The Study of Competition of Cultivated Banana Producers in Isaan Region: The Case of Sangkom District, Nong Khai Province

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Abstract

The objective of this research was to measure the competitive level of cultivated banana producers in Isaan region. Competition was measured via an ability of mark-up pricing by calculating the Lerner index. Research samples were the cultivated banana growers from Ban Muang and Ban Wang Mon communities, Sangkom district, Nong Khai province. Purposive sampling method was used to select 40 samples from both communities. There were 3 key results. First, overall, the Lerner index indicates that the growers competed in monopolistic market, and their profitability varied because of cost differentiation in each grower. Second, the competitive level in Ban Muang was higher than Ban Wang Mon. Third, 10 out of 40 growers had their marginal cost exceeding the selling price. They did not acknowledge this loss because their opportunity cost of labor was not counted into production. These results entailed two recommendations. First, there should be an advice on cost accounting including financial and opportunity cost of labor. Second, as the higher cost of growing, farmers should seek alternative option such as selling leaves and processing banana, aside from selling only fruits, to increase their income

Keywords: 1) Cultivated banana 2) Competition 3) Lerner index

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Introduction

Cultivated banana or Kluay Nam Wa is a fruit that has long been part of the Thai society. The Thai name “Nam Wa” reflects its origin of this banana which is supposedly from the Wa River or Wa Creek that flows through Santisuk District and Mae Charim District, Nan Province. Nowadays, cultivated banana has been genetically modified to offer a wide range of sub types. Examples include Nam Wa Khom, Nam Wa Dum, Nam Wa Thong Ma Eng, Nam Wan Nuanchan (Kluay Nam Wa Ngoen, Kluay Nam Wa Nang), Nam Wa Mali Ong (or White Kluai Nam Wa), Nam Wa Pak Chong 50, Nam Wa Chok Wichian, Nam Wa Tha Yang, and the giant Kluay Nam Wa. The cultivated banana can be farmed all year round in all regions across the country. More importantly, when compared to other banana varieties, the cultivated banana is a more versatile plant. That is, edible banana blossoms are consumed as side-dish vegetables and salads. (Other types of bananas present strongly astringent and bitter tastes.) The leaves of cultivated banana are used for packaging and in decorations. (While the banana leaves of cavendish bananas bring about bitter flavor in a dish.) Moreover, cultivated banana is edible and is highly nutritious as 1 cultivated banana contains 100 calories of energy and 3 important natural sugars: glucose, sucrose and fructose. It is also rich in useful minerals such as iron, phosphorus, potassium, magnesium, carbohydrates (Saengsrisote, 2000, p. 3-5) and can be industrially processed into many foods such as banana chips, dried and processed bananas, etc.

Thanks to the said properties, today’s several sectors are encouraging farmers to grow bananas and use them more commercially. According to Pisanwanich (2017, p. B12), in 2016, Thailand produced a total of 1.1 million tons of fresh bananas. Cultivated banana made up with 900,000 tons while 171,000 tons were cavendish bananas. 80% of fresh bananas were exported to China, followed by Japan 7%. Thailand's processed banana exports in the same year were recorded at 800 tons. As per these statistics, cultivated banana clearly owned the highest share in production volume. However, the total production of bananas in Thailand is still very small as opposed to the global production of 150 million tons. The size of the world’s market is an excellent indicator that cultivated banana has a very large opportunity and can support far higher production from Thailand.

Although the above-mentioned information reflects the market opportunity of banana production, it fails to elaborate on the market shares and competition in the banana production business, especially the competition among the production units in the northeastern provinces, which is one of the important banana planting areas. According to the data from the Department of Agriculture (Department of Agriculture, 2016, pp. 4-6), the northeastern region was the third largest in the size of cultivation, after the central region (including the eastern and western regions), and the northern region respectively. In terms of yield per rai, it was ranked as the second highest (3.08 tons/rai) and its highest purchase price was 14.99 baht/kg. These effectively mirrored the Northeastern region's potential as a source of banana cultivation. Therefore, the objective

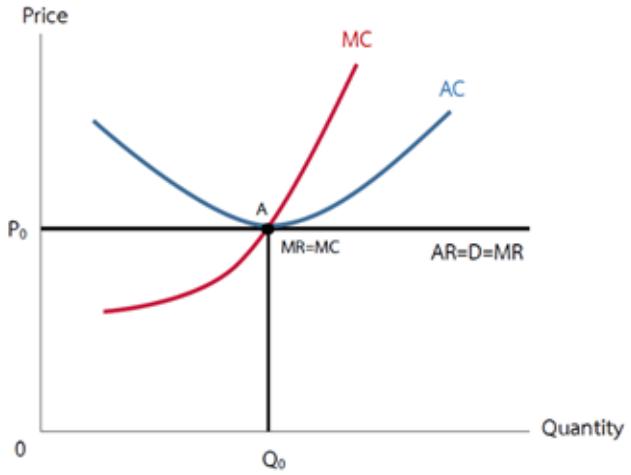
of this research is to analyze the nature of competitiveness in the Northeastern region's banana industry by looking into the ability of mark-up pricing in a concrete way by using the Lerner Index to assess the competitiveness of banana growers. This can be used as part of policy proposal to enable banana growers to adapt to a more efficient and profitable production model amid the competitive markets.

Literature Review

1. Market and Market Power Theories

According to economic theory, market is the interaction between the buyer (demand) and the seller (supply) relevant to pricing and product quantity (Samualson and Nordhaus, 2005, p. 410). Market would be taken place as a physical market, for example, flea market, department store, etc. Also, it can be traded through other channels: mobile phone or internet. The market can be divided into manufacture market and factor market. According to supply chain of cultivated banana, the trading of cultivated banana manufactured in food processing industry took place as a factor market while the trading of its products was taken place in product market.

In attention to market power and competition relevant to quantities and prices, there were different kinds of market competition. Based on perfectly competitive market, the outstanding aspects referred to that the manufacturers did not have power in pricing which can be called as the price taker. They were considered as a small manufacturer with smaller power productivity compared to whole industry. Consequently, the manufacturers had to agree with the market price. For example, rice export market cannot limit their own price, the price was based on world's market. According to Picture No. 1, the price taker which presented as the demand was parallel with the horizontal axis. This can be implied that the price P_0 was a market price. At this rate, the manufacturers can unlimitedly sell their products. When the price was higher than P_0, the sales rate would be equal to zero. A lower price than P0 would not exist because it is unnecessary to decrease the price since the market price (P_0) provided unlimited trading. In addition, if the demand was parallel with the horizontal axis, it indicated that the marginal revenue (MR) and average revenue (AR) were the same line as the demand which the manufacturer reached. For instance, if P_0 was equal to 10 baht, the seller will get 100 baht when they sold 10 units. The average revenue was 100/10 or 10 baht. When they sold 11 units, the revenue would be increased 10 baht, from 100 baht to 110 baht. Thus, the demand was equal to average revenue and marginal revenue.

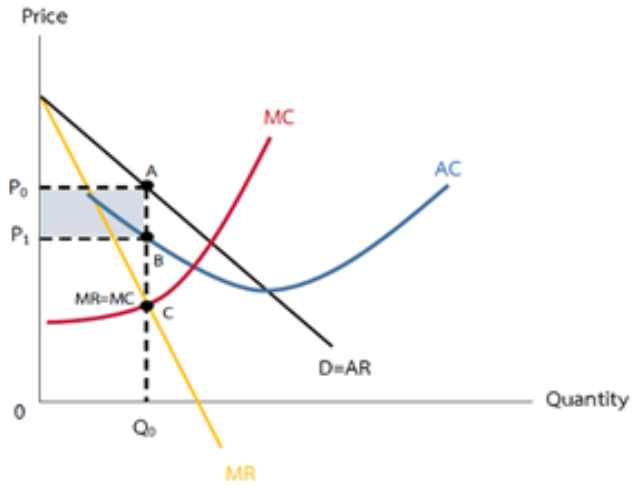


Picture No. 1 The pricing of each manufacturer in the perfect competition market

If the manufacturers cannot limit the price at perfectly competitive market, the productivities were the alternatives to reach higher profit under the conditions that marginal revenue and marginal cost (MC) should be equal, i.e. the same amount productivity of Q_0. This model was significantly revealed that the conditions of perfectly competitive market influenced mark-up pricing of the manufacturers as P_0 was equal to the marginal cost. Also the manufacturers tended to gain long-term normal profit where average revenue (AR) was equal to average cost (AC).

On the other hand, the manufacturers of the imperfect competitive market, i.e. monopoly market, monopolistic market and oligopoly market, had power in pricing. According to Picture No. 2, it revealed that the manufacturers of imperfect competitive market reached the demand lines at the slope from the left to the right; therefore, the line of AR and MR were separated. The highest profit remained the same at MR = MC, at C, while the price was, limited relied on the demand line at P_0. This indicated that the price at P_0 influenced the market power of the manufacturers in relations to mark-up pricing. This can be implied that the price was higher than the marginal cost; A was higher than C. Also, the manufacturers tended to gain higher profit than usual as shown in square area, P_0ABP_1.

The economist provided the index for market power measurement to measure the competition of market structure, Herfindahl index (H), initiated by Orris C. Herfindahl (1950) [3]. H index was developed for concentration ratio by combining market share of all manufacturers. For example, there were n manufacturers in the market, the market share of the i manufacturers was S_1; therefore, the H index included market share of all manufacturers as squared as follows. [1]Normal profit is where the economic profit is equal to zero. However, even though the economic profit is equal to zero, the accounting profit does not mean to be equal to zero since the economic cost is higher than the accounting cost. The accounting cost includes the opportunity cost. [2] Besides Orris C. Herfindahl, Hirschman (1945) also initiated similar index. This index can be called as Herfindahl-Hirschman index (HHI)



Picture No. 2 The pricing of manufacturers in the imperfect competition market

$$H = S_1^2 + S_2^2 + S_3^2 + ... + S_n^2$$

From the above formula, if there is only one manufacturer in the market, the market share of this manufacturer is equal to 1 as follows:

$$H = (1)^2 = 1$$

If there are n manufacturers who share the market equally, then it can be calculated as follows:

$$H = (1/n)^2 + (1/n)^2 + ...+ (1/n)^2$$
$$= n(1/n)$$
$$= 1/n$$

From the above formula, we can analyse that if n is high, it means that no one has market share over others. It shows that the industry is close to the perfect competitive market. In this case, H approaches 0. Conversely, if the n value is low, it will make the H value high which shows that the industry has a high degree of monopoly or has few producers.

Using the H index has the advantage of being able to identify structural competitive situations, but there is also a point of neglect because it does not consider the profitability of "individual" manufacturers, which is another important factor that measures how competitive the market is. It also shows the profitable nature of the key players in the market, particularly among the growers of cultivated bananas. Their competitive abilities may be different depending on cost management and the inclusion of profits in price. Therefore, this research proposed a method for measuring competitive conditions with the Lerner index (L), invented by Abba Lerner (1934) by considering the manufacturer's ability to set the price higher than the marginal cost as follows:

$$L_{i,t} = (p_{i,t} - mc_{i,t})/p_{i,t} \quad \text{----- (1)}$$

by $L_{i,t}$ is the Lerner index of the industry i at the time t

$P_{i,t}$ is the price level of the industry i at the time t

$mc_{i,t}$ is the marginal cost of the industry i at the time t

The value of estimated Lerner index is in the range $0 \leq$ Lerner index ≤ 1. If the Lerner index approaches 0, the industry is highly competitive. However, if it is closer to 1, it indicates that there is a tendency towards monopoly. For example, if the Lerner index is 0.09, it means that the industry is highly

competitive, close to the perfect competitive market, or if the Lerner index is 0.9, it means that the industry has a high monopoly tendency. Moreover, there are two benefits of the Lerner index estimation for this research project. Firstly, it gives an idea of the overall level of competition among banana producers in the Northeast. And, secondly, it postulates the ability of making the mark-up price of each manufacturer. This is helpful in segmenting producers to determine what conditions make them more or less competitive. However, this study measures the level of competition through the ability of profitability at a given moment in the questionnaire design. This makes it impossible to examine trends in the changes of competition levels resulting from changes in time-related variables, such as information, tastes and regulations.

2. Related Literature

A review of past papers can divide research on cultivated bananas into two main groups: (1) the science-technology group on physical properties testing of cultivated bananas and research to develop products derived from cultivated bananas' yields, peels, etc.; and (2) the research that analyzes economic dimensions related to the cost, distribution and production structure of the banana market.

Research in the scope of the first group, such as Kongthong and Yuenyongsawat (1994, pp.1-13), investigating the properties of polysaccharide extracts from banana peels, and Tongchom, et al. (2016, p. 1) studied the antioxidants and phenolic compounds from all five banana species (including cultivated bananas). Moreover, some works were applied to product development. For example, the study led by Pojpimol, et al. (2010, pp.70-81) that developed fried banana chips by using caramel formulations together with consumer ratings on form, taste, smell, and color. Besides, Hutakowit, et al. (2010, p.1-40) developed a breakfast product made from cultivated banana flour by using a single screw extruder (to make it look like a breakfast in a form of grain or cereal), and the study led by Kanaenok (2013, pp.1-30) developed tea derived from banana peels. It was found that the samples accepted the banana tea supplemented with lemongrass and the standard formula the most. In addition, the work of Suthanukul's (2015, pp.24-29) described the need of creating more alternatives for using banana flour in various processed products.

It can be noted that the above research has neglected the economic aspect significantly. The research in the second group was also taken into account the economic issues, such as Boonchouy (2017, pp. 1884-1994) who outlined the costs and income from growing cultivated bananas. The research led by Woldie and Nuppenau (2009, p. 493-505) and Komrek (2010, pp. 775-784) also focused on marketing channels. The study was carried out on various variables (price, bargaining costs, distance, etc.) that resulted in greater participation of growers in commercial activities. However, the aforementioned research lacked an assessment of the level of competition in the banana industry. More comprehensive research on competitive issues was led by Enibe, et. al. (2008, pp. 32-40), which studied the structure of the banana market in Nigeria. The Gini coefficient was applied to

calculate the concentration of banana males as a structural measure of the level of competition. However, this study lacked consideration of a measure of the level of non-structural competition, such as the ability to add profits to the manufacturer's price.

Therefore, this research project filled the research gap by using a logarithmic total cost function model or Translog cost function to estimate the marginal costs to be calculated as the Lerner index. This method allowed us to assess the competitive situation of the cultivated banana industry in a concrete manner and know the ability of each manufacturer to add profits into the price as well which was very interesting. Thus, it was considered as a pioneering new method for measuring the level of competition in the industry of cultivated banana growers.

Methods

The details were divided into 3 sections. The first section described the definition of population and sample groups. The second section was to present a questionnaire to collect data on price, yield and cost from the planting process of cultivated bananas. The last section showed the model involved in calculating the Lerner index, including research hypotheses. The details were as follows.

1. Population and sample

This research determined that the population was cultivated banana farmers in Sangkhom District, Nong Khai Province. The samples were banana farmers in Ban Muang and Ban Wang Mon communities, Ban Muang Sub-district, Sangkhom District, Nong Khai Province with a purposive sampling method (not probabilistic). The process of defining the samples began with an overview study of where the Cultivated banana were planted in the Northeastern region. The result showed that there were 3 provinces that were the main planting areas, namely Nakhon Ratchasima, Nong Khai and Loei. The researcher then attended a forum organized by Cultivated banana farmers in Pak Chong District, Nakhon Ratchasima to observe and collect information about cultivated banana planting process from farmers. Therefore, it was found that the important condition was that the Cultivated banana planting area should not be more than 200 kilometers from the market in order to remain intact. Almost all of the banana plantations in Pak Chong were sent to Bangkok and metropolitan areas. From this condition, it could be deduced that the produce of bananas in the Northeast must come from two main planting areas, Nong Khai and Loei provinces.

In Nong Khai and Loei provinces, it was found that most of the cultivated banana planting areas were in Sangkhom and Pak Chom districts, respectively, which both districts have adjoining boundaries and have similar geography. The area is mostly mountains and forests. Some parts are plains next to the Mekong River, causing the soil in the area to be sandy loam, making banana cultivation produce quite good results. However, the difference between these two districts is Sangkhom district has a clear policy to continuously promote the cultivation and processing of bananas. From the investigation, it was discovered that the district's main OTOP products were processed bananas, such as dried bananas, banana chips, and fried

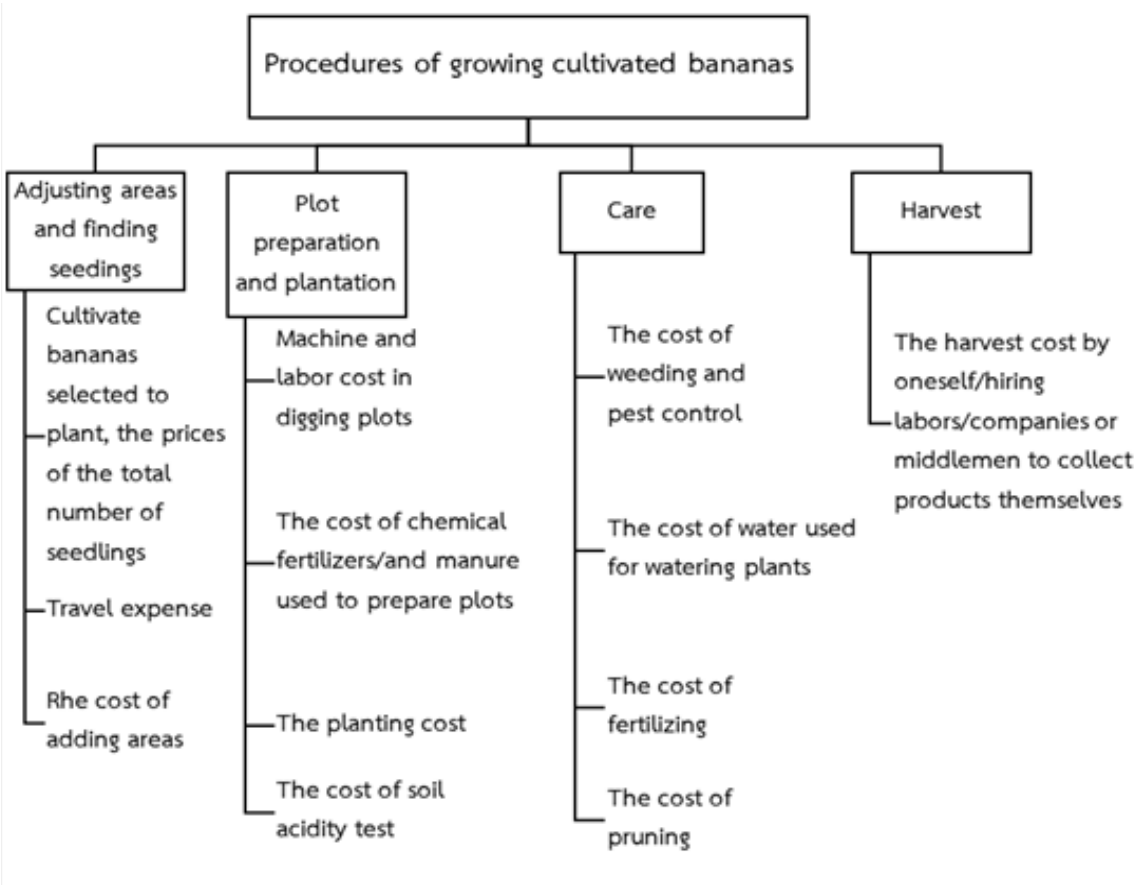
banana, reflecting the economic activities that occurred and creating a variety of products from bananas.

Therefore, the population of this study was a group of banana farmers in Sangkhom District Nong Khai Province, however, the researcher might not know the real number of this population. Therefore, a specific randomization was performed by contacting the agricultural district for more information on where in the district was popular for growing bananas. In this study, the researcher defined the sample selection data that the sample should come from a variety of size of the area used for cultivation, i.e. small (less than 5 rai), medium (more than 5 rai but not more than 15 rai) and large sizes (more than 15 rai). Under this condition, the researcher was advised to collect data from the Cultivated banana farmers from the sample group. The samples were 48 Cultivated banana farmers in Ban Muang (24) and Ban Wang Mon (24) communities in Sangkhom District, Nong Khai Province.

2. Questionnaire and information

To create a questionnaire, the researcher started by interviewing and having a group discussion with experts. It was revealed that the process of planting the Cultivated banana in one planting cycle could be divided into (1) area adjustment and cultivating seedlings, (2) the process of plot preparation and planting (3) maintenance process (4) harvesting process. Picture No. 3 showed the steps and details of activities in banana cultivation. The questionnaire used for collecting data was designed in accordance with the details of this planting by asking about the inputs used and the costs incurred by using the inputs in different steps.

The information obtained will be structured in accordance with the Translog cost function to shows the costs incurred by all three types of planting activities: pre-harvest wages (w_1) incurred in stages 1-3, harvesting cost (w_2) incurred in stages 4, and capital expenditures (w_3) which are the purchase of seeds, rental of machinery (excavators), purchase of fertilizers and pesticides, etc., which can occur throughout the production process. Details of cost variables and their calculations are shown in the following sections.



Picture No. 3 Procedures and activities for growing cultivated bananas

3. The model used in the analysis

This section shows the steps for calculating the Lerner index in order to assess the level of competition (market power) of the cultivated banana market in Ban Muang and Ban Wang Mon Communities, Ban Muang Sub-district, Sangkhom District, Nong Khai Province. However, there are 3 steps for evaluating of the index. The first step is to estimate the equation of the total cost. The second step is to calculate the marginal cost (mc), and the last step is to calculate the Lerner index for each farmer from the sample group. The details are as follows.

3.1 The Translog cost function model

The present study applied the logarithmic total cost function (Fungacova, et al., 2014, p. 358). Total cost is defined as a function of the cost of three inputs (pre-harvest labor cost, harvest labor cost, and labor cost). The reason why this study used the Translog cost function model because the nature of the function was consistent with the cost type of farmers who grow cultivated bananas. The aforementioned functions can be written clearly in a simulated form as follows:

$$\ln(C_i) = \alpha + \beta_1 \ln(q_i) + (\beta_2/2)(\ln(q_i))^2 + \sum_{k=1}^{3} \Phi_k \ln(w_{ki}) + \sum_{k=1}^{3} \gamma_k \ln(q_i)\ln(w_{ki}) + (1/2)\sum_{k=1}^{3} \delta_{kk}(\ln(w_{ki}))^2 + \delta_{12}\ln(w_{1i})\ln(w_{2i}) + \delta_{13}\ln(w_{1i})\ln(w_{3i}) + \delta_{23}\ln(w_{2i})\ln(w_{3i}) + \varepsilon_i \quad \text{---- (2)}$$

by i = Farmers who responded to the questionnaire (purposive sampling)

C = total cost per year

q = yield (number of combs per year)

w_1 = The pre-harvest labor cost per year / The number of combs per year

= The pre-harvest labor cost per comb

w_2 = The harvest labor cost per year / The number of combs per year

= The harvest labor cost per comb

w_3 = The capital cost per year / The number of combs per year

= The capital expenditure per comb

ε = error

After that, the model was estimated using the least ordinary least square together with the cross-sectional data obtained from the questionnaire along with checking the properties of the model on the variance of the error values if they're stable or not and the relationships between the error values and the observations were related or not. However, the estimation in the model used both independent variables a lot or used independent variables in the form of the interact term, so more observations are required to make the estimation of the Translog cost function reliable. However, this study used only 40 samples, which was considered reliable to some extent.

3.2 The Marginal Cost Equation

After estimating the total cost equation next step is to apply the estimated coefficients β_1, β_2, γ_1, γ_2 and γ_3 to be calculated in conjunction with the total cost data (C_i) and yield (q_i) obtained from each farmer who responded to the questionnaire to find to the marginal cost (mci) of each farmer as follows:

$$mc_i = (c_i/q_i)[\beta_1 + \beta_2 \ln(q_i) + \sum_{(k=1)}^{3} \gamma_k \ln(w_{ki})] \quad \text{--- (3)}$$

3.3 The Calculation of the Lerner Index

In the final step, the marginal cost (mci) obtained from step 3.3 together with the yield price (pi) or purchase price per comb (baht per comb) of each farmer who responded to the questionnaire is calculated for values of the Lerner Index.

$$\text{Lerner index}_i = (p_i - mc_i)/p_i \quad \text{---- (4)}$$

The Lerner index (L) has a probability value from zero to one. It means that in case L = 0, it implies that the price equals the marginal cost. Manufacturers cannot add profits to the price. Therefore, the market manifests a perfect competitive form, but in the case of L = 1, it implies that the producer is a monopolist, or 0 < L < 1 reflects that the market is considered as a monopolistic competition market.

This study hypothesizes that the cultivation for selling cultivated banana products of Ban Muang and Wang Mon community would incline towards a monopolistic competition. The index value should be less than 0.5, which indicates the relative degree of competition. A rationale behind this hypothesis is that the yield characteristics of each grower are the same, but the abilities to add different prices were different due to the variability of ability to manage costs of each grower.

Results

The results were divided into two parts which are general information and results. The details are as follows.

1. General information

This section reveals the cost structure and marginal cost of cultivated banana (Nam Wha Banana) for sell of Baan Muang and Baan Wang Mon communities, Baan Muang Sub-District, Sang Khom District, Nong Khai Province. The original number of question-

naires was 48, but there were incomplete 8 questionnaires, 3 questionnaires of the farmers from Baan Muang Community and 5 questionnaires of the farmers from Baan Wang Mon Community. Thus, the study proceeded the analysis by using only 40 legitimated questionnaires.

The participants were 6 male farmers and 34 female farmers, 15 and 85 percent respectively. Most of them were 50-65 years old. According to table No. 1, the participants of Baan Muang and Baan Wang Mon have similar experience in cultivated banana plantation, approximately 20 years. The plantation areas of both communities were 12 rai in average. However, the plantation circulation of both communities were different, from the preparation stage till dismantling for replanting. The farmers of Baan Muang Community spent about 7 years of 1 cycle plantation which was shorter than the cycle plantation of the farmers from Baan Wang Mon, about the average of 11 years.

Table No .1 The basic information on growing cultivated bananas

	Ban Muang	Ban Wang Mon	Total
A period of time for planted bananas (year)	19.19	20.03	19.59
A period of time for a planting cycle (year)	7.14	11.08	9.01
Planting area (rai)	11.19	13.53	12.30

Source: From the researcher's calculation

Table No. 2 The basic statistics of variables: the cost structure, prices and products

	Total Cost (C)	The pre-harvest labor cost per comb (W1)	The labor cost per comb (W2)	The capital expenditure per comb (W3)	Purchase price per comb (P)	The comb numbers of products per year (q)
Mean	24,339	1.92	1.77	1.29	6.80	7,418
Highest Value	63,870	8.08	9.00	8.02	10.00	31,200
Lowest Value	5,000	0.09	0.10	0.01	4.00	1,200
S.D.	1,5748	1.90	1.79	1.70	1.45	6,218
Numbers of Data	40	40	40	40	40	40

Source: From the researcher's calculation

Table No. 2 presents significant cost variation of 40 participants. It reveals that the farmers gained the average total cost of 24,339 baht per year, the average total cost per bunch was 4.98 (W1 + W2 + W3). Most costs were from the wage before harvest, e.g. excavation, plantation and pruning with the average cost of 1.92 baht per bunch. The wage for harvesting was 1.77 baht per bunch while the costs, i.e. seed, fertilizer and insecticide, were 1.29 baht per bunch in average. In addition, the products per bunch were 7,418 per year. The average buying market price was 6.8 baht per bunch. The data possibly covered all plantation areas, 2-20 rai. It is possible that the farmers would limit the cost with different levels relied on the highest value and the lowest value of cost variation at the most different level. The standard deviation was consequently different.

According to table No. 3, the data presents the coefficient estimation of the Translog total cost function (Equation 2). The coefficient β_1 β_2 γ_1 γ_2 and γ_3 were combined with the cost (C) and products of each farmer (q) to find the marginal cost as shown in the 3rd equation. The estimation of the Translog total cost function had proved the error properties and found that there was no variance of heteroscedaticity. Also, the autocorrelation of confident level was at the percentage of 99.

Nevertheless, some independent variables did not statistically significant at the level of confidence 95 per cent (β_2 γ_1 and γ_2). In case that β_2 can indicate the relations between the total cost and products as linear cost function than quadratic cost function. This can be implied that the products and cost were not relevant in diminishing returns; the reason might be caused by the number of participants. The participants were small numbers, 40 participants. It was insufficient to find the relations of products and cost as quadratic cost function. In addition, the value of γ_1 γ_2 was not statistically significant which was relevant to the fact that the wage before harvest and the wage cost provided similar number among the farmers. However, there were the differences of cost among these two groups.

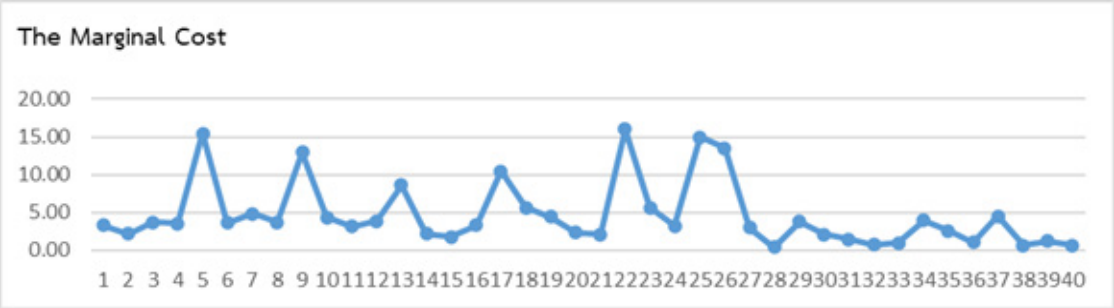
Table No. 3 The coefficient estimation of the Translog cost function

Independent Variables	The Estimated Coefficent	The Standard Deviation
Constants	α = 1.627	1.771
ln (q)	β_1 = 0.860**	0.406
$(\ln(q))^2$	β_2 = 0.018	0.023
$\ln(w_1)$	Φ_1 = 0.176	0.126
$\ln(w_2)$	Φ_2 = 0.564**	0.210
$\ln(w_3)$	Φ_3 = 0.085	0.122
$\ln(q)\cdot\ln(w_1)$	γ_1 = 0.021	0.015
$\ln(q)\cdot\ln(w_2)$	γ_2 = - 0.025	0.024
$\ln(q)\cdot\ln(w_3)$	γ_3 = 0.025*	0.014
$(\ln(w_1))^2$	δ_{11} = 0.102***	0.007
$(\ln(w_2))^2$	δ_{22} = 0.097***	0.009
$(\ln(w_3))^2$	δ_{33} = 0.064***	0.007
$\ln(w_1)\cdot\ln(w2)$	δ_{12} = -0.129***	0.012
$\ln(w_1)\cdot\ln(w_3)$	δ_{13} = -0.062***	0.011
$\ln(w_2)\cdot\ln(w_3)$	δ_{23} = - 0.064***	0.008
The Adjusted R-squared = 0.998		
Akaike info criterion (AIC) = -4.2656 Schwarz criterion (SC) = -3.6323		
LM test = 3.2414 (P-values = 0.0575 White test = (P-value =0.0406)		

Source: From the researcher's calculation

** and * There were statistically significant at the confidence levels of 95% and 90% respectively.

Picture No. 4 presents that most of the participants gained the marginal cost between 1.5 and 4.5; the farmers gained a higher marginal cost about 1.5-4.5 baht for 1 bunch of banana. Only 7 farmers, farmer 5, 9, 13, 17, 22, 25 and 26, gained very high marginal cost. This was influenced by some expenses related to cost and wage which were higher than the other farmers. For example, high marginal costs were from chemicals or biological materials for controlling pests. Also, the wage for pruning to protect epidemic or produce higher productivity. The costs were different partly caused by the demand for different products, the costs were varied. The participants also indicated that there were sufficient soil, weather and rain. The plants can be grown without fertilization. Only trimming was needed. The plantation was different among each farmer.



Picture No. 4 The marginal cost of each farmer who answered the questionnaire
Source: From the researcher's calculation

2. The Main Results

This section begins with presenting the results of calculating the Lerner index of each farmer out of a total of 40. Considering from picture No. 5, it shows that each farmer had different Lerner index values. The values of some farmers were different from the theory (theoretically the Lerner index ranges from 0 to 1), but most were between 0 and 0.5, which can be interpreted economically that the majority of farmers' groups dominated the market power in the form of monopolistic competition market. In addition, when analyzing the areas of Tambon Ban Muang (Picture No. 5, No. 1-21) and Ban Wang Mon Sub-district (Picture No. 5, No. 22-40), it was found that Ban Muang had a higher competitive level of producing bananas than Ban Wang Mon because the Lerner index of banana farmers in Ban Muang community is lower than 0.5, while the Lerner index of Ban Wong Mon is higher than 0.5. In other words, because of the high competitive level of banana production in Ban Muang community comparatively, the ability to set prices above the mark-up pricing, also known as the "adding profits into the price" of Ban Muang community, was less than that of Ban Wang Mon by comparison.

However, from Table No. 4, if considering the overall picture of the 2 villages, it demonstrates that the average Lerner index of all 40 farmers was 0.31, or it could be interpreted that the production of cultivated bananas in these 2 communities reflected the level of competition as a monopolistic competition by dominating the market power (can add profits into the price). However, if considering only the groups of farmers who can make a profit or can set a selling price higher than the marginal cost (the Lerner index is higher than zero), it was found that the number of entrepreneurs reached 30, while the remaining 10 entrepreneurs will not be able to make a profit because the Lerner index is negative (the marginal cost is higher than the selling price) for two main reasons. The first reason was that these groups of farmers used their own labors or invited neighbors to help in preparing the planting area, digging the plot, planting and weeding, including pruning the banana trees, which was a pre-harvest task of the banana products, but they did not pay for their own wages (or paying meals as compensation for neighbors who came to help instead). Therefore, the researcher estimated the wages for collecting questionnaires from them for 300 baht per day. This was why the higher costs affected the

farmer that led to the increase of the marginal cost which was more than the selling price. The second reason was that these farmers had another income from selling banana leaves which can be cut and sold as daily income. However, this research didn't include this income, but only the dominance of the market power for selling bananas was considered (the cost used for planting banana trees until ready to cut the leaves for sale cannot be separated from the cost used for planting and selling the cultivated banana's bunches.

Picture No. 5 The Lerner index of each farmer who answered the questionnaire
Source: From the researcher's calculation

Table No. 4 The results of the Lerner index's means, divided by the farmer groups who answered all questionnaires, the farmer groups who answered profitable questionnaires and the farmer groups who responded to unprofitable questionnaires

	All entrepreneurs	The entrepreneurs who make profits	The entrepreneurs who suffered a loss
Lerner index (mean)	0.31	0.61	-0.58
The numbers of data (Observations)	40	30	10

Source: From the researcher's calculation

Conclusion and Discussion

The objective of this study is to measure the competitiveness of cultivated banana farmers in Baan Muang Village and Baan Wang Mon Village in Sangkhom District, Nong Khai Province. The competitive level was evaluated by Lerner index, which measured the mark-up pricing abilities, or in other words, the Market Power. The Lerner Index was used in non-structural model to measure the competitiveness of each farmer for market power or mark-up pricing abilities. Previously, the Lerner Index was widely used in structural model to see the concentration ratio or Herfindahl-Hirschman index, which was unable to see the market mechanism.

The target group for this study are Baan Muang Village and Baan Wang Mon Village. The

sample size is 40 cultivated banana farmers. The method of purposive sampling was used to see the difference in farm size and farming experience of each individual farmer (which is a good representation of population). The study showed that the market competition of Cultivated banana farming in Baan Muang Village (Baan Muang Village and Baan Wang Mon Village were randomly picked as a target group) was monopolistic market, which was more perfectly competitive market than monopoly market. It reflected the reality of the livelihood of the farmers. The farmers were still able to do mark-up pricing under different marginal cost. Furthermore, the farmers in Baan Wang Mon Village had comparatively less competitiveness level in producing Cultivated banana than the farmers in Baan Muang Village.

Nonetheless, taking a closer look to the study, it showed that some farmers earned no economical profit from producing banana. It was because in one farming cycle (which includes land levelling and finding sapling, land preparation and plantation, fertilizing and crop protection and harvesting), there would be labor cost, which was a significant cost (e.g. fertilizer and digging machine). However, the farmers did not hire workers, they did it by themselves or with the help of the neighbors (who only worked for food). The labor cost was not included in the production cost, which made the cost cheaper than it actually was. (the total cost was too low) Also, some farmers aimed to generate income from selling banana leaves more than selling banana fruit. They neglected the loss in selling Cultivated banana as long as they could earn some profit from selling banana leaves. However, the study tried to measure the economic competitiveness level, so the opportunity cost and the labor cost were included to see the reality in the market competition.

The study led to a discussion, which brought out two suggestions. The first one is the District Agricultural Office should give an advice to farmers to do cost accounting (which includes financial and opportunity cost of labor) to make the farmers understand the true total cost. Second, the study showed that the farmers did not have much market power from producing cultivated banana and they could not set the price much higher than the marginal cost. Also, the farmers were the one who accepted the price for cultivated banana production. Therefore, to increase the market power and profit making abilities for the farmers, the District Agricultural Office or people in charge of the cultivated banana market in Baan Muang Village and Baan Wang Mon Village, Sangkhom District, should give an advice in how to make money out of banana planting, not only selling the fruit such as turning the fruit into food products or setting up a group of local farmers to sell other parts of banana and finding the buyer for that.

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