farmer can be defined as a farmer who knows how to access the right information in order to make the right decisions regarding commodities, marketing management, and product quality awareness (The Committee to Impel the Smart Farmers Project and Smart Office, Ministry of Agriculture and Cooperatives, 2013). As to "Smart Officers", they are members of the Department of Agricultural Extension under the section of the Ministry of Agriculture and Cooperatives in charge of the Smart Farmer improvement program (Project and Budget Group, Planning Division, Department of Agricultural Extension, 2017). They have genuine respect for the farming profession, have good academic credentials and are well-versed in the use of technologies and the application of policies that can strengthen the operations of farmers and help them transit to the green economy and zero waste agriculture. They also have pride in being civil servants. Although being a relative of farmers is not a requisite, it helps smart officers understand farmers well and get a good grasp of what they have to deal with on a daily basis. The work of the Department of Agricultural Extension can be summarized as the management of agricultural knowledge.

The department runs a Smart Farmer Development Program and has articulated a training curriculum for improving the performance of farmers (Agricultural Economic Monitoring and Forecast Center, 2015; Farmer Development Division Department of Agricultural Extension, 2018). It provides agricultural skills to young farmers as well as older ones throughout their careers (Singkhawanit, 1 9 8 8). Its chief aim is to increase their farming capacity and develop their potential to become smart farmers. The program developed by the department targets various groups of farmers both in terms of principles and practice. As part of the implementation of the Smart Farmer Development Project, between the fiscal year 2014- 2017, 1,014,786 farmers registered into the Smart Farmer program. They were divided into different groups as follows: 981,649 smart farmers, 25,539 smart farmer models and 7,598 young smart farmers (Ministry of Agriculture and Cooperatives, 2018). A smart farmer is a 'normal' farmer who registers in to the Smart Farming program and is over 45 years old. A smart farmer model refers to a farmer who has more potential than other farmers registered. A young farmer is a farmer who belongs to neither of these categories and is 17-45 years old. In the fiscal year 2018, the year of reference for this study, a total of 233,058 farmers were evaluated (Farmer Development Division Department of Agricultural

Extension, 2018). This paper seeks to determine whether the current Smart Farmer curriculum meet the needs and expectations of farmers and generate the level performance expected by the Department of Agricultural Extension. More specifically, this study seeks to address the following research question: Does the training program provide farmers with enough knowledge and adequate understanding for them to be able to upgrade their performance as general farmers and become Smart Farmers?

2. Literature Review

- Curriculum Development

A curriculum is a learning plan (Taba, 1980). It is about the selection and arrangement of content. Curriculum development is about creating or developing courses. It refers to a project plan for a specific group of people, with specific objectives, content, methods of teaching and evaluation in order to complete the goals set by the institution (Saylor & Alexander, 1974). As determined by Saylor and Alexander (1974), the steps are as follows: (i) goals, objectives, and domain, (ii) curriculum design; (iii) curriculum implementation, and (iv) curriculum evaluation. Specifically, after setting their goals and objectives, curriculum designers need to select teaching methods and teaching materials that will help students learn as specified. They also need to be clear about the duration of each part of the content. At the curriculum evaluation stage, the focus should be on assessing the curriculum as well as the quality of teaching and the learning behavior of students (Khrasanati, 2004). In this research study, the curriculum evaluated is based on this approach.

- Smart Farmer

According to The Committee to Impel the Smart Farmers Project (2013) and to The Smart Office, Ministry of Agriculture and Cooperatives (2013), Smart Farmers are farmers who: (i) are knowledgeable in their field; (ii) can obtain the right information to make the right decisions; (iii) understands product management and marketing; (iv) are aware of product quality and consumer safety issues; (v) are environmentally and socially responsible; and (vi) takes pride in what they do. In other words, they are farmers who take into account the safety of consumers, societial needs, including food security, and the quality of the environment. Smart Farmer development along these guidelines is central to the training of smart farmers. The knowledge required goes well beyond the field of agriculture and includes seemingly unrelated fields such as marketing and cost accounting. Being a smart farmer also presupposes having access to relevant information, which in turn assume that the farmer knows which channels to go through to obtain the proper information. Therefore, it is necessary to have an effective mechanism to help farmers secure access to these various forms of knowledge (Srimuk, 2015). Obviously, given the breadth of the knowledge and skills targeted as defined by the 6 aforementioned fundamental qualifications and the average age of farmers, turning a "Thai Farmer into a Smart Farmer" can be challenging and requires steady efforts.

- Department of Agricultural Extension

The Deaprtment of Agricultural Extension is a service designed to develop farmers' skills and promote the sustainability of their operations. It provides knowledge, experience, and agricultural skills to farmers throughout their careers (Singkhavanich, 2010). Since developing new skills and becoming a smart farmer is seen as a life-long process. Agricultural Extension officials are associated with a specific farmers' community and spend most of their time working with farmers in that community. As the individuals who work the most closely with farmers, they understand their needs and cahllenges better than anyone else. One of their main objectives is to ensure harmonious relationships with their

communities. For these reasons, people who are hired for this job must understand the basic principles of human behavior in rural society and have a solid graps of societal influences on farmers. Simply put, they must be flexible and open-minded as the people with whom they have to work may adhere to different beliefs, values, cultures and traditions. As Khemthong (2011) pointed out, they have specific needs which agricultural officials cannot ignore. Agriculture Extension officers must provide an environment conducive to learning and therefore develop a climate of mutual trust and respect (Hirunratsamee, 2010).

3. Research Framework and Metholod

Figure 1 shows the conceptual framework used in this research study. Central to the framework is the six qualifications articulated by the Ministry of Agriculture and Cooperatives (2013).

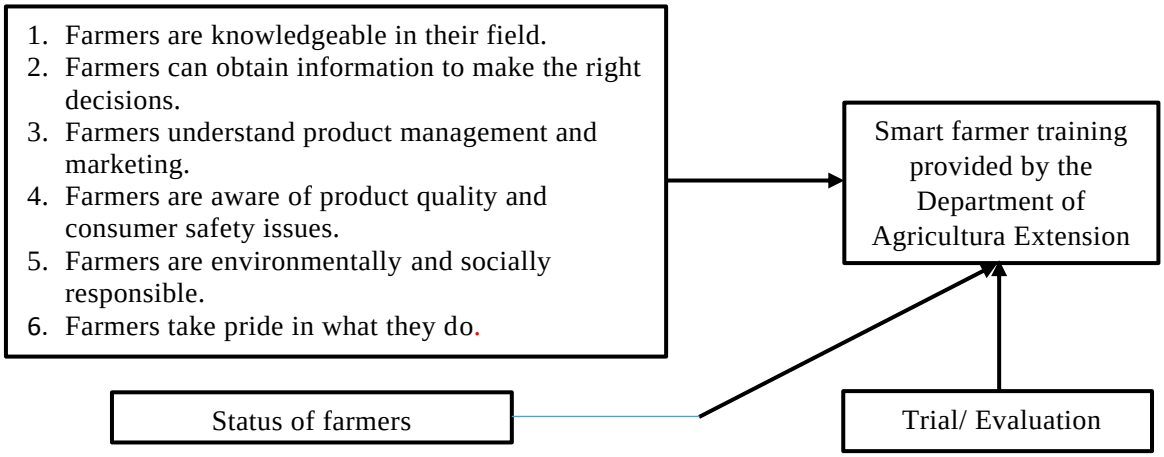

Figure 1: Conceptual Framework and Research Methodology

- Population

The population studied in this research consisted of farmers from the Phrae province, north of Thailand. This province was selected for the following reasons:

(1) Phrae is one of the provinces that have been allotted a budget for implementing the Smart Farmer Development Project since 2015;
(2) This province is where one of the researchers in this study work as a government official in the Department of Agricultural Extension;
(3) The researchers have been involved with this project from the very beginning of its implementation.

There are 71,150 farmers in that province (Pornhan, 2018; Ministry of Agriculture and Cooperatives, 2018). A representative sample of 400 farmers was selected from all the districts across the Phrae province as shown in Table 1 to test the Smart Farmer program for curriculum improvement purposes. They were farmers who had either not yet joined a farmer program or had previously joined the Smart Farmer Development Project of the Department of Agricultural Extension but had failed to test. For these reasons, they fell in the Developing Smart Farmer (DSF) group of general farmers. Nonprobability sampling was used to select the 400 farmers.

Table 1: Size of Sample Group in Each District

District	Farmers	Sample	
Mueang Phrae	15,118	85	
Rong Kwang	8,618	48	
Long	10,262	58	
Soong Men	9,571	54	
Den Chai	4,020	23	
Song	10,401	58	
Wang Chin	10,046	56	
Nong Muang Khai	3,114	18	
Total	71,150		400

Source: Department of Agricultural Extension (2018: Online)

In addition to this 400-farmer sample, a smaller sample of 30 farmers was also selected. However, since 2 farmers failed to show up at the training sessions, the sample was eventually reduced to 28 farmers. The main criteria for selecting these 28 Phrae province farmers was that they had never had any prior training in the fields covered in the Smart Farmer curriculum. They attended the Smart Farmer program and took the assessment tests before and after taking the course in order to determine their level of knowledge of 6 qualifications set out by the Ministry of Agriculture and Cooperatives and the level of difficulty (Item Difficulty). Purposive sampling was used for selecting this small group of farmers.

- Instruments

Several instruments were used in this mixed methodology research study. They included a proficiency test, performance analysis forms, interviews, a questionnaire, and a seminar.

- Proficiency Test

A proficiency test consisted of 30 multiple choice questions was administered to the 400 farmers selected for this research. It aimed to test their level of understanding of the smart farmer concept and to help researchers improve the curriculum and ensures it meets the needs of farmers. The results would provide guidelines for curriculum development in the future. The researchers selected questions which had a level of complexity between 0.3-0.7.

- Performance Analysis Forms

Performance analysis forms were used to test farmers before and after studying smart farming (13 topics, 18 hours, covering 6 sets of skills). They covered the 6 essential qualifications requirements articulated by the Ministry of Agriculture and Cooperatives. 8 experts wrote the questionnaires. Yamane's (1973) model test was used to determine the mean average, percentage, and Chi-square. Standard deviation used 5 criteria were used: small (1.81 - 2.60), moderate (2.61 - 3.40), very (3.41 - 4.20) and most (4.21 - 5.00).

- Farmers' in-Depth Interviews

In-depth structured interviews were conducted with 10 farmers. The aim of the interviews was to measure the extent to which farmers understood about the smart farmer development project and collect their opinions on curriculum. Content analysis, systematic synthesis, and perception analyses were used used to analyze the interviews.

- Satisfaction Questionnaire

A 10-item satisfaction questionnaire was designed by 4 experts from the Agricultural Extension Department and education experts and was used to test the level of satisfaction of the 28 farmers who undertook training. Standard deviation and meaning evaluation were used

for the following 5 criteria: smallest (1.00 - 1.81), small (1.81 - 2.60), moderate (2.61 - 3.40), very (3.41 - 4.20) and most (4.21 - 5.00).

- Villagers' Forum

The researchers formerly organized a group discussion whose purpose was to improve and modify if necessary the Smart Farmer Training Course. Referred to as a 'Villager Platform', it focused on guidance to fit farmers' development. Content analysis was employed to categorize, interpret and summarize the content of the discussion.

- Content Validity

To ensure the quality of the various instruments used in this study, the validity of the content of the proficiency test taken by farmers was tested. The 30 questions were validated by 5 experts. The Performance analysis forms used before and after studying were checked by 5 Agricultural Extension experts for content validity. 41 questions were initially validated. However, when analyzing the consistency index (Item Objective Congruence Index = IOC), it was found that 1 item had an IOC value that was lower than 0.50. The test was then revised and based on expert advice, 40 questions were kept.

4. Results and Discussion

This section reports the results of the proficiency test taken by the 400 farmers selected for this research, the various experimentations undergone by 28 farmers as well as the findings from the interviews with 10 of them, experts' advice, and the villagers' platform.

- Farmers' Performance on the Proficiency Test

A majority of the farmers who took the test were females (54.75%). Over half of them were between 46-60 years old (56.50%) and had completed primary education (67.50%) but did not pursue their studies further. The average farm unit in this sample consisted of 4 people and the average farmland amounted to 12,800 square meters (8 rai in Thai measurement unit). 82.00 percent of the farmers followed their father's footsteps. Their agricultural income averaged 92,528.90 baht (USD2,950) per year and their non-agricultural income 31,595.40 baht (USD1,000), which means that when both sources of income were combined, these farmers had an average annual income of 123,413.40 baht (USD3,950) against household's expenditure of 121,026.90 baht (USD3,880). 83.50 percent of their agricultural income came from crops, mainly rice (56.50%), field crops (23.25%) and vegetable (32.75%). Livestock production (essentially poultry, cattle, pigs, and fishery) provided the remaining agricultural income. Some farmers also supplemented their income with the production of insects, frogs, and shrimps.

Moreover, most of the 400 farmers tested have joined King Rama IX's project and 51.50 percent operate under the royal umbrella of the Agricultural Career Restoration program set up for flood-affected farmers. Other projects with which some of them are involved include: the Efficiency Enhancement and Adjustment Program for maize production (37.00% of the farmers tested), the project to stop burning in agricultural areas (29.00%), large agricultural extension projects (23.50%) and various projects for the promotion and development of agricultural careers (21.00%). The following is a summary of the farmers' performance. As shown in Table 2, 48.25 percent of them scored in the 0-10 point range (grade F, failing), 26.75 percent in the 11-15 point range (grade D, very weak), 20.00 percent in the 16-20 point range (Grade C, fair), and only 5.00 percent in the 21- 25 point range (grade B, good). The highest score was 23 points and the lowest one only 4 points. The average score was 11.98 points out of a full score of 30 points.

Table 2: Performance Level of the 400 Farmers Tested

n = 400

Competency of farmers according to scoring criteria based on grades			Samples	
Grade	**Result**	**Score Range**	**Number of Farmers**	**Percentage**
A	Excellent	26 – 30	0	0.00
B	Good	21 – 25	20	5.00
C	Fair	16 – 20	80	20.00
D	Very low	11 – 15	107	26.75
F	Fail	0 – 10	193	48.25

Farmer's performance (30 points) Min. = 4 points Max. = 23 points Mean = 11.98 points

The results of the Chi-Square, used grade cut based on criteria, and sig. analysis indicate that personal circumstances did not relate to the competency level of farmers. This is because the Competency Test is a test that measures their knowledge and understanding in very specific areas covering the six qualifications outlined by the Ministry of Agriculture and Cooperatives. While in theory, age could possibly be a factor, all the farmers have the same questions and very similar backgrounds that place them on an even-playing field.

- Results from Experimentation and Valuation of Training Curriculum

60.71 percent of the 28 farmers who were tested before and after learning about the 6 smart farmer basic qualifications were females aged between 46 and 60 years old. The mediam age was 43.57 years old. A majority of them (64.29%) did not study past primary school. 96.43% of the farmers essentially used mobile phones to keep up with information provided by the Department of Agricultural Extension Ministry of Agriculture and Cooperatives. Very few had smart phones as most of them could not afford their higher prices. As was expected, scores before and after learning substantially differed. As Table 3 shows, the 28 farmers graduated from the Smart Farmer program. 53.57 percent of them obtained scores ranging from 22 to 28 (good, grade B) and no one had a score below 7 (failing, Grade F). The highest score was an impressive 34 points and the lowest one, 9 points. The average score was 24.79 points.

Table 3: Scoring Before and After Studying

n = 28

Grade	Result	Score Range	Ability	Farmer	Percentage
A	Excellent	29 – 35	Before Class	0	0.00
			After Class	9	32.14
B	Good	22 – 28	Before Class	2	7.14
			After Class	15	53.57
C	Fair	15 – 21	Before Class	10	35.72
			After Class	1	3.57
D	Very low	8 – 14	Before Class	9	32.14
			After Class	3	10.72
F	Fail	1 – 7	Before Class	7	25.00
			After Class	0	0.00

Before class: Min = 4 points; Max. = 23 points; Mean = 12.89 points
After class: Min. = 9 points; Max. = 34 points; Mean = 24.79 points

These scores sharply contrasted with those obtained by the 28 farmers before learnin smart farming; 13 farmers had received a low score or failed. As indicated in Table 4, the mean score almost doubled after they took the course.

Table 4: Overall Comparison of Farmers' Performance Scores Before and after Studying

Experiment	N	Mean	Std. Deviation	t	Sig. (2-tailed)
Before Class	28	12.89	6.93	-8.99	.000**
After Class	28	24.78	6.16		

*At the statistical significance level of 0.05

Clearly, the level of understanding before and after studying dramatically improved. As Table 5 shows, when comparing the level of understanding of each of the features of the 6 smart farmer qualification criteria before and after studying, it was found that farmers obtained much higher scores after learning, than before on every criterion at the significance level of 0.05. There was no exception, they improved across the board.

Table 5: Criteria-Based Assessment of Understanding Before and After Learning

n =28

Qualification Criterion	Evaluation	Mean	Std. Deviation	t	Sig. (2-tailed)
1. Knowledgeable in their field	Before Class	1.96	0.74	-9.88	.000**
	After Class	3.75	0.59		
2. Have information to make decisions	Before Class	1.86	0.71	-7.88	.000**
	After Class	3.61	0.96		
3. Have product & marketing management skills	Before Class	1.73	0.70	-10.99	.000**
	After Class	3.73	0.65		
4. Be aware of product quality and consumer safety.	Before Class	1.66	0.62	-11.94	.000**
	After Class	3.75	0.62		
5. Responsibility for the environment/society	Before Class	1.80	0.64	-14.38	.000**
	After Class	3.75	0.61		
6. Proud of being a farmer	Before Class	1.77	0.75	-12.51	.000**
	After Class	3.89	0.66		

*At the statistical significance level of 0.0; n =28.

One the forms the 28 farmers had to fill out was related to the utlitization of the criteria in their daily practice once the training was completed. As Table 6 shows, the criterion that ranked first was the pride they would take in being farmers as they would value more than ever the philosophy of sufficiency economy and its implications in terms of the societal role of farmers. This is also why the assessment score was the second highest for the second component of this crieteria. The training helped them realized how critical it was for them to do what they do and try to better their farming operations. Related to these two components of criterion 6 and ranked number 3 was being knowledgeable in their field. Specifically, they valued the fact that as part of their training, the lecturers would help them create an individual farm production plan (IFPP) customized to meet their specific needs. Also ranked high on their priority list was being aware of product quality and consumer safety (criterion 3), which is closely related to access to information to make decisions (criterion 2), ranked fouth. Using information technology and applications as required by criterion 2 for farm management, production management, financial planning, and accounting, may even become more important in the future as the digital economy keeps growing. Awaresss of product quality and consumer safety, whose main construct is good agricultural practices standards GAP

(criterion 4.2) came next, followed by responsibility for the environment/society. One of the dimensions of this criterions is the use of technology and the latest innovation for the creation of agricultural products that are safe for consumers and do pollute the environment (Green Economy). With the clean food narrative gaining currency, the debate over the use of farm chemicals is likely to intensify in the future. However, as the ranking of this smart famer qualification criterion show, farmers are still ambivalent and scekptical of techniques that would avoid the heavy use of farm chemicals in trafitional farming.

Table 6: Utilization of Qualification Criteria

n = 28

Qualification Group	Subject	Ranking	$\bar{x}$	Std. Deviation	Meaning
1. Knowledgeable in their field	1	3	4.14	0.65	well
2. Have information to make decisions	1	4	4.07	0.77	well
3. Have product & marketing management skills	1	3	4.14	0.65	well
	2	6	4.00	0.72	well
4. Be aware of product quality and consumer safety	1	3	4.14	0.71	well
	2	5	4.04	0.58	well
	3	7	3.96	0.64	well
	4	8	3.89	0.69	well
5. Responsibility for the environment/society	1	9	3.82	0.72	well
	2	6	4.00	0.82	well
	3	7	3.96	0.84	well
6. Proud of being a farmer	1	1	4.25	0.75	Great
	2	2	4.18	0.77	well

- After-Training Satisfaction Level

As the scores detailed in Table 7 show, the farmers surveyed were satisfied with all aspects of the training. The overall assessment score was ($\bar{x}$ = 4.45), which suggests that farmers' expectations have been met. The two lowest scores pertain to the appropriateness of the schedule and the clarity of the objectives on which training is based; two issues which in spite of the good scores obtained should nevertheless be looked at in the future so that farmers' level of satisfaction with regard to these topics increases. In light of the above discussion, that the competence of lecturers is ranked first is not surprising. Recall from above that farmers greatly value the fact during the training lecturersassist them in creating their own business plans, using parameters suitable for their own farms.

Table 7: After-Training Satisfaction Level

n = 28

Item	Ranking	$\bar{x}$	Std. Deviation	Meaning
1. Lecturers are competent.	1	4.64	0.49	Great
2. Training and facilities are appropriate.	2	4.61	0.50	Great
3. Criteria and training conditions are appropriate.	3	4.54	0.51	Great
4. Overall structure and course details are appropriate	4	4.50	0.51	Great
5. The rationale of the training makes sense	5	4.46	0.51	Great
6. Criteria for certification are appropriate	6	4.43	0.50	Great
7. Snacks, drinks, and lunch are adequate	6	4.43	0.57	Great
8. Before and after class competency analysis are appropriate	7	4.36	0.49	Great

9. Training schedule is appropriate.	8	4.29	0.53	Great
10. Training is based on clear objectives.	9	4.25	0.44	Great
Total		4.45		Great

- Findings from Interviews with Farmers

The interviews for knowlege conducted with 10 of those general farmers revealed that in spite of the much improved scores after completing the training sessions, there were gaps remaining in their understanding of the 6 qualifications criteria. Only three interviewees could knowledgeably talked about the six fundamental requirements and thoroughly articulate their content. Other could only classify certains aspects of them. Yet, all the farmers interviewed by the Department of Agricultural Extension expressed a strong desire to enhance their potential, become smart farmers, and develop their technologyical skills and ability to be innovative. While they knew the fundamental requirements but not their detailed aspects, they all wanted to improve the performance of their farms based on the targets set by the Ministry of Agriculture and Cooperatives. In their opinion, this can be achieved with even more support from the Department of Agriculture Extension. According to them, support should come in two ways. More training sessions in the future along the same format, which as we just saw above, they found quite satisfactory at all levels, and material support. If smart farmer sessions were more frequent, farmers could have more opportunities to build up on their knowledge from previosu sessions session and reflect upon what they have learned so far and what they still have to learn based on their own daily practice. This may prompt them to come back to the training with novel questions and issues

They stressed the need for the Department of Agricultural Extension to provide some support for them to acquire natural fertilizers (as opposed to farm chemicals) as well as various pieces of equipment various agricultural pieces of equipment. This support could come in the form of subsidiaries, low-interest bank loans, or group purchases. As mentioned earlier, the use of information technology and applications as required by criterion 2 for farm management, production management, financial planning, and accounting, however, was hampered by the lack of smartphones. Since they were too expensive and beyond the means of farmers, only a few of them could afford them. In this particular straining session, lecturers solved the problem by asking farmers to work in groups. But as the interviewees pointed out, smartphones are not just useful in the classroom. In fact they would be even more useful one farmers are back home as they could retrieve valuable information of the daily management of their farms and the transition towards greener farming, an essential component of smart farming. In other words, subsidized smartphone and tabmlest would the easiest and most practical way to access vital agricultural technology information

- Finidngs from the Villagers' Platform

The results of the villagers' platform, which, as we saw earlier, brought together 3 agricultural promotion lecturers and the 28 farmers, can be summarized as follows. Consistent with findings from the satisfaction form, the admission criteria, the training method and its principles were all found to be appropriate by both farmers and experts. All the participants also concurred that the structure and description of each course and the training schedule were equally appropriate and did not warrant any particular remark. Regarding the evaluation and certification process (performance analysis before and after examination and various assessment forms), it was unanimously agreed that the amount of time allocated to complete the performance analysis before and after studying was adequate and that the difficulty level of the tests was acceptable (this applied to the 35 items of the test). Other issues discussed included the operational budget, the lecturers in each topic, snacks, drinks, and lunch, and the overall facilities, all of which were found to meet

expectations. The farmers and the three scholars from the Department of Agricultural Extension made some suggestions as to how to enhance the benefits of the Agricultural Extension Program. Farmers thought it would be appropriate to have more training in the near future in order to review their knowledge, increase their understanding, and encourage farmers in their respective areas to seek knowledge about how smart farming fit in their operations and can be applied to their own farms. As to the three scholars, they reiterated the fact that the training course for smart farmers was critical for the development of Thai farmers and their ability to raise their mastery of technical skills and knowledge, without which they would not be able to raise the yield of their farms and their income level, let alone their sustainability over time. They also suggested that since the final topic of the training is usually completed at 4:30 pm, farmers should not be required to take tests right after studying. This also should apply to various assessment forms and surveys which they are typically asked to fill out at that time as well. They recommended that, instead, farmers take the questionnaires and forms home and send them back the next day, which in their view would make the assessment of their own understanding more realistic. Given that farmers expect more routine training session in the future, this makes sense as it enables farmers to know exactly what they would need to emphasize in the next training sessions.

- Experts' Advice

The focus group discussion between the researchers in this study and the 8 officers from the Department of Agricultural Extension (hereinafter referred to as 'experts') can be summarized as follows. All of them found the overall design appropriate. In terms of objectives, since the training involves working around personalized business plans as we saw earlier, and given the breadth of the topic, all the experts saw the need for some rewording of criterion 1 as follows: "Knowledge of all the subjects covered in the training program." All the experts agreed that the training criteria and conditions were suitable. All of them also found the expected results of the training to be fair objectives. Moreover, the 8 experts concurred that the terminology was defined appropriately and the curriculum was relevant. They found the training schedule suitable for the program but recommended that for the conduct of practical activities, farmers be divided into 6 groups of 5 people. While all the experts found the budget for the training sessions adequate, half of them suggested that there should be an allowance for the transportation and storage of documents for all farmers. In their opinion, the allowance will encourage to fill out documents more efficiently. Finally, even though the experts found that the application forms which farmers had to fill out to register for the training sessions were adequate, they also suggested that some slight modifications should be made in the future to reflect the fact that the digitalization of our daily lives is a reality. For instance, since many farmers use Facebook and Line, the application forms should include personal details such as 'Line ID' or Facebook ID'. This could stimulate – and facilitate – online dialogues between farmers and the officers after taking the Smart Farmer program. This last point is important as there is no doubt in the mind of the researchers that digitization will accelerate in the years to come and forms and training should reflect this trend.

5. Conclusion, and Recommendations

The Phrae province farmers involved in this study were between 46-60 years old. This figure is consistent with the report of the Department of Agricultural Extension, which stated that out of a total population of farmers of 12,401,600 in 2018, almost half of them (5,754,400) were between 46-60 years old (Ministry of Agriculture and Cooperatives, 2018). All the demographics in this study are also in line with basic information in other provinces (Prasertkhorawong, 2014). The aging farming population makes it even more critical for

farmers to acquire new skills as smart farmers and run their farms more efficiently. This is one of the reasons why farmers involved in the program did want the Department of Agricultural Extension to expand their knowledge of agriculture and introduce new technologies and innovation so that they could transit from general farming to smart farming. The framework of the 12th National Economic and Social Development Plan (2017-2021) rests on the shift from traditional to modern agricultural management through the widespread use of technology and innovation under Thailand 4.0 policy. Obviously, this important transition toward the implementation of the 20-year strategy of agriculture and cooperatives (2017-2036) will not be possible without the widespread use among farmers of more sophisticated technology support. (Office of Agricultural Economics Ministry of Agriculture and Cooperatives, 2016).

Dealing with an older population, however, presents challenges as suggested by the performance of the 400 farmers tested. As we saw, out of a maximum score of 30 points, the highest score was 23 and the lowest 4 (the average score at 11.98 points). Almost half of the farmers (48.25%) received a score between 0-10 points, which means they failed the training. In other words, most farmers failed to develop the knowledge and ability to become smart farmers as determined by the qualifications articulated by the Ministry of Agriculture and Cooperatives. For those who had never been involved in the Smart Farmer program before, that they failed is quite understandable. However, for those who attended training before, this raised important questions. One of them relates to resistance to change. While the 10 farmers interviewed stressed the importance of the program and the need to keep up with new technology and new trends away from the heavy use of farm chemicals (consumers may eventually refuse to buy products they perceive as ‘unsafe’), it may nevertheless prove to be difficult to change almost overnight years of practices passed down from one generation to another. Much of the burden of making farmers accept and ‘embed’ change rests with lecturers and scholars from the Department of Agricultural Extension. Clearly, the transition to smart farming is not easy. First and foremost, it requires a change in attitude, especially attitude towards change (Singkhavanich, 2010). This is consistent with Khemthong (2011), who discussed the importance of psychology as applied to farmers. When transfering knowledge to farmers, officers need to have a good understanding of the basic principles of human behavior in rural society.

Importantly, the agricultural extension scholars needs to provide flexibility with regard to the courses selected as farmers’ adaptation to the techniques of smart smarting is an evolving process that constantly raises new issues. In other words, it is critical for lectures to keep asking these two interrelated questions: "What do students want to learn?" and “What should we do to make sure they learn what they need?” The key point here is that the content of the subjects taught must be about the learners, the conditions under which they will implement what they learn, and societal problems. Agricultural extension scholars must act as caretakers and assist learners in exploring their own needs and interests and help them solve problems arising therefrom. They must also seek new knowledge which they would want to have access to if they were actually practicing themselves. Dealing with an older population also points to the need to prepare the next generation of farmers and turn them as smart farmers as early as possible in their careers. This may be made easier by the fact that they are more inclined to use technology and social networks. They may also be more flexible. On the other hand, though, they may have to grasp with generational issues as any change they may want to implement in their farming practices may met with resistance from older family members. Hence the importance to continue to train older people as well along the directives set forth by the Minister of Agriculture and Cooperatives.

The farmers who attended the training were able to score higher after studying than before at a significant level of 0.05. Interestingly enough, most of those who tested in this research study were still unable to efficiently use a tablet or a smartphone. As discussed earlier, this lack of mastery of basic information technology is largely due to the fact that many cannot afford to buy such relatively high price products. This keeps them from searching information on technology and agricultural innovations via the internet which farmers should nevertheless receive. Yet, the framework of the 12th National Economic and Social Development Plan (2017 - 2021) rests on the shift from traditional to modern agricultural management through the widespread use of technology and innovation under Thailand 4.0 policy. The transition is especially critical during the first 5 years of the 20-year strategy of agriculture and cooperatives (2017-2036) (Office of Agricultural Economics Ministry of Agriculture and Cooperatives, 2016). The government should therefore focus on policies designed to support farmers to acquire communication devices that would help them search for information on agricultural technology and innovations. Searching data online and using helpful and relavant applications is already critical now and it will be even more so in the future; hence the need for a policy ensuring farmers access to inexpensive and good quality devices to support their transition to smart farming.

- *Recommendations*

The Department of Agricultural Extension has developed a distinguished training program suitable for farmers and their present needs. However, developments such as more frequent and more intense weather events (which may become the 'new normal') may create the need for new and innovative training initiatives. It is therefore important that all those involved in the Agricultural Extension program remain alert to new dvelopments and flexible in their approach to training and in their working relationships with farmers the way they have so far. While many farmers have been able to participate in this program, many have not yet. So it is may be helpful to increase the number of sessions, which would also enable 'repeats'. All these are important considerations for policy formulation and future plans drafted by the Department of Agricultural Extension Ministry of Agriculture and Cooperatives in the next fiscal year. For all the reasons discussed throughout this research paper, with which readers are now familiar, the government should focus on policies designed to support farmers to acquire communication devices that would help them search for information on agricultural technology and innovations. This could come in the form of subsidies, low-interest loans, tax rebates, or leases. Finally, this reseach studied was limited to Phrae province in northern Thailand, which, while exhibiting national characteristics in some ways, may also not include others, which it would also be worthwhile exploring. Furture studies may thus want to consider a geographically broader population.

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