

An analysis of impact of collaboration affecting profit in agricultural supply chains in Chiang Mai province: A case study on producers and wholesalers

Napat Boonprasert and Anuphak Saosaovaphak

Faculty of Economics, Chiang Mai University

Abstract

An analysis of impact of collaboration affecting profit in agricultural supply chains in Chiang Mai Province: A case study on producers and wholesalers; an analysis on how bargaining power, trust, and damage mitigation or problem solving skill scan impact on the supply chain. In this research, the data collected by questionnaire from 2 sampling target groups, namely agricultural producers, and a group of agricultural product wholesaler in Chiang Mai Province, a total number of 350 individuals interviewed. The study was performed during July and August 2014. Later on, the Multi-Level Analysis had been employed to process the data. Result shown that Trust and Damage Mitigation or Problem Solving Skills on the Wholesalers' part proves to be a major factor affecting decision making on collaboration between agriculture producers and wholesalers. On the other hands, Bargaining Power, Power enforcement, Damage Mitigation or Problem Solving Skills, and Features of Farmers seen less degrees of effect on such decision. The information from this research could be applies as a guideline to improve cooperation between stakeholders in the supply chain, i.e., producers and wholesalers at all levels, and leads to improved business advantage and agro-business competitiveness. Moreover, the government bodies could realize tangible channel of support through its policies and activities for sustainable development in supply chain of agricultural products in Chiang Mai province.

Keywords: Collaboration, agriculture, supply chain, producer, wholesaler

1. Introduction

Thailand is an important agricultural country that has the terrain and the climate favorable for cultivation throughout the year. Thailand contains the total area of 320.6 million Rais¹, the area of use was distributed into 3 main sections, forest area, area of agricultural, and the area without agricultural activity. By the year of 2013, area of agricultural was counted the most part of the country which is 151.9 million Rais or 47.31 percent of the country [1]. The details of agricultural land use are as follows:

Table 1. Agricultural land use

Agricultural land use	Area (Rais)	Percentage
Residence	3,716,591	2.72
Rice field	71,652,930	49.74
Dry crops	35,096,001	21.37
Perennial crops	34,621,093	21.35
Vegetables and flowers	1,522,788	0.85
Pasture	999,839	0.74
Abandon Area	1,577,441	1.38
Lands of any other cultivation	2,736,236	1.86
Total	151,922,919	100.00

Source: Department of Agriculture Extension (2012)

From the used of agricultural land, according to the data, Thailand has a great potential in producing agricultural products to generate income for the farmers and the country [2]. The total export values of agricultural products are as follow:

TABLE 2. The export values of agricultural products from year 2004 to 2013

Year	The export values
2547	664,490.70
2548	691,360.50
2549	805,444.80
2550	850,816.50
2551	1,054,073.70
2552	964,945.00
2553	1,135,749.50
2554	1,444,994.40
2555	1,341,821.20
2556	1,268,351.60

Source: Office of Agricultural Economics (2013)

The agricultural land use is varying among each region of the country depending on the terrain, climate, and shape [3]. In the northern part hold the most in agricultural land use account for 27.2 million Rais and was distributed to over 1.3 million farmers. Chiang Mai is a province that holds the second most in agricultural land use of the northern part of Thailand which accounted for 1,835,425 Rais and the total farmers of 164,521. Chiang Mai has the terrain, the climate, and infrastructure favorable for cultivation. Also Chiang Mai is a center of commerce and modern industry; as a result, the business in agricultural expanded and highly competitive. Hence, an agricultural producer or a supply chain of agricultural products should collaborate with farmers

¹ Rai is a common measure of area for Thailand. 1 Rai is approximately equals to 0.3953 Acre.

and wholesalers. In order to develop the potential within the supply chain, as a result, contribute profits, sustainability, and to respond to consumer and competition of the marketplace.

Thus, this research aimed at focusing on the factors that influence the decision to collaborate between agricultural producer and wholesaler along with the supporting policies from the government in order to develop a potential of agricultural products of Chiang Mai.

2. Literature review

From the review of the literature and related research which shows that the supply chain refers to all links of the production units and any other agencies together by using the systems and resources applied to achieve manufacturing and distribution. Later on it has created the circulate cash flow [4]. The efficient in management of supply chain require a good relative strategy such as sourcing, procurement, conversion, and logistics management. In addition, coordination with suppliers, wholesalers, third - party and partners are also included in a good strategy. In doing so leads to a development in manufacturing, the competitiveness and sustainable growth in the supply chain [5].

Because of highly competitive world, a successful business required a good management to bring the highest profit. Every business sectors tend to reduce costs especially in variable cost. However, cost reductions alone are not sufficient for agricultural business since agricultural products has several limitations. And the agricultural products pass through many manufacturers and wholesalers before it reaches the consumer. Hence, to creating cost competitiveness for agricultural products may cause a cooperation or collaboration among trading partners in the supply chain to lower the cost and the risk of the business [6].

The collaboration consists of 3 main factors, power, trust, and exception handling [7]. The power may refer to the right to control over the operations of the business and mostly applied to producer [8]. The trust means confidence, faith, trustworthy and believe in particular person or organization [9]. For business sector, trust is often applied to wholesalers because wholesale is an activity that require trust from trade partners [8]. The last factor is exception handling which means to control and resolve the uncommon that occurred in the supply chain. This is the situation that always happened in doing business and often resulting in an unpleasant outcome, later on, have a negative impact to business [10]. In the supply chain, exception handling is an important factor for both producers and wholesalers because, in doing business, a good exception handling always leads to a better and sufficient outcome [8].

3. Data

The instrument used for data collection was a questionnaire, collected from 2 samplings, producers and wholesalers of agricultural products in Chiang Mai. The populations were uncertain, thus, the formula of WG Cochran (1977) is required:

$$n = \frac{z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

Where

n is number of sampling

p is proportion of population

Z is level of satisfaction

d is acceptable error rate

In this research, the proportion of population was set to equal to 0.35 at a confidence level of 95 percent, and the acceptable error rate is no more than 5 percent which equals 1.96 at a confidence level of 95 percent. Hence, the samplings estimated are as follow:

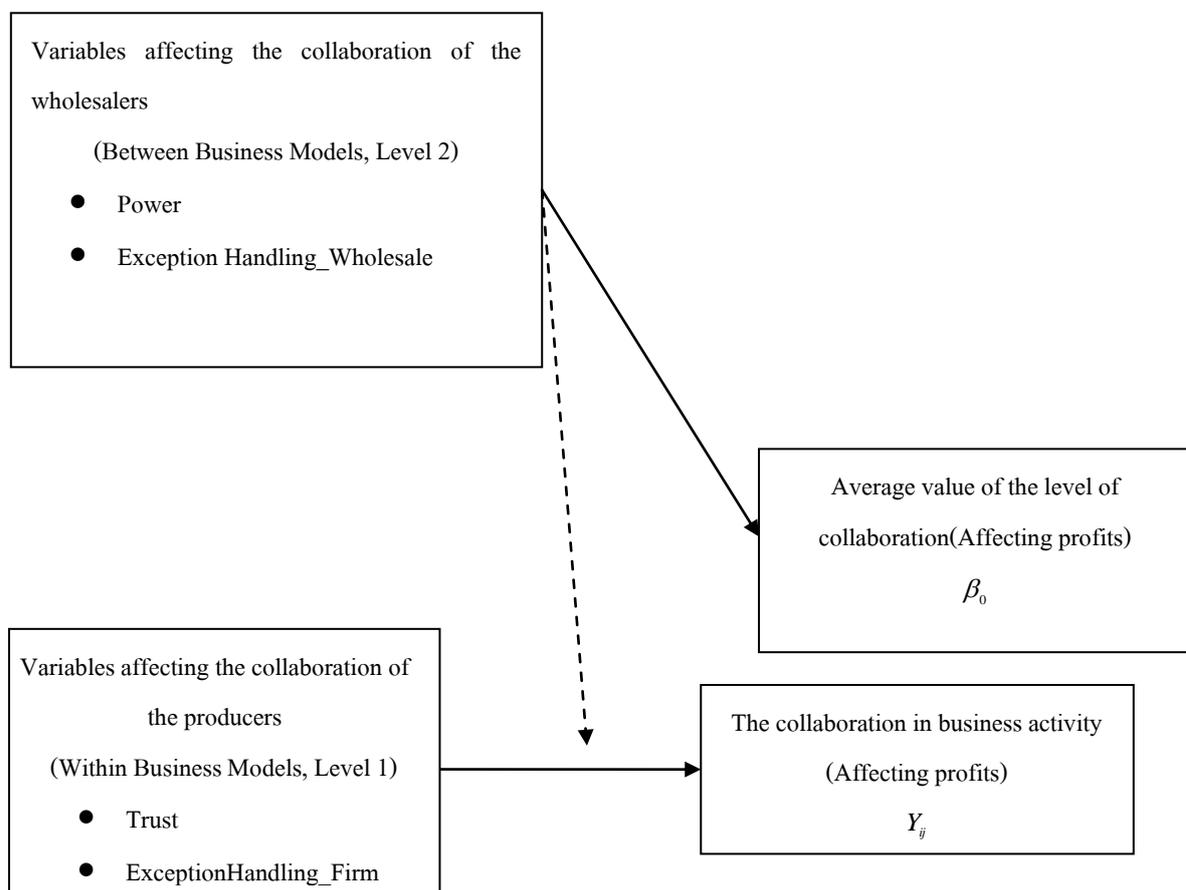
$$n = \frac{(1.96)^2 (0.35)(1 - 0.35)}{0.05^2}$$

$$= 349.44 \approx 350 \text{ people}$$

For the acceptable number of samplings, the estimated sampling was adjusted to equal 350.

4. Methodology

The analysis of this research can be analyzed using the methods as shown below; Frameworks and models used in this research Frameworks and models used in the study of impact of collaboration affecting on profit in agricultural supply chains in Chiang Mai province: a case study between producers and wholesalers. By using the method of Multi-Level Analysis which is based on the hypothesis that said the collaboration would bring more profits in the supply chain of agricultural products. The conceptual frameworks of this hypothesis are as follow;



Source: Data collection

Figure 1. Data analysis framework

From the framework above, it shows the study of the impact of variables on collaboration between agricultural producers and wholesalers, in doing so, the variables did affect the average value of the level of collaboration and business activity. The independent variables included Power, Trust, and Exception handling. The dependent variable is collaboration in business activity which affects the profits.

From the data collected from agricultural producers and wholesalers by questionnaire, and transform basic information into statistic data using SPSS. Then, analyze the statistic data using Multi-Level Analysis by HLM7. The totals of 3 steps are as follow:

1) Multi-level Analysis model with fully unconditional models or null model is a multi-level analysis with only dependent variable, and no predictor variable at any level.

Level 1 Within-Business Models

$$Y_{ij} = B0 + r$$

Level 2 Between – Business Models

$$B0 = G00 + U0$$

The value from the calculation can be used to calculate the intra-class correlation coefficient (ρ) in order to obtain internal variance (Y_{ij}) (the variable that created collaboration in business activity) and in between the level of producer.

The hypothesis are as follow

Ho: The sum of the variance is minimal

H1: The sum of the variance is utmost

$$\rho = \frac{Var(u_{0j})}{Var(u_{0j}) + Var(r_{ij})}$$

$$\rho = \frac{\tau_{00}}{\tau_{00} + \sigma^2}$$

2) Multi-level Analysis with unconditional models or simple mode is a multi-level analysis with dependent variable, and predictor variable at level 1 only

Level 1 Within - Business Models

$$Y_{ij} = B0 + B1(TRUST_FA) + B2(EXCEP_FA) + r$$

Level 2 Between - Business Models

$$B0 = G00 + U0$$

$$B1 = G10 + U1$$

$$B2 = G20 + U2$$

3) Multi-level Analysis with hypothetical model is a multi-level analysis with dependent variable, and predictor variable at any level according to the research hypothesis.

Level 1 Within - Business Models

$$Y_{ij} = B0 + B1(TRUST_FARM) + B2(EXCEP_FA) + r$$

Level 2 Between – Business Models

$$B0 = G00 + G01(POWER_HS) + G02(EXCEP_HS) + UO$$

$$B1 = G10 + G11(POWER_HS) + U1$$

$$B2 = G20 + G21(EXCEP_HS) + U2$$

The value from the calculation can be used to obtain the value of coefficient of determination. To show the percentage that the independent variable (X) could interpret the change in dependent variable (Y), the value between 0 -1 and if approach 0 can be interpret that an independent variable is less associate with dependent variable. And the value is approach 1, that is, an independent variable is much associate with dependent variables.

The calculation of R-square (R^2) is shown below:

$$R^2 = \frac{\tau00(Unconditional) - \tau00(Hypothetical)}{\tau00(Unconditional)}$$

The result of the calculation multiplied by 100 to represent a percentage in proportion of variance explained.

5. Results

The results of the research on the analysis of impact of collaboration affecting on profit in agricultural supply chains in Chiang Mai province using Multi-level Analysis are shown below;

5.1 Fully Unconditional Models or Null Model

TABLE 3. an analysis on 2 levels of data using fully unconditional models or null model

Fixed effect	Coefficient	Standard error	t-Ratio	P-value
$G00$ (Average value of business collaboration)	0.459201	0.041416	11.087	0.000
Random effect	Variance Component	df	X^2	P-value
U_{0j} (Partial value apart from business collaboration), (β_{0j})	0.05009	49	120.90472	0.000

Source: Calculation

Note; *** significant level at $\alpha = 0.1$ or 90% in level of confidence, ** significant level at $\alpha = 0.05$ or 95% in level of confidence, * significant level at $\alpha = 0.01$ or 99% in level of confidence

From table 5.1 which show an analysis on 2 levels of data using fully unconditional models or null model, by testing with fixed effect found that the average value of the factors that has an impact on collaboration in supply chain of agricultural products in Chiang Mai is equal to 0.459201 and the dependent variable at cultivator's level also has an impact on supply chain at significant level of 0.01 or 99 percent in level of confidence. And the results from testing with random effect found that the average value of the factors that has an impact on the decisions on collaborate with each other in agricultural business activity in Chiang Mai, there is a variation between business activity at significant level of 0.01 where $t = 11.087$, variance component or tau (τ) is equal to 0.05009 ($X^2 = 120.90472$). Those numbers can be used to calculate the Intra – class correlation coefficient (ρ), the results are as follow:

Intra – class Correlation Coefficient (ρ)

The calculation from Intra – class correlation coefficient (ρ) shows that $\rho=0.185553$ and it is greater than 0.05 (>0.05) which leads to an approval of a hypothesis H0 and rejection of a hypothesis H1. From the hypothesis can be concluded that the variance of the endogenous variables are a lot like in the model and it is less in number.

5.2 Unconditional Models or Simple Model

TABLE 4. an analysis on 2 levels of data using unconditional models

Fixed effect	Coefficient	Standard error	t-Ratio	P-value
<i>G00</i> (average value of business collaboration)	0.458961	0.041385	11.090	0.000
<i>G10</i> (average value of coefficient of trust that has an impact on decision making in collaboration of agricultural business activity of cultivators, β_{1j})	- 0.061508	0.032953	-1.867	0.068
<i>G20</i> (average value of coefficient of wholesalers in exception handling that has an impact on decision making in collaboration of agricultural business activity of cultivators, β_{2j})	0.044202	0.021852	2.023	0.049
Random effect	Variance Component	df	X^2	P-value
U_{0j} (partial value of β_{0j})	0.05027	47	118.43135	0.000
U_{1j} (partial value of β_{1j})	0.00071	47	32.51290	>.500
U_{2j} (partial value of β_{2j})	0.00006	47	31.11330	>.500
Reliability of OLS Regression Coefficient	Estimates			
<i>G00</i>	0.579			
<i>G10</i>	0.006			
<i>G20</i>	0.001			

Source: Calculation

Note: *** significant level at $\alpha = 0.1$ or 90% in level of confidence, ** significant level at $\alpha = 0.05$ or 95% in level of confidence, * significant level at $\alpha = 0.01$ or 99% in level of confidence

From an analysis which shows the results both in fixed effect and random effect but since the certainty of data is required, hence, the results from only the fixed effect is usable in this research. The fixed effect analysis required all of the possible outcomes from an experiment and converted into constant term and it is an analysis without error term, thus, the fixed effect analysis yields a clearer and a more certainty of data than the random effect analysis.

From the table 5.2 which shows the results from unconditional models testing with fixed effect and t-test. In testing hypothesis of within business variable or the 1st level of variable that has an impact on decision making in collaboration of agricultural producers and wholesalers, the hypothesis is show below:

$$H0 : G00 = 0, H1 : G00 \neq 0$$

$$H0 : G10 = 0, H1 : G10 \neq 0$$

$$H0 : G20 = 0, H1 : G20 \neq 0$$

From an analysis shows that the 3 variables used for testing are the factor that has an impact on decision making in collaboration of agricultural producers and wholesalers in Chiang Mai at significant level of 0.01, the details are shown below:

1. G00 or an average value of business collaboration (Intercept β_{0j}) which equals to 0.458961 at significant level of 0.01, that is, the value of this variable is significant since it is unequal to 0.
2. G10 or average value of the slope of trust (β_{1j}) or an average value of trust variables (TRUST_FARM affect to Y_{ij}) is equals to -0.061508 at significant level of 0.01 (unequal to 0), that is, trust has an impact on decision making in collaboration of agricultural producers and wholesalers.
3. G20 or average value of the slope of exception handling (β_{2j}) or an average value of exception handling variables (EXCEPT_FARM affect to Y_{ij}) is equals to 0.0044202 at significant level of 0.01 (unequal to 0), that is, exception handling has an impact on decision making in collaboration of agricultural producers and wholesalers.

5.3 Multi-Level Analysis using hypothetical models.

TABLE 5. an analysis on 2 levels of data using hypothetical models

Fixed effect	Coefficient	Standard error	t-Ratio	P-value
Average value of business collaboration (β_{0j})				
<i>BASE, G00</i>	0.457642	0.041324	11.075	0.000
<i>POWER_HS, G01</i>	-0.015360	0.079519	-0.193	0.848
<i>EXCEP_HS, G02</i>	-0.015268	0.077396	-0.197	0.844
Effect of TRUST_FARM to Y (β_{1j})				
<i>BASE, G10</i>	-0.062256	0.034131	-1.824	0.074
<i>POWER_HS, G11</i>	0.003074	0.023675	0.130	0.897
(Power variables that has an impact on decision making on collaboration with wholesalers)				
Effect of EXCEP_FARM to Y (β_{2j})				
<i>BASE, G20</i>	0.049943	0.021454	2.328	0.024
<i>EXCEP_HS, G21</i>	0.012029	0.010639	1.131	0.264
(Exception handing variables that has an impact on decision making on collaboration with wholesalers)				
Random effect	Variance Component	df	X^2	P-value
U_{0j} (partial value of β_{0j})	0.05220	45	117.43474	0.000
U_{1j} (partial value of β_{1j})	0.00070	45	32.39456	>.500
U_{2j} (partial value of β_{2j})	0.00009	46	29.25993	>.500
Level – 1 effect, r_{ij}	0.20141			

Source: Calculation

Note: *** significant level at $\alpha = 0.1$ or 90% in level of confidence, ** significant level at $\alpha = 0.05$ or 95% in level of confidence, * significant level at $\alpha = 0.01$ or 99% in level of confidence.

From table 5.3 the results from an analysis of 2 levels of data using hypothetical models testing with fixed effect and t-test are as follow:

1. An analysis of a variables at a level of wholesaler that has an impact on an average value of coefficient of collaboration (β_{0j}) shows that there are no variables at wholesaler’s level that has an impact on value of coefficient of collaboration (β_{0j}) and at significant level of 0.01 means that there are factors other than Power and Exception handing that has more impact on collaboration of wholesalers.
2. An analysis of a Power variables that has an impact on decision making in business collaboration of wholesalers (wholesaler’s level) which affect the value of trust coefficient (β_{1j}) shows that there are no variables at wholesaler’s level that has an impact on value of coefficient (β_{1j}) means that Power has no effect on decision making in business collaboration of wholesalers.
3. An analysis of Exception handling variables that has an impact on decision making in business collaboration of wholesalers (wholesaler’s level) which affect the value of exception handling coefficient (β_{2j}) shows that there are no variables at wholesaler’s level that has an impact on value of coefficient (β_{2j}) means that Exception handling has no effect on decision making in business collaboration of wholesalers.

Prediction coefficients (R^2)

TABLE 6. values of Prediction coefficients (R^2)

Model	$Var(B_{0j})$	$Var(B_{1j})$	$Var(B_{2j})$
(1) Unconditional Model (from table5.2)	0.05027	0.00071	0.00006
(2) Hypothetical Model (from table5.3)	0.05220	0.00070	0.00009
(3) Prediction coefficients (R^2)	0.0384	0.01408	0.5
Proportion of Variance Explained ($\%R^2$)	3.84	1.408	50

Source: Calculation

From the table 5.4 shows the result of independent variable (X) that associated with the dependent variables (Y), the details are as follow:

1. Shows an association of business collaboration variables (β_{0j}) and collaboration variables that has an impact on decision making of partners. The value is equal to 0.0384 or 3.84 percent meaning that it is less associated.
2. Shows an association of trust variables and an impact on decision making in collaboration between producers (β_{1j}). The value is equal to 0.01408 or 1.408 percent meaning that it is least associated.
3. Shows an association of exception handling of wholesaler variables and an impact on decision making in collaboration between producers (β_{2j}). The value is equal to 0.5 or 50 percent meaning that there are associated at a medium level.

6. Discussion

The results of the study of impact of collaboration affecting on profit in agricultural supply chains in Chiang Mai province: a case study between producers and wholesalers are stated below;

At cultivator's level

There are 2 variables that have an impact on decision making of cultivator in collaboration between wholesalers, that is, 1) Trust variables and 2) Exceptional handling of wholesalers variables.

1. Trust variables

According to the results of the research, trust is one important factor which guarantee the cultivators that the wholesalers are able to manage and sale all the agricultural products in the market. As a result, the cultivators or the producer be able to receive the better income and wealth. If the wholesaler cannot be trusted, it is certain that the cultivators or producers will lose their profits. This is because the agricultural products are a product that would be rotten very quick and this is very limited in time of transport and stores the products.

The result from the studied of impact of collaboration affecting on profit in agricultural supply chains in Chiang Mai province shows that the trust of cultivators to the wholesalers has an impact on collaboration. The trust variables are included trustworthy, honesty, reliability, understanding the needs of customers, good performance, be on time and responsibility.

2. Exception handling of wholesalers

If there is issue occurs during the time of collaboration between supply chains. A good wholesaler who dedicates him/herself to fix a problem would likely bring a good solution. As a result, prevent the loss of profits and created wealth among cultivators. From the studied about potential of a kind of wholesalers is a variable that affect a collaboration on profit in agricultural supply chains in Chiang Mai province.

At a wholesaler's level

On the other hand, variables that do not applied to the hypothesis and do not effect on decision making in collaboration between cultivators and wholesalers are 1) Power variables and 2) Exception handling of cultivators.

1. Power variables

Because the wholesalers emphasize more on price, quality and quantity of the products that is effect to profits or lost. The wholesalers, thus, choose to ignore any of Power variables as stated below;

1.1 Coercive and legitimate power. The wholesalers accept to pay additional payment in order to ignore any coercive and legitimate power, such as, the wholesalers would likely to pay fine in order to break the deal with cultivators or producers if they see that the product are not in a good condition or the purchase price is too high.

1.2 Reward power and additional benefits to wholesalers. Because of customers nowadays emphasize more on price, quality and quantity of the products, hence, to prevent the loss of market cap the wholesalers should emphasize on price, quality and quantity of the products rather than any other benefits.

1.3 Referent power. Since there are smaller group of producers than large group of producers in Chiang Mai, the wholesalers have to visited many farms just to buy the right amount of agricultural products. The party would likely be only with wholesaler and cultivator, thus, the authority of cultivator is not influence the decision making of a wholesalers.

1.4 Expert power of cultivator. From the collected data shown that the cultivators unable to do the work at full potential as there are limitation to capital both in terms of money and technology. Thus expert power has no impact on decision making of wholesalers.

2. Exception handling of cultivators

An uncommon problems or problems that are not occur from cultivators such as transportation issue, natural disaster, and competitiveness of the market. These problems are not affect to decision making of wholesalers. The wholesalers only emphasize on quality and quantity rather than emphasize on which agricultural products are from which cultivators. Thus, the exception handling of cultivators do not affect the decision making on collaboration as the wholesalers would likely to collaborate with other cultivators that has lesser issue rather than working together and fixed the problems.

7. Conclusion

The study of impact of collaboration affecting on profit in agricultural supply chains in Chiang Mai province provides a better understanding to the market for agricultural industry. Thus, it is important to study the impact on collaboration between cultivators and wholesalers in the supply chains in order to understand and to develop the market of the agricultural supply chains in the near future. Then this research emphasize on cultivators or agricultural producer and the wholesalers in Chiang Mai province. The data collected from 2 sampling, cultivators and wholesalers total of 350 papers. The details in questionnaire are include the variables that has an impact on decision making in collaboration between cultivators and wholesalers, that is, Power, Trust and Exception handling. Later on an econometric was used to analyze the data, in doing so, the Multi-Level analysis is required.

The program HLM7 (Hierarchical Linear and Nonlinear Modeling) was used in this research. There are 2 levels of analyzing the data, the first level is within-business model which included Trust variables and Exception handling of cultivator variables that has an impact on decision making in collaboration between those 2 parties. And the second level is between-business model which included Power variables and Exception handling of wholesaler variables that has an impact on decision making in collaboration between those 2 parties. There are 3 steps of analysis, that is, 1) Fully unconditional models or Null models, 2) Unconditional models or Simple models, and 3) Hypothetical models.

From the research can be concluded that the factors that has an impact on the decision making in collaboration between the 2 parties are the trust that cultivators place on wholesalers and exception handing of wholesalers. On the other hand, coercive and legitimate power, reward power, reference power, expert power, and exception handling of cultivators do not have an impact on the decision making in collaboration between the 2 parties.

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