DECISION-MAKING MODELS FOR PALM OIL PLANTATIONS USING BINARY LOGISTIC REGRESSION

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ABSTRACT

This research aims to develop a predictive model for the decision to increase the palm plantation area of palm oil farmers in the Pakpanang basin and nearby areas in Nakhon Si Thammarat province. Using a binary logistics regression method, the samples of 394 oil palm growers in the study area. Data is collected in a random way, proportionately by population in each district. Use simple sampling by the lottery method from existing contacts and collect data with questionnaires as a research tool. The results of the study predicted the decision to increase the palm oil plantation, finding that the variables that affect the model were statistically significant at 0.05, with 2 variants of 27 variables: training and support staff or contacting seedling sources and the palm oil acquisition market. Farmers who are trained in palm oil cultivation tend to decide to increase the palm oil plantation area significantly higher than those who are not heavily trained. Meanwhile, farmers who have help educators or contact seedling sources and the market to buy palm oil are resisting the decision to increase the oil palm plantation area.

Keywords: Oil Palm, Decision Model, Binary Logistic Regression.

INTRODUCTION

Since 1999, the government has promoted the expansion of planting areas and encouraged the cultivation of palm oil to replace palm oil varieties over 20 years old. As a result, palm oil output has continued to increase. The government has a 2004-2029 palm oil industry strategy to focus on producing and exporting palm oil alongside global leaders. Malaysia and Indonesia, as well as the policy of making palm oil the country's renewable energy source. The company aims to expand the palm oil plantation area to 10 million rai by 2029, which will increase by 400,000 rai per year, dividing the operation time to 5 years. For the first five years, the company aims to expand the country's palm oil plantations from 2.04 million rai to 3.67 million rai, which will accelerate the development of the existing palm plantations more efficiently and support the industry through simple and high-value processing. As a result, farmers and investors have turned their attention to the palm oil industry and the palm oil industry. Especially in the hot, humid southern region, close to the equator, which is a suitable and important area for growing palm oil in Thailand?

Currently, Thailand has an oil palm plantation area of 4,565,555 rai, with the southern region growing 3,898,745 rai of palm oil, representing 85% of the total palm plantation area. The first 10 provinces of palm oil are planted in Suratthani. Krabi, Chumphon, Nakhon Si

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Thammarat, Phang Nga, Trang, Ranong, Prachuap Khiri Khan, Satun and Chonburi, especially Nakhon Si Thammarat. The rapid expansion of palm oil plantations (Information and Communication Technology Center, Department of Agricultural Promotion, 2017). Nakhon Si Thammarat province is an interesting target province to study the factors that affect the decision of farmers to increase the palm oil plantation area. To implement the results of the study in the development and the planning of the proper cultivation of oil palm oil by the public and private sectors and to achieve further efficiency (Raposo & Alves, 2007; Rogers, 1983).

Research Objectives

1. To study the basics of palm oil growers in the Pakpanang basin and neighboring areas in Nakhon Si Thammarat province.
2. To develop a model predicting the decision to increase the oil palm plantation area of palm oil farmers in the Pakpanang basin and nearby areas in Nakhon Si Thammarat province.

REVIEW LITERATURE AND RESEARCH CONCEPT FRAMEWORK

Decision-making means the process of selecting the best choice in a number of choices based on discreet consideration criteria to make the most of those choices. This leads to the fulfillment of the practical objectives of the person who made the decision. In accordance with other research, which explains that decisions are a matter of inevitable management, and in management, decisions are at the heart of every operation. In order to achieve the purpose stipulated, there may be tools to facilitate consideration. There are personal reasons. Decision-making is a process of choice from many ways, by considering the information available to each person's values to choose an alternative to achieve their desired objectives. The decision of farmers to have a social influence is a contributing factor. The concept of social action is one of the influential factors that have changed the actions of many individuals. There are 3 reasons:

1) Factors include cognition, learning, gestures, motivation and attitude.
2) Social factors are the nature of group membership.
3) Cultural factors are related to the majority of cultures and sub-segments.

Shaner (2019) said that if you look at the whole agro-ecosystem, farmers' households are a small production system that is part of a larger system in this system. Environmental economics Therefore, factors affecting the behavior, decision-making, and acceptance of the technology of the farmer may be divided into four things:

1) Physical or ecological factors such as soil properties or species, terrain, water resources, climate, rainfall and precipitation distribution.
2) Economic factors are related to the quantity and quality of resources available to farmers, such as areas, funds, materials, equipment, production factors as well as the opportunity to obtain those resources, and economic infrastructure services such as loans, farmers' productivity markets, and the quality of the resources.
3) The influence of social factors on farmer personality includes traditions, cultures, beliefs, ethnicity, religions, and social groups.
4) Technical factors include opportunities to receive news, technology, or other agricultural promotion-related innovations, as well as other forms of communication.

Binary Logistic Regression Analysis is a one-way regression analysis technique in which a variable based on a qualitative variable has only two values (dichotomy or binary variable).

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The value of the variable based on the probability that the event will occur or not occur is between 0 and 1. For example, when considering whether farmers will change the rice fields to grow oil palms. 2 responses: *"Change the area to grow palm oil"* and *"Do not change the area to grow palm oil"* (Kerlinger, 1973)

In this study, the study factors can be divided into 6 groups:

1) Social factors include: Membership of agricultural groups Getting advice from community leaders The introduction of neighbors Officials recommend planting Household members encourage planting and see others doing good. Experience in palm planting and Asian opening in 2015.
2) Economic factors include sufficient household labor. The family has investments, enough holding space, palm oil prices, low production costs, and a market to support productivity.
3) Physical factors include the state of the area, soil fertility, palm oil plantations, and transportation.
4) Biological factors include palm oil disease and pests, as well as practice and care.
5) Investment, ease of supply, seedlings, seedlings, varieties, and agricultural machinery are all production factors.
6) Receiving information, training, certification, and conversion are examples of promotion and service factors. Getting advice from the authorities receiving visits from the authorities Input support The establishment of a palm oil grower cooperative and the presence of staff to assist or contact seedling sources and the palm oil market.

From the review of the above literature the researchers developed a framework for research in this study in Figure 1.

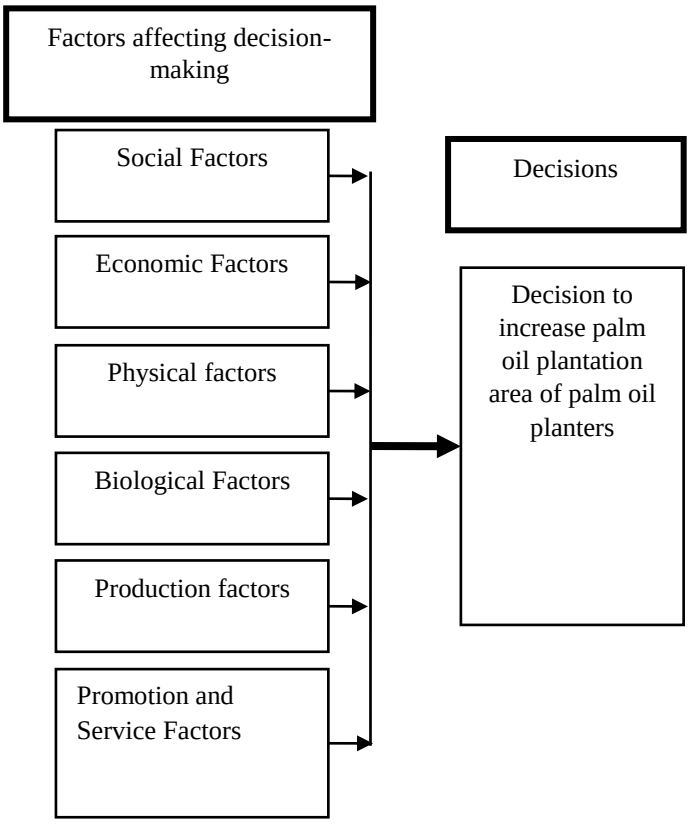

FIGURE 1
RESEARCH CONCEPT FRAMEWORK

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RESEARCH METHODOLOGY

The population used in this study is the palm oil growers in the Pakpanang Basin and neighboring areas in Nakhon Si Thammarat province registered by the Department of Agricultural Promotion. In 18 districts, Yamane (1973) formulated a sample size of 95 percent and set a 5 percent tolerance level, a minimum sample of 394 households, with a proportional sampling in each district. Use simple random sampling by the lottery method from existing listings.

Research Tools

The tools used to collect information include questionnaires created by researchers based on theories, concepts and research related to farmer's decisions, as well as interviewing farmers in 3 districts and developing questionnaires into 3 sections:

Part 1: The basic information of farmers is a choice of responses and fills to gather the sample data, namely gender, age, education, occupation, income, palm oil plantation size. The number of family members who are agricultural workers and have experience in palm oil planting.

Part 2: Information, factors related to decision-making It is divided into 6 main groups: social factors. Economic factors Physical factors the answer is classified into 5 points according to the likert scale. Level 5 means the most effective decision-making effect. Level 4 means a huge impact on decision-making. Level 3 means moderate decision-making.

Part 3: Information about the decision to increase the palm oil plantation area is measured by using one question about the decision to add or not to increase the palm oil plantation area, which has 2 answers: add and not add, with the scoring criteria: answer 1 point and no answer to 0 points.

The researchers examined the content validity of the questionnaire and applied the index of item objective congruence (IOC) of the content by three experts at the School of Management, Walailak University, and then updated the questionnaire before taking the data test with the actual sample. In one district, 30 sets of reliability were found to be 0.94, which was close to 1, so it was considered to have a high level of reliability.

Data Analysis

Part 1: Analyze the basics of farming with descriptive statistics such as frequency, percentage, mean, minimum, maximum, and standard deviation.

Parts 2 & 3Developing a decision model to increase the palm plantation area of palm oil farmers will use inference statistics using the Binary Logistic Regression analysis method at the 95% CI confidence range to determine the forecast of factors that affect the decision to increase the palm oil plantation area of the palm oil planters in the Pakpanang Basin and neighboring areas in Nakhon Si Thammarat province.

RESULTS AND DISCUSSION

General Farmer Basics The sample in this study was 394 households, 58.6 percent were male and 41.4 percent were female, 49.7 percent were women over the age of 50, 34 percent

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were aged 40-50 and 16.2 percent were younger than 40. 34.5 14.2% finished 6th grade, 12.9% finished third grade, 12.9 percent graduated above 3rd grade, 2.3% uneducated and 23.1 percent graduated in other ways, farmers 88.6 percent married, 7.6 percent single and 3.3 percent divorced.

Farmers 51% and 51% have 4-6 household members, 43.4% have 1-3 household members, and 5.6% of household members have 5 or more. 78.2% of farmers have household workers, and 1-3% have 3- 20.8% have no household workforce and 1% of the remaining 1% are household workers, 44.7% of household workers. 21.2%. With liabilities in excess of 100,000 Baht 11.9%. Liabilities range from 10,000 to 30,000 Baht.9.3% of the 6.2%, 30,001-50,000 Baht, and 6.720,000 less than 10,000 Baht, farmers 22.3% of 19.4 %Savings ranging from 10,000 to 30,000 BahtSavings range from $30,001 to $50,500,000 at a rate of 16.8%. Savings of 50,001-100,000 Baht at 14.4%13.9% less than 10,000 baht and 13.1% no savings at all. 44.2% of palm oil plantations are smaller than 10 rai, 37.3 percent are 10-20 rai, and 18.5% are larger than 20 rai. Farmers have the lowest palm oil growing area of 1 rai, up to 130 rai and an average of 14.549 rai, with 77.4 percent of the farmers having other occupations in conjunction with palm oil plantations and 22.6% growing palm oil alone. 55.6% of farmers have decided to plant themselves. 27.7% were recommended by relatives. 14.7 per cent were advised by friends and 2 per cent were advised by other sources.

Table 1
27 INDEPENDENT VARIABLES

Factor Type	Variables
1. Social Factors	Membership of agricultural groups
	Getting advice from community leaders
	Introduction of neighbors
	Officials recommend planting
	Household members encourage planting
	Seeing other people do a good job.
	Knowledge Experience in palm planting
	Asean Opening in 2015
	Enough household labor
2. Economic Factors	The family has investments.
	There is enough holding space.
	Palm oil prices (more revenue than other plants)
	Low production cost
	Having a market to support
	The area is suitable.
3. Physical factors	The area is plentiful.
	There is enough palm oil plantation area.
	Convenient transportation from home to palm oil plantation
	Easy practice and maintenance
4. Biological Factors	There are few outbreaks of diseases and pests.
	Funding sources of loans
5. Production factors	Ease of supply of seedlings
	The price of seed varieties is not high.
	The presence of agricultural machinery
	Receiving news from the media
6. Promotion and Service Factors	Getting training
	Help staff or contact seedling sources and palm oil market.

Analyze the predictive model of the decision to increase the palm oil plantation by analyzing the binary logistics regression with the binomial logit model. The way forward

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Stepwise to select the variables of the logistics regression equation by adding one variable at a time, and checking the values of likelihood – Ratio Statistic Omnibus Test, Hosmer and Lemeshow Test, Cox & Snell R2 and Nagelkerke R2.

Table 2
ANALYSIS OF MODEL SUITABILITY

Omnibus Test		Cox & Snell R2	Nagelkerke R2	Hosmer and Lemeshow Test	
Chi-square	Sig.			Chi-Square	Sig.
12.629	0.002	0.032	0.044	3.137	0.535

According to Table 2, the value of the Omnibus Test is statistically significant; the $\chi 2$ is 12.629, p-value of 0.002. This indicates that the binary logistic regression equation has at least one variable that affects the prediction of the decision to increase the oil palm plantation area. The Hosmer and Lemeshow Test value a $\chi 2$ of 3.137, p-value of 0.535. Indicates that the model is appropriate (Goodness of Fit) and The Cox & Snell R2 value is 0.032 and Nagelkerke R2 is 0.044. This indicates that the variation can be explained by the binary logistic regression equation is 4.4 percent.

Table 3
ANALYSIS OF ACCURACY IN PREDICTING THE DECISION-MAKING OF MODELS

Observation		Forecasting		
		Increase the palm oil plantation area next year		Percentage of accuracy
		Do not increase space	Increase space	
Increase the palm oil plantation area next year.	Do not increase space (262)	257	5	98.1
	Increase space (132)	122	10	7.6
รวม				67.8

According to Table 3, the data observed by farmers is intended to increase the palm oil plantation area in the next year. Answers do not increase space for 262 people, but when using binary logistic regression, it can be accurately predicted to be 257 (98.10%). 132 farmers intend to increase the palm oil plantation area in the next year, but when using the binary logistic regression, it can be predicted that 10 (7.6 per cent). Overall, the model predicts that the decision to expand the palm oil plantation by 67.8 percent will be made.

Table 4
BINARY LOGISTIC REGRESSION MODEL

Forecast variables	B	S.E.	Wald	Sig.	Exp(B)
1. Getting training (X1)	0.361	0.104	11.997	0.001	1.435
2. Help staff or contact seedling sources and palm oil market (X2)	-0.235	0.098	5.821	0.016	0.790
Constant	-1.125	0.265	17.980	0.000	0.325

According to Table 4, the variables that affect the model predict the decision to increase the palm oil plantation of farmers statistically significant at the level of 0.05, there are 2 variables: training (X1) and support staff, or contacting seedling sources and the palm oil acquisition market (X2). The constant value of the equation is -1.125 can be explained that farmers who are not trained in palm oil cultivation (untrained, answer =0) and have help staff or

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contact seedling sources and the palm oil acquisition market (answer=1) are likely the group who decide not to increase the palm oil growing area the most.

When considering the exponential beta, (Exp (B)) found that farmers who were trained in growing palm oil. It is likely to increase the oil palm plantation area by about 1.4 times higher than those who are not trained and farmers with aid staff or contacting seedling sources and palm oil markets are more likely to decide to increase palm oil plantations below those without aid staff or contact about 21 percent.

Based on the analysis with the binary logistic regression, the tally can be modeled to predict the decision to increase the oil palm plantation area of palm oil farmers in the Pakpanang Basin and neighboring areas in Nakhon Si Thammarat province as follows:

$$\text{Logit}(Y)=-1.125+0.361\ X1-0.235\ X2$$

Where Logit(Y) = Probability or opportunity to decide to increase the palm plantation area of the farmer's oil.

X1=Getting training

X2=Help staff or contact seedling sources and palm oil market.

From the above prediction equations. The relationship is located in a linear form, called Logit Response Function and can predict or estimate the probability of an event occurring.

$$\text{p(Increase palm oil plantation area)} = \frac{e^{-1.125+0.361\ X1-0.235\ X2}}{1+e^{-1.125+0.361\ X1-0.235\ X2}}$$

Where P (Increase palm oil plantation area) <0.5; Farmers decide not to increase palm oil plantations

P (Increase palm oil plantation area) ≥ 0.5; Farmers decide to increase palm oil plantation area

CONCLUSION

The rapid expansion of palm oil plantations in Nakhon Si Thammarat province has increased rapidly. Therefore, it is an interesting area to study and develop the decision to increase the palm oil plantation area of the palm oil farmers in order to use the results of the study to develop and guide the planning of the promotion of palm oil in the direction of the public and private sectors in accordance with the area conditions. The research aims to study the basics of farmers and develop a predictive model for the decision to increase the oil palm plantations of palm oil farmers in the Pakpanang Basin and nearby areas in Nakhon Si Thammarat province. Using a sample of 394 households, the analysis was based on 27 predictive variables to study whether these predictive variables affected the decision to increase the oil palm plantation area and in any form.

According to the Study of General Information, 84% of people over the age of 40 completed 4th grade to 34.5 percent. There are 1-3 household members and workers. The average palm oil plantation size of the farmers is approximately 15 rai, with 77.4 percent of farmers having other occupations in conjunction with palm oil plantations and 22.6% of palm oil cultivation alone is in line with other research that found that most farmers are small farmers. There are 2-3 family workers with an average area of approximately 10 rai.

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The results of the study predicted the decision to increase the palm oil plantation area, finding that there are two statistically significant factors that affect the model: training and assisting staff or contacting seedling sources and the palm oil acquisition market. The two predictive variables can explain the decision to increase the oil palm plantation area. Farmers who are trained in palm oil cultivation tend to decide to increase the palm oil plantation area significantly higher than those who are not heavily trained. Meanwhile, farmers who have help educators or contact seedling sources and the market to buy palm oil are resisting the decision to increase the oil palm plantation area. Farmers who do not have assistance or contact seedling sources and the palm oil market are more likely to make decisions to increase the palm oil plantation area, which is consistent with the other research; it studying the factors of helping local organic farmers, they were able to find a way to get the best out of them. Instead, it was found that it had no effect on the decision to grow organic cassava.

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