Factors Influencing Farmers’ Decisions on Highland Paddy Rice Planting in Chiang Mai Province

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Abstract
Rice has been the national food in Thailand and the most important economic crop bringing numerous incomes to the country for a long time. Farming is the main occupation of most Thai people. The most popular and famous rice variety in Thailand is Khao Dok Mali 105. This research studies factors influencing the farmers’ decisions on paddy rice planting in Chiang Mai Province and its benefits. Furthermore, it is beneficial to strengthen Thailand’s rice production along with educating farmers on the production process according to international standards aiming to stop using chemicals in the agricultural sector. From the population of 244,291 ethnic farmers in Chiang Mai, the sample was 400 ethnic farmers who plant highland paddy rice in Chiang Mai by calculating from Taro Yamane’s formula using the survey research. Most of them were married 40-to-49-year-old men who graduated from primary school. Descriptive statistical analysis included mean, percentage, and standard deviation. The findings revealed that the factors influencing farmers’ decisions on paddy rice planting at a high level were health, cost, labor, and price, and the factors influencing farmers’ decisions on paddy rice planting at a moderate level were production, market, environment, and policy. The farmers gave more importance to the health factor than the price, environment, production, market, and policy factors. Also, they gave more importance to the cost factor than the market and policy factors. Besides, they gave more importance to the price than the market factor. In addition, they showed more importance to the labor factor than the market factor. However, they gave less importance to the market factor than the environmental factor.

Keywords: Farmer’s Decisions, Khao Dok Mali 105, Highland Paddy, Rice Planting.
1. Introduction

Rice has been the main food of Thai people since ancient times and is considered the life of Thai people. Consequently, farming is the main occupation of the majority of the country's people. It can be considered that rice is the most important economic crop that brings a lot of income to the country, so rice is important to everyone because it is a matter of people's lives. Rice seed is like the life of rice growers as it is one of the most important factors in increasing rice production efficiency without increasing production costs. If there is a rice variety with high production, quality meeting market demands, disease and pest resistance, and local environment suitability, it will decrease the expenses of rice production or decrease the cost of rice production (Office of the Royal Development Projects Board, 2019). Rice and Thai people’s way of life has been closely bound together for a long time because rice is not only the main food but also the foundation of culture, spiritual life, dignity, and pride. Rice is also an export product and a great influence on the farmers’ way of life, which can earn money from rice farming products. There are mechanical tools to help in farming, which is different from the ancient times when oxen or buffaloes were used for plowing. Thai and Asian people focus on growing rice for consumption and creating a main occupation to support their families. Nowadays, rice cultivation has changed from exchanging to trading by using more modern technology to get the fastest and most productive (Nakhon Ratchasima Agricultural Extension Office, 2019).

Fragrant rice in Thailand is widely grown in all regions which also have steamed rice, sticky rice, local rice varieties, and bred rice varieties, such as Khao Dok Mali 105, Pathum Thani 1, RD6, RD15, et cetera; the most popular and famous rice variety for the country is Khao Dok Mali 105. In addition to the aforementioned rice varieties, there are Thai fragrant rice varieties such as Hom Nang Mol, Hom An, Hom Dong, and Hom Jan, which are steamed rice; there is also sticky rice such as RD6 and Dok Hom. It was reported that there were more than 155 fragrant rice varieties in Thailand (Saengnual, 2005). Fragrance rice is considered an important factor in setting rice prices; fragrant rice has a higher selling price than non-fragrant rice. In 2017 (November 2016 – October 2017), it was revealed that fragrant rice was sold at 1,825 – 3,133 baht per 100 kilograms, and 5% white rice (non-fragrant rice) was sold at 1,125 – 1,205 baht per 100 kilograms. The low production ability was due to low adaptation to the environment ability and low disease and insect resistance ability. Nevertheless, local rice varieties with unique genetics have adapted to the local environment well.

Nowadays, farmers and consumers are paying attention to health, environmental protection, and the reduction of the use of chemicals in agriculture. Consequently, farmers begin to produce rice that is produced in farms. This is a production method that avoids the use of
chemicals or synthetic substances such as chemical fertilizers, plant growth regulators, herbicides, and insecticides in all steps of production and during harvest storage. If necessary, natural materials and non-toxic plant extracts for humans are used, or no pesticide residues contaminate a product in the soil or water. At the same time, it preserves the environment, resulting in good-quality rice production and safety from the harmful effects of pesticide residues. As a result, consumers have good sanitation and quality of life. (Kangwol, 2019).

From the significance and the problems, the researcher intends to be a part of solving the problems, promoting, and pushing for rice cultivation to encourage more farmers to grow rice. So, the researcher aims to study the factors influencing affecting farmers’ decisions on highland paddy rice planting in Chiang Mai Province. However, the research is conducted on factors influencing farmers’ decisions on highland paddy rice planting in Chiang Mai Province. It will be beneficial to strengthen Thailand's rice production along with educating farmers on the production process according to international standards aiming to stop using chemicals in the agricultural sector. Increasing the area and the quantity of farming production will give Chiang Mai Province the potential to produce more rice for export to the world market. Furthermore, rice farmers in Chiang Mai Province have become solid, lessened their debt burden, and are healthy and ready for country development by producing safe agricultural products for the country sustainably.

2. Literature Review

Acceptance Process

An acceptance process that person has to go through 5 different stages (Roger and Shoemaker, 1978 referenced in Jaruwan Futan, 2017), namely, the first step, the awakening stage, or the information perception stage. 1) Awareness Stage is the stage of information awareness. 2) Interest Stage is a step after the information awareness stage, and farmers are interest in that innovation and starts searching for more news by asking their friends who have tried it before or from the agricultural extension staff. 3) Evaluation stage is the stage where farmers have already received details. It will be taken into consideration and evaluated whether it's worth it or not. 4) Trial stage or test (trial stage) is the stage after considering the advantages and disadvantages, this step will be brought to trial by themself and 5) adoption or acceptance (adoption stage) is the final stage of the process and is the acceptance of new ideas, new process or technology to be used in further works.

However, accepting the five steps from the above mentioned is not a permanent change in behavior because a person will find other things to
confirm his or her thoughts. If not confirmed that what he or she received was correct, he or she could give up that idea. Rogers (2022) proposed a new structure called the innovation-decision process, which consists of four steps. 1) Knowledge is the stage where innovation has occurred, and research has been conducted to understand the innovation. 2) Persuasion stage is the stage of farmers' attitude toward new things in the way they agree or disagree with that innovation. 3) Decision is the step where farmers decide to participate in that innovation and decide whether to accept that innovation or not. However, the decision is not permanent and may change later, and 4) confirmation is the last step of the process, which is to find information to support the decision. This may take a long time until the new ideas are accepted into permanent practice, which affect the acceptance of innovation and the acceptance of innovation of individuals.

Acceptance Theory

Technology or product acceptance is a mental process of farmers from obtaining information about the technology or product to accepting, implementing the technology or purchasing the product to use. (Roger, 1983) mentioned the internal and external factors that influence acceptance making acceptance more complex. Collecting data from practice to study the factors affecting the acceptance or rejection decision. Occurs as the dependent variable with only two options. Such a model is called a binary choice model with regression equations to describe which variable followed and the dependent variable in the two-choice models in the three models, which are the linear probability model, probit model and logit model. Aree (2549) mentioned that the logit model is capable of producing more satisfactory predictions than the linear probability model. Even though the direction of the relationship between the prevailing and dependent variables is the same, but the logit model, in terms of explaining the relationship of the variables, is broader than the probit model. Therefore, the logit model is suitable for this study as follows (Aree Wiboonpong, 2549)

(logit model)

\[
E(y|x_i) = F(w) = \frac{\exp w}{1+\exp w} = 5.1
\]

The commonly seen figure of the logit model is in the logarithm of probability is a log of the odd

\[
\ln\left[\frac{\frac{1}{1-p_i}}{1-p_i}\right] = X' \beta = 5.2
\]

Two alternative modeling are the introduction of a latent variable (y') to represent y, the value of y. In this equation, it is the utility value that accrues to the level of income arising from satisfaction and the potential of corn seeds that farmers decide to accept and buy that seed as a factor in the production of corn. Which represents the decision-making power of each farmer; therefore, each farmer (i) may be satisfied, and the
potential of different maize seed. Decision equations can be written to accept different seed by the equation of the independent variable \(x'i\) and unobservable variables \(u'i\).

Equation (5.2) will be estimated by the maximum likelihood method (maximum likelihood) to get the value \(\beta\) and the probability \(y'i = 1\) when \(x'i\) is

\[
P_i = \frac{\exp^{x'i}}{1 + \exp^{x'i}} = \frac{1}{1 + \exp^{-x'i}} \tag{5.3}
\]

And the result of the independent variable \(x\) is also called marginal effect, and the result (3.4) focuses on probabilities (Pimpiccha Tana, 2555)

\[
\frac{\partial P_i}{\partial x_i} = \left[ \frac{e^{x_i}}{(1 + e^{x_i})^2} \right] [b x_i] \tag{5.4}
\]

In summary, concepts and theories about technology acceptance, including the definition of acceptance, manner of acceptance and acceptance model which discusses the behavioral factors that drive the adoption of technology, perceived ease of use, perceived benefits, and technology user attitude. Besides, it also mentions the step of technology acceptance, which consist of the awakening phase, such as attention, assessment, test and acceptance stage. Thus, whether a person will accept the technology depends on what type of person they are. In this research, various concepts were brought to determine the study issues about Factors Affecting Farmers’ Acceptance of Hom Na Rice cultivation in Chiang Mai Provinces, including ideas that lead to deciding factors related to technology adoption.

Factors related to technology adoption

Factors related to technology adoption are divided into three main parts: economic, social and other factors, which have details as follows:

The economic factor is an economic factors or conditions, including financial status, land tenure, occupational labor and having good credit are the critical factor affecting the acceptance of innovation. Rogers and Shoemaker (1971: 182 Quoted in Naradol Prapaisri, 2557) mentioned that things that involved technology acceptance and making changes for the farmer to use technology are ownership of more land, having more arable land or having more income, including having a large number of production resources, will accept technology aster. The economic factor that motivates targeted individuals to buy and implement is 1) cost and result are the most critical factors affecting the acceptance rate. If the investment is high, the acceptance will be slow. If the method gives results faster, there will be faster acceptance and the ability to convey meaning. Concept or practices that are easy to convey or understand is often accepted more quickly than more complex and consistent methods. People tend to get new ideas or techniques consistent with existing practices or experiences. 2) size of farms also matters; farmers
with larger farms will inevitably learn quicker to find than small farms or fields farmer. And 3) size of income; high-income farmers will be interested in accepting innovation that efficiently requires investment and has the idea to raise the status to be better using academic principles as the mainstay.

Social factors Rogers and Shoemaker also mentioned that the social background of the target person tends to accept technology easily. (Puttsan Kruekham, 2561) Also mentioned that farmer adoption of innovation at a fast or slow rate, more or less depends on key farmer characteristics, including social status, as follows 1) gender; females are more likely to believe and accept innovation and easy to change attitudes 2) Age; farmers who are still young can accept changeable innovations. Older or younger affects acceptance. Older people are often hesitant or find it difficult to believe. Age is an essential factor in acceptance. Youn farmers accept new trainers better than older farmers. Younger farmers or target individuals are more inclined to accept the new plan than older ones. Thus, they were interested in new technology, while older farmers tend to be conservative and resist accepting new practices on the farm. 3) the ability to communicate, farmers who have the ability to read is faster to understand and accept innovation, and 4) level of education and experience- farmers with higher education and experience tend to have positive attitudes towards change. They are also knowing the way to get to know and understand quickly. Those with higher education are more likely to receive agricultural trainings than farmers with lower education levels. People with higher education tend to be more accepting because knowledge level plays an important role. The farmers with higher education have knowledge, and rationality, and can compare the benefits of new technology. It helps farmers make decisions easier, faster and with higher confidence. Experience in agriculture, for farmers, if the ancestors worked in agriculture, their children will tend to follow the way their ancestors used to or may have some improvement. However, those who start new farming are always interested in new methods.

5) the attitudes of farmers- who have a good attitude toward education and knowledge lies in promoting and disseminating their careers and leading farmers and having readiness in actual conditions faster and more

6) reasonable- reasonable people who meet to exchange ideas make promotion faster and more than people who are irrational and do not meet to exchange knowledge.

7) intelligence- people with intelligence and a good memory quickly learn and accept.

8) socializing- farmers who are socializing and serving society tend to be interested in work.
9) being modern and not behind the times will inevitably accept innovation and change

10) traditional farmers who adhere to their beliefs and traditions will change slowly and little.

Jaruwat Futun (2017) mentioned that the summary of factors related to technology adoption is as follows: 1) New sources such as newspapers, periodicals, radio, and television are also important. If the target person does not receive the news at all, acceptance will not happen. 2) if that is the type of education they already have known it, it will be easier and faster for them to accept it 3) visiting extension officers - if the officer visits frequently, the acceptance will be higher 4) if local relevant agencies help to spread the news, the acceptance will be higher 5) activities and participation such as exhibitions, group activities will encourage familiarity 6) to what extent the society we live in has developed as an old or new type of society. It is open or closed to receiving information.

7) if there is support, a favorable environment such as irrigation systems, marketing systems, electricity, roads, and credit systems can be created. The acceptance will be faster and higher.

In summary, factors related to the acceptance of technology include factors related to the technology itself or issues related to the technology, such as cost and ease of use, as well as factors related to the technology users, such as personal characteristics, knowledge, economic and social characteristics. In addition, factors associate with the promotion of technology acceptance by the relevant organizations are also important.

Finding management methods for rice cultivation to increase special quality and yield in selected strains

Two selected fragrant rice varieties and two standard check varieties were grown under environmental conditions and nutrient management. The experimental plan was a split plot design. The main factors were nutrient management, secondary factors were three replicates of cultivars in 2 orchard fields, namely the faculty of experimental agriculture plot. Chiang Mai University and farmer plots at an Altitude of 800 meters above sea level, Chiang Mai Province, the plot size is 1.5x4 meters, planting distance is 25x25 centimeters, planting one tree per hole, recording growth, maturity, yield and yield components after planting. Seed moisture after that, the product is dried in the sun until it is completely dry and colored. Take a random sampling of brown rice. Analysis 2-acetyl-1pyrroline (2AP) using a Gas Chromatograph-Mass Spectrometer (GC-MS). Individual saplings, one ear of each, 30 saplings per cultivar for accurate breeding of gene-specific molecular markers developed by high-efficiency sequencing technology. Transcriptome (Subactivity 2) for the second year, soil samples were collected before
and after planting. By using composite samples for analysis. Nitrogen content (N), phosphorus content (P), potassium content (K), soil pH (pH), electrical conductivity, soil organic matter (OM) and soil fertility.

Development of Gene-specific DNA markers using high-efficiency sequencing techniques under nutrient management conditions in rice cultivation

Rice samples from subactivity 1 in the booting stage were collected for RNA extraction for analysis using high-efficiency sequencing technology. RNA extraction was performed by taking 8-10 rice flower samples, ground them with liquid nitrogen and inserted into an Eppendorf tube, followed by adding 500 μl of NucleoZOL RNA extraction reagent and 200 μl of distilled water and left at room temperature. Chamber 5 min, centrifuged at 14,000 rpm, temperature 4 °C for 15 mins, aspirate 500 μl of supernatant, insert a new Eppendorf tube, then add 500 μl of phenol: chloroform: isoamyl alcohol, homogenize the liquid 10-15 s (vortex), centrifuged at 14,000 rpm, temperature 4 °C, then aspirated 400 μl supernatant, inserted a new Eppendorf tube and placed on ice for 10 mins, adding NaOAC 3M 40 μl and ethanol. Pure in the ratio of 2:1 of the resulting solution. The supernatant was then cooled at -20 °C for 1 night and then centrifuged at 14,000 rpm, 4 °C for 20 mins. The supernatant was discarded. The precipitate was washed with 500 μl 75% ethanol before centrifugation at 14,000 rpm, 4 °C for 1 min. This was repeated twice. The result of the RNA precipitate was dried at room temperature with 100 μl of distilled water, then checked for RNA quality by a Nanodrop machine. The resulting RNA was sequenced using high-efficiency sequencing technology. Transcriptome to analyze for SNPs and indels to develop gene-specific molecular markers (functional markers).

Improving of Highland Paddy Rice type, high productivity and precisely selected from local indigenous Paddy Rice

Two selected high-quality cultivars selected from year 1 (sub-activity 1) were grown under environmental conditions and nutrient management at the experimental plot of the Faculty of Agriculture, Chiang Mai University, planted in a garden field by black cutting method, 10 rows of each variety, 5 meters long, 4x5 meters plot size, 25x25 centimeters planting distance, 1 plant per hole, 3 sets of each variety with totaling 30 rows per variety.

After planting, the faculty recorded the growth, collect leaf samples, the age of the crop when it was ripe for harvest and yield components and the seed moisture. After that, the product was dried in the sun until the moisture content was at 14% for color. Brown rice was randomly sampled and analyzed for substance content analysis. 2-acetyl-1-pyrroline (2AP) using a gas chromatograph-mass spectrometer (GC-MS) to be evaluated with a mark
After planting, growth record collects leaf samples, record the age of the crop, when it is ripe for harvest, and measure the yield and yield components. Seed moisture after that, the product was dried in the sun until the moisture content was at 14% for color. Brown rice was randomly sampled and analyzed for substance content analysis. 2-acetyl-1-pyrroline (2AP) using a Gas Chromatograph-Mass Spectrometer (GC-MS). To be assessed with gene-specific functional markers developed at year 1 (subactivity 2), plants with alleles of the desired molecular markers were selected.

DNA extraction takes leaf samples from 7 specially selected high-quality rice cultivars and grinds them with liquid nitrogen. By grinding each sample separately, DNA was extracted using the CTAB method (Panaud et al. 1996), which consisted of 4% CTAB, 100 mMTris-HCl (pH 8), 20 mM EDTA (pH 8), 1.4 M NaCl and 0.4% β-mercaptoethanol. Extracted DNA was thawed with TE buffer, and DNA quality was tested with 1.2% agarose gel electrophoresis. DNA enrichment the extracted DNA was augmented by PCR using 50 SSR Molecular markers. Polymorphism was reported to occur. The PCR reaction consisted of deionized water, 10X buffer, 50 mM MgCl2, 25 mM dNTP, 20 μM primer, and 0.5unit Taq DNA Polymerases determination of DNA products from PCR reactions PCR-derived products was examined, and DNA bands were recorded by capillary electrophoresis using QIAxcel Advanced (Qiagen, Germany).

3. Methodology

The research was observatory research to study factors influencing farmers’ decisions on highland paddy rice planting in Chiang Mai Province.

Population and Sample in Research

The population in the research was 244,291 ethnic farmers who plant highland paddy rice in Chiang Mai Province (Highland Research and Development Institute, 2018).

The sample was from Taro Yamane’s formula at p-value = 0.05, meaning 400 ethnic farmers who plant highland paddy rice in Chiang Mai Province.

Research Instrument

The instrument for research consisted of an interview questionnaire which was divided into three parts as follows: Part 1: general information about the respondents; Part 2: factors influencing decisions on rice planting; Part 3: suggestions of decisions on farmers’ rice planting.
Checking Instrument Quality

1) Content validity is to analyze whether the generated questionnaire matches the content, covers the research objectives, and is suited to language use with respondents. This was achieved by consulting advisory committees.

2) Questionnaire reliability is to generate an interviewing questionnaire for a 30-person sample that has resembling characteristics to the sample in the research for finding Cronbach’s alpha to measure the questionnaire reliability quality. Normally, the acceptable value is more than 0.70.

Data Collection

The questionnaire was used for research data collection by individually collecting data from the farmers who plant highland paddy rice in Chiang Mai Province.

Data Analysis

1. Data from the questionnaire was analyzed by using descriptive statistics, including percentage, mean, and standard deviation. Using the midpoint method to divide significance levels of factors influencing decisions on rice planting can be interpreted (Srisa-ard, 1992) as the following.

<table>
<thead>
<tr>
<th>Mean Score</th>
<th>Factors influencing Decision on Rice Planting</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.51 – 5.00</td>
<td>affect the decision at the highest level</td>
</tr>
<tr>
<td>3.51 – 4.50</td>
<td>affect the decision at a high level</td>
</tr>
<tr>
<td>2.51 – 3.50</td>
<td>affect the decision at a moderate level</td>
</tr>
<tr>
<td>1.51 – 2.50</td>
<td>affect the decision at a low level</td>
</tr>
<tr>
<td>1.00 – 1.50</td>
<td>affect the decision at the lowest level</td>
</tr>
</tbody>
</table>

2. For describing data and inferential statistics and comparing mean differences and significance levels of factors influencing farmers’ decisions on rice planting, repeated measure ANOVA was used at p-value = 0.05. In case there was a significant difference, the Bonferroni method was tested to compare per pair.
4. Findings

1. General information of the respondents

This study found that 400 respondents were mostly male, at 51.3 percent, and female, at 48.7 percent. Their age was between 40 and 49 years old, at 22.9 percent, followed by between 30 and 39 years old, at 22.6 percent. They were mostly married, at 82.9 percent, and those who were single, at 16.6 percent. Their highest education level was primary level, at 50.8 percent, which was the maximal, followed by other lower education levels, at 29.60 percent. Their average monthly income was between 10,000 and 30,000 baht, at 98.50 percent, which was maximal, followed by between 50,001 and 70,000 baht, at 0.00 percent. Those that had 21-30 years of experience in rice planting at 35.00 percent, which was maximal, followed by 10-20 years of experience at 19 percent. The number of household laborers less than 5 was at 67.10 percent, followed by between 5 and 10, at 32.4 percent. Those that owned a plantation area of less than 10 rai, at 77.9 percent, followed by between 10 and 20 rai, at 21.6 percent.

2. Factors influencing the decision on rice planting

Factors influencing the decision on rice planting at a high level were health, cost, labor, and price. Factors influencing the decision on rice planting at a moderate level were production, market, environment, and policy. Respondents gave importance to the level of factors influencing rice planting decisions of farmers in all eight aspects sorted from highest to lowest: 1) health; 2) cost; 3) labor; 4) price; 5) environment; 6) production; 7) market; 8) policy respectively. Farmers differently gave importance to the level of factors influencing rice planting decisions of farmers in all eight aspects with statistical significance at p-value = 0.05 as follows. Farmers gave more importance to the health factor than the price factor, environment factor, production factor, market factor, and policy factor. Farmers gave more importance to the cost factor than the market factor and policy factor. Farmers gave more importance to the price factor than the market factor. Farmers gave more importance to the labor factor than the market factor. Farmers gave less importance to the market factor than the environmental factor.

Table 1 Factors Influencing Farmers’ Decision on Rice Planting

<table>
<thead>
<tr>
<th>Factors influencing Farmers’ Decision on Rice Planting</th>
<th>( \bar{x} )</th>
<th>S.D.</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cost</td>
<td>3.74</td>
<td>0.55</td>
<td>High</td>
</tr>
<tr>
<td>1.1 Cost of planting</td>
<td>3.75</td>
<td>0.54</td>
<td>High</td>
</tr>
<tr>
<td>1.2 Need for the high cost of production</td>
<td>3.73</td>
<td>0.56</td>
<td>High</td>
</tr>
<tr>
<td>2. Production</td>
<td>3.36</td>
<td>0.63</td>
<td>Moderate</td>
</tr>
<tr>
<td>2.1 Methods</td>
<td>3.36</td>
<td>0.63</td>
<td>Moderate</td>
</tr>
<tr>
<td>3. Price</td>
<td>3.88</td>
<td>0.46</td>
<td>High</td>
</tr>
<tr>
<td>3.1 Product price</td>
<td>3.85</td>
<td>0.48</td>
<td>High</td>
</tr>
</tbody>
</table>

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5. Discussion

From the findings, factors influencing farmers’ decisions on highland paddy rice planting in Chiang Mai Province have been discussed as the following.

Factors influencing rice planting decisions of farmers in all eight aspects sorted from highest to lowest were 1) health; 2) cost; 3) labor; 4) price; 5) environment; 6) production; 7) market; 8) policy. For the health factor, farmers were concerned about health problems and feared that there would be illnesses from the use of chemicals. For the cost factor, the production cost tends to increase. The price of chemical fertilizers, pesticides, and seeds prices have increased, and there is a shortage problem. Hence, the Department of Agricultural Extension should focus on providing production factors to farmers, such as Credit Support Projects to Help Farmers in Fertilizer Procurement and Special Price Fertilizer for Farming Projects. In addition, the rice production costs must be reduced by focusing on preservation practices as well as the proper and appropriate use of technology such as seed preparation and appropriate seed rate. In addition, an introduction to the use of fertilizers and soil amendments, the use of chemical fertilizers according to soil analysis values, herbicides, and rice pest control combination to reduce the use of chemicals. For the labor factor, there are labor shortage problems in rice cultivation and high labor costs. The solution is to encourage the use of combine harvesters because it is convenient and takes less time than hiring laborers, resulting in more cost savings. For
the price factor, buyers mainly set the price. The price depends on the rice quality and the buyers’ demands. Thus, there should be a price guarantee for rice to get the market price and to prevent the farmers from being taken advantage of by the buyers. In addition, farmers should form groups for price negotiation with the buyers. For the environmental factor, the environment has been changed. For example, aquatic animals in the rice fields that were originally food for farmers are reduced; people do not dare to eat due to fear of toxins. When farmers switch to rice cultivation, it helps to improve the environment and be more environmentally aware. For example, when chemicals are used, they end up in the soil, causing harm to people in the community or pets. For the policy factor, government agencies need to promote and provide support for rice production. Research and development of production methods or the development of rice varieties that are resistant to climate change to increase the quantity of rice production to meet the consumption demand as well as to provide knowledge and understanding in the production system that considers the rice quality rather than to increase the production quantity. Tien et al. (2022) found that six important factors determining rice production of rice farmers in Quang Tri and Thua Thien Hue provinces, sorted in order of priority, were government policies, usefulness comparison, import and export control in the production process, the attitude of farmers, influence of a family and farmer groups, and risk perception from rice production. This study suggested that the Vietnamese government should strengthen policies to support inputs for rice farmers, promote communication, establish a farmer group, and make agricultural contracts to link production and consumption processes.

6. Suggestions

There should be a promotion for farmers to produce rice seeds for their use, supply paddy rice seeds, and support important factors of production to solve a shortage of paddy rice seed problems. Practical research should be encouraged on the issue of reducing production costs, and the government should assist farmers with production costs, then help with low-interest funding sources that are easy to access. Farmers should keep records of income and expenses in order to determine whether the cost of cultivation should be increased or decreased in order to obtain maximum income. Therebefore, farmers should be encouraged to join groups in agricultural activities to strengthen the agriculture community.

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