



Onion Growers' Adaptation Strategies in the Context of Thailand–China Free Trade Agreement: The Case Study of Chiang Mai Province, Thailand

Nawan Thinnarach¹, Kamol Ngamsomsuke², Benchaphun Ekasingh³
and Anupong Wongchai⁴

Received: October 18, 2022

Revised: April 7, 2023

Accepted: May 1, 2023

ABSTRACT

The study aimed to investigate adaptation strategies of the onion growers in response to the impact of Thailand-China Free Trade Agreement and their fostering factors in Chiang Mai province of Thailand. Multinomial logit regression was used to analyze factors fostering the three strategies namely production and marketing adjustment, request to postpone import or no adaptation. These strategies were grouped from the six strategies adopted among onion growers in the area. The analysis showed that only three factors, and their interaction were among the tested factors included in the best fitted model. The investment in the production (production cost) and access to Thailand–China FTAs information of the household head as well as interaction between production cost and household income were statistically determinant of the adaptation strategies. In more detail, onion growers with higher investment in the production or household head had access to Thailand–China FTAs information would choose to strategy on adjusting the production or marketing activities. Onion growers with higher investment in the production and producing household income would choose strategy on the request to postpone import of onion into the country from February to August or no adaptation.

Keywords: FTAs, Thailand-China FTAs, Small-scale Growers, Adaptation Strategies, Onion

¹ Corresponding Author, Ph.D. Candidate, Faculty of Agriculture, Chiang Mai University, E-mail: nimnawan@gmail.com

² Assistant Professor, Faculty of Agriculture, Chiang Mai University, E-mail: kamol.ngam@gmail.com

³ Associate Professor, Faculty of Agriculture, Chiang Mai University, E-mail: benchaphun@gmail.com

⁴ Assistant Professor, Faculty of Agriculture, Chiang Mai University, E-mail: Anupong.w@cmu.ac.th

Background and Signification of the Research Problem

National trade-related policies, such as subsidies and support measures, trade restrictions and tariffs, have a major impact not only national agricultural systems, but also on agricultural performance in other countries. The increasing importance of multilateral and bilateral trade agreements, the rule established significant effects on national trade policies also on the structure and nature of the global system of agricultural trade and production patterns (Lim Li Ching, 2013). The framework of trade has influenced the policies of many developing countries comprises rules of the World Trade Organization (WTO), rules in bilateral and regional trade agreements as well as unilateral policy measures. In case of China - ASEAN Free Trade Agreement, after China became a member of the World Trade Organization, many countries became aware China's competitiveness because China had the capacity to expand its role in the world economy (ASEAN-China Expert Group on Economic Cooperation, 2001). Therefore, China is able to support agricultural production, domestic consumption, and high export potential. Many countries developed their production and government policy to increase competitiveness. Thailand's six free trade agreements (FTAs) with Australia, China, India, New Zealand and the 10 member countries of ASEAN have made Thailand an even more attractive place to invest. In the 2000s, the free trade agreement (FTA) showing the expansion in Asia-Pacific region, many FTAs have successively become effective since 2008. For Thailand, there are not only a multilateral FTA with ASEAN but also bilateral FTAs with China, Japan, Korea, India, and other signatory countries. A group of ASEAN members consist of Thailand, Indonesia, Malaysia, Philippines, Singapore, and Brunei called ASEAN 6 eliminated tariff an almost all products under AFTA in January 2010 (Table 1). Vietnam, Cambodia, Laos PDR, and Myanmar eliminated tariffs almost all products in January 2015.

Table 1 Major Free Trade Agreement in Effect in the Asian

Free Trade Agreement	Date in Effect
AFTA	January, 1992
ASEAN-China	January, 2004
ASEAN-Korea	January, 2007
Thailand-India	September, 2004
Thailand-Australia	January, 2005
Thailand-New Zealand	July, 2005
ASEAN-Australia-New Zealand	January, 2010
ASEAN-India	January, 2010

Source: ASEAN Briefing (2021)

Since 2010, China has become Thailand's No. 1 export destination because the value and proportion of Chinese Direct Investment into Thailand and continually increasing after the ASEAN–China Investment Agreement (ACFTA). Before FTAs in 2003, Japan's main trading partner but after 2006 China become the main biggest value of trading partner (Bank of Thailand, 2017). The China - ASEAN Free Trade Agreement, in which tariffs were removed on a significant number of fruits and vegetables traded between the two countries, has created a flood of cheaper imports of fruits and vegetables into Thailand. This would likely have led to the loss of the balance of trade with a negative effect on the growers and onion growers would got a negative effect on if the consumers changed their behavior and consumed more Chinese fruits and vegetables. Vegetable trade between Thailand and China under free trade agreement in Early Harvest varieties, under the customs tariff schedule codes 07 and 08, including fruits and vegetables lines of products. On Accelerated Tariff Elimination under the Early Harvest Program of the Framework Agreement on Comprehensive Economic Cooperation between ASEAN and China, which eliminated tariffs on all items under these categories as of October 1, 2003. Vegetables in Harmonized code 07 includes Thai onion. Japan is the biggest market and value which Thailand export vegetables since 1999 - 2017 and after that China has become the biggest of import value more than other countries. When tariffs were removed on a significant number of fruits and vegetables traded between the two countries, there is created a flood of cheaper imports of fruit and vegetables into Thailand. In 1961, onion production was promoted to farmers in Chiang Mai province of Thailand, the grower gets quality yields and get profits from onion production, and then they change to grow onion substituted annual rice and longan fruit. The main planted area are Fang, Mae Wang, Chai Prakan and Mae Ai District in Chiang Mai province, which was the largest plated area for onion cultivation (Chiang Mai Provincial Agricultural Extension Office, 2019). The Office of Agricultural Economics Ministry of Agriculture and Cooperatives had a measure to controls the production and marketing of onions by importing the onion seeds in accordance with the WTO obligations of 3.15 tons or 6,944 pounds per year since 2004. The onion Growers Cooperative of Thailand was act as the importer and allocated onion seeds to cooperative members and the growers could not get more onion seed than onion quality has been established by WTO regulations (Onion cooperative of Thailand, 2018). In addition, the smuggling of onions from foreign countries was an important obstacle in Chiang Mai Province. the prevent measure of the smuggling of by setting the strict regulation in the importation, especially the border trade with neighboring countries in 2018 (Onion cooperative of Thailand, 2018).

Deepened on above details, we should be aware of the FTAs' impacts, because of Thai farmers will have received relatively few benefits from trade liberalization. The Thai government needs to make the adjustment of Thai economy and develop the competitiveness in order to maximize the benefits of FTAs and minimize the negative impacts. Many studies have only analyzed these impacts from FTAs. There's not adequate research about the effect of Thailand - China FTAs impacts to small farmers and their adaptation to the impact especially the change of household income. Due to these reasons, this paper tried to present the impact of the FTAs bilateral and the adaptation of onion growers to find strategies or policies to improve their production and quality of life.

Objective

This study aimed to investigate adaptation strategies of the onion growers in response to the impact of Thailand - China Free Trade Agreement and their fostering factors.

Scope of the Study

This research focused on the adaptation strategy of small-scale onion growers to Thailand-China free trade agreement. The framework that had been constructed based on the assumption that there are various driving forces their households' decisions to choose adaptation strategies. Multinomial logit regression model used to analysis of the factors influencing the choice of adaptation strategies for Thailand - China FTAs' impact by small-scale farmers to be competitive in the market.

Research Methodology

1. Study Area

The study area conducted of Chiang Mai province in Northern region of Thailand. In Chiang Mai province, there are 2,010,706 hectares, 80% are highland and mountainous areas and 20% are flat land which suitable for cultivation. Important economic crops such as rice, longan, orange, garlic, shallot, and onion. Chiang Mai province is the main planted areas (Table 2-3) to produce onion for domestic consumption, export and import. Fang, and Mae Wang district are the main study area in this research.

2. Population and Sampling

Table 2 Onion' Planted Areas in Chiang Mai Province in 2017

District	Planted area (Hectares)	Harvested areas (Hectares)	Total yields (Tons)	Average yield (Tons/Hectare)
Fang	322.72	319.52	6,644.00	20.79
Mae Wang	536.80	531.36	11,853.00	22.31
Other	218.24	205.76	4,426.00	21.51
Total	1,077.76	1,056.64	22,923.00	21.69

Source: Chiangmai Provincial Agricultural Extension Office (2019)

The number of samples would be calculated from the total number of onion growers in Chiang Mai province by using of Taro Yamane formula (Yamane, 1973). The total onion growers in this study mentioned on the number of samples who is head of household in this study are 141 samples.

Table 3 Planted Area, Harvested Area, and Total Yield of Onion Production in 2011-2018

Year	Planted area (Hectares)			Planted area (Hectares)			Total yields (Tons)		
	Whole Kingdom	Northern region	Chiang Mai	Whole Kingdom	Northern region	Chiang Mai	Whole Kingdom	Northern region	Chiang Mai
2011	2,016	1,958	1,660	1,934	1,879	1,586	50,104	48,796	42,710
2012	2,070	2,009	1,689	1,941	1,883	1,585	54,300	52,819	45,508
2013	1,622	1,586	1,330	1,557	1,523	1,273	39,909	39,345	34,261
2014	1,411	1,386	1,132	1,389	1,364	1,112	37,756	37,048	31,187
2015	1,416	1,389	1,082	1,414	1,414	1,082	35,466	34,900	28,020
2016	1,538	1,498	1,192	1,532	1,495	1,192	40,378	39,487	32,786
2017	1,441	1,404	1,020	1,413	1,378	1,057	31,981	30,163	22,923
2018	1,574	1,534	1,174	1,564	1,524	1,167	41,269	40,261	32,171

Source: Office of Agricultural Economics (2018)

3. Data Collection Secondary data collection will be collected and identify on production and supply chain system for evaluation of the onion production in local to region market from related documents and government, semi government, and non-government organizations, onion marketing, farmer adaptations, measurement methods, and related trade policies in both Thailand and China agricultural trade. Primary data collection collected from key informant as onion growers in Chiang Mai by use the questionnaire for individual interviews and focus group during 2017 - 2018.

4. Data Analysis Multinomial logistic regression (MNL) was used to predict categorical placement in the probability of category membership on a dependent variable based on multiple independent variables. The independent variables could be either dichotomous or continuous, and necessitate careful consideration of the sample size and examination for outlying cases. In this research, assumed that the choice of small-scale growers in one adaptation strategy is not related to the choice growers of another adaption strategy. MNL used to analysis of the factors influencing the choice of adaptation strategies for Thai-China FTAs' impact by small-scale growers. MNL was analyzing several variables in this study, and *no adaptation* to FTAs impact was a reference category. A multinomial logit model was fit for the full factorial model and parameter estimation is performed through an iterative maximum-likelihood algorithm (Greene, 2002; Vanichbuncha, 2005). The model was used by following Hosmer & Lemeshow, 2000; Bayard, Jolly, & Shannon, 2006; Sosina, Holden, & Barrett, 2010; Mustapha, Tanko, & Iddrisu Abukari, 2017, to express the probability of a farmer being in a particular category in general form of the multinomial Logit model:

$$\Pr(y_i = j) = \frac{\exp(X_i \beta_j)}{1 + \sum_{j=1}^J \exp(X_i \beta_j)} \dots\dots\dots (1)$$

And to ensure identifiability,

$$\Pr(y_i = 0) = \frac{1}{1 + \sum_{j=1}^J \exp(X_i \beta_j)} \dots\dots\dots (2)$$

where for the 1th individual,

y_i refers to the observed outcome

X_i refers to a vector of explanatory variables

β refers to the unknown parameters

Table 4 Variable Included in Analysis

Variables	Description	Data type
Dependent variable		
Y	Onion growers' adaptation strategies to avoid impact from Thailand–China FTA Y = 1 Production or marketing adjustment i.e. reduce cost of production, stop to grow vegetable 1-2 years, extend to other domestic market, or improve vegetable quality and post-harvest technology Y = 2 Request to postpone import period from February to August Y = 3 No adaptation	
Independent Variables		
X ₁	Production cost: Money invested for farm production (100,000 baht per year)	Continuous
X ₂	Household income: Total household income (100,000 baht per year)	Continuous
X ₃	Access to Thailand–China FTAs information of household head X ₃ = 0 No Access X ₃ = 1 Access to Thailand–China FTAs information of household head	Category

MNL applied to know the fostering factors which influenced growers' adaptation strategies and each small-scale onion growers faces a set of strategies of adaptation measures, its means that a grower chooses exactly one of the options, not more and not less, and are assumed to depend on x, which x represents a number of impacts attributes, socioeconomic characteristics of households and other related factors (Table 4).

Results

The finding from field survey found that, there are 141 samples which used in this study and focus on the growers who is head of household head (Table 5). The most of growers are the membership and non-membership of agricultural cooperative in the number of 132 and 9 respondents respectively. Most of them which have literate in primary school and were over 55 years old.

Table 5 Characteristic of Samples

Characteristic of Samples	Number of samples	Characteristic of Samples	Number of Samples
Age of household head		Education level of household head	
26 - 45 years old	14	Primary school	131
46 - 55 years old	54	Higher than primary school	10
More than 55 years old	73	Farm experience of household head	
Household farm labor		Less than 25 years	78
Less than 3 persons	114	More than 25 years	63
3-5 persons	27	Cooperative member status	
Farm size		Non member	9
2.00 - 5.00 Rais	90	Membership	132
5.01 - 20.00 Rais	51		

The following three adaptation strategy have been selected for this study. The onion growers' adaptation strategies were grouped 3 adaptation strategies to cope with FTAs impact: production or marketing adjustment, request to postpone import period, and no adaptation in the number of 55, 54 and 32 growers respectively (Table 6). There were three of Pseudo R-square which consists of Cox and Snell R-square, Nagelkerke R-square, and McFadden R-square which were 0.168, 0.190 and 0.086 respectively, represented that the variability is explained by the variables use in the model for 16.80% 19.00% and 8.60% of the dependent variable (Table 7).

Table 6 Number of Onion Growers Classified by Adaptation Strategies Adopted in Respond to Thai-China Free Trade Agreement

Adaptation Strategy	Description	Frequency
Strategy 1	Production or marketing adjustment: Seek for FTAs' information, extension, and training, reduce production cost/ labor cost, fertilizer, and chemical substances, improve onion quality, and post-harvest technology.	55
Strategy 2	Request to postpone import period: Seek for FTAs' information, extension, and training, bargaining to postpone import period during February to August.	54
Strategy 3	No adaptation: Do not adopt any strategy.	32
Total		141

Relationship of independent variables and dependent variable using likelihood ratio test, which evaluates the overall relationship between an independent variables and dependent variable. The full model showed the independent variables were statistically significant, which implied that the odds value indicated adaptation strategy of the growers were related to 3 independent variables, consists of production cost (X_1), household income (X_2), access to FTAs information of household head (X_3), which used in the model to analyzed the factors influencing the adaptation strategies. Production cost (X_1) was significant at 5% ($p \leq 0.05$) and similarly with access to FTAs information of household head (X_3), which had P value of 0.015 and 0.035 respectively. However, household income (X_2) appears non-significant. The interaction between production cost (X_1) and household income (X_2) influenced the adaptation strategies and was significant at 10% ($p \leq 0.10$).

Table 7 Overall Statistics Testing for Factors Influencing Adaptation Strategy of Onion Growers under Thailand-China FTAs during 2010-2018

Effect / Likelihood Ratio Test	-2 Log Likelihood of Reduced Model	Chi - Square	Likelihood Ratio Tests (Sig.)
Intercept	280.625	4.366	0.113
X_1	284.610	8.350	0.015
X_2	278.421	2.161	0.339
X_3	282.943	6.683	0.035
$X_1 * X_2$	282.086	5.826	0.054
Pseudo R-Square			
Cox and Snell	0.168		
Nagelkerke	0.190		
McFadden	0.086		

Note: The chi-square statistic is the difference in -2 log likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0. a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom. b. unexpected singularities in the Hessian matrix are encountered. This indicates that either some predictor variables should be excluded or some categories should be merged.

The likelihood-ratio test is based on deviance which is the difference between two times likelihood of empty and full model [-2 log likelihood]. The chi-square values were 25.867 with P value 0.001 ($p \leq 0.001$) which was less than 0.05 level of significance. Table 8 show that statistical tests for model fitness of factors influencing adaptation strategy of onion growers,

which there is the statistics test was 0.001 and means that the full model statistically significantly predicts the dependent variable better than the intercept-only model alone. The independent variables in consists of includes production cost (X_1), household income (X_2), and access to FTAs information of household (X_3) are the influenced factors of onion growers' decision making to choose the difference adaptation strategy under Thailand - China's FTAs' affects. The conclusion drawn based on multinomial logistic regression analysis including these independent variables of adaptation strategies is appropriate.

Table 8 Statistical Tests for Model Fitness of Factors Influencing Adaptation Strategy of Onion Growers under Thailand-China's FTA during 2010-2018

Model	Model Fitting Criteria		Likelihood Ratio Tests	
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	302.126			
Final	276.260	25.867	8	0.001**

Note: The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

Table 9 show that predicted correctly percentage of the growers who preferred production adjustment or marketing adjustment, request to postpone Import period, and no adaptation strategy respectively, were predicted correctly in the multinomial logistic regression model for adaptation strategies. The growers who choose production adjustment or marketing adjustment strategy in the total number of 55 samples, there were 36 growers who are able to predict correctly or 65.5%. The growers who choose request to postpone Import period strategy, there were 39 growers who are able to predict correctly or 72.2%. However, the growers who choose no adaptation strategy, there were 3 growers who are able to predict correctly or 9.4%. The predicted correctly percentage of adaptation strategy of onion growers was 55.3%.

Table 9 Statistical Tests for the Predicted Accurate Percentage of Adaptation Strategy of Onion Growers

Observed	Predicted			Percent correct
	Strategy 1: Production or marketing adjustment	Strategy 2: Request to postpone Import period	Strategy 3: No adaptation	
Strategy 1: Production or marketing adjustment	36	19	0	65.5%
Strategy 2: Request to postpone Import period	14	39	1	72.2%
Strategy 3: No adaptation	11	18	3	9.4%
Overall percentage	43.3%	53.9%	2.8%	55.3%

Table 10 and 11 show the adaptation strategies which onion growers choose to cope with the impact from FTAs when consideration of independent variables in term of parameter estimation were statistically significant ($p \leq 0.05$ and $p \leq 0.10$) when the reference strategy was no adaptation and production and marketing adjustment respectively. Details of the major findings are as follows.

1. In case of the growers choose adaptation strategy 1, the parameter estimation described some factors or independent variables are influencing for production or marketing adjustment strategy. The growers adapt by seek for FTAs' information, extension, and training, reduce production cost especially labor cost, fertilizer, and chemical substances, improve onion quality, and post-harvest technology, while they will sale fresh onion in other domestic market. Some growers reduced chemical substance quantities and expenditures for production cost reduction. Some of them change production practice to less chemical or organic onion production. On the other hand, if the growers access more the FTAs information or trade situation, they had probability extend to other domestic market especially in early harvesting period that have over supply situation. The result from NML found that production cost (X_1) and access to FTAs information of household head (X_3) were statistically significant, the statistic test equal to 0.043 ($p \leq 0.05$) and 0.097 ($p \leq 0.10$) respectively (Table 10). There are some independent variables had statistics test (Significant level) more than 0.10, such as household income (X_2) will not influence with the growers' decision making to choose production adjustment or marketing adjustment strategy ($p = 0.162$). However, the interaction between X_1 (Production cost) and X_2 (Household income) have the statistics test of 0.054 ($p \leq 0.10$), which indicated that the

onion growers who had higher investment in the production (X_1) and produced high household income (X_2) would not choose production or marketing adjustment strategy.

2. In term of adaptation strategy 2: request to postpone import period, found that there were no independent variables influenced the growers' decision making to choose this adaptation strategy ($p \geq 0.05$) (Table 11). The significant levels of three independent variables consists of production cost (X_1), household income (X_2), access to Thailand–China FTAs information of household head (X_3), and the interaction between production cost (X_1) and household income (X_2) were 0.382, 0.347, 0.620 and 0.905 respectively. In short part 2 of table 10 shows us that no variable was statistically influence on growers in choosing strategy on the request to post pone import onion. However, this does not the case if we also consider the findings in Table 11.

3. Results as shown in Table 11 shows that onion growers with higher investment in the production of onion, access to Thailand-China FTA, and the interaction between production cost (X_1) and household income (X_2) were statistically determinant of not choosing strategies on the request of postpone importation of onion and no adaptation ($p \leq 0.05$ or 0.10) and the parameter estimates were all negative).

4. Combining the findings in Table 10 and 11, they tell us the comprehensive idea of factors influencing onion growers in choosing strategy to cope with the impact of Thailand-China FTA. Table 10 shows that onion grower with higher investment in the production or household head had access to Thailand–China FTAs information would choose to strategy on adjusting the production or marketing activities [Production cost and access to Thailand–China FTA information of the household head was statistically and positively associated with choosing strategy on production or marketing adjustment ($p=0.043$ and 0.097). On the other hand (Table 11), grower with higher production cost was statistically and negatively associated with choosing strategy on the request to postpone importation of onion and no adaptation ($p=0.008$ and 0.043). At the same time grower with access to Thailand-China FTAs information of household head was higher level statistically significant and negatively associated with choosing strategy on the request to postpone importation of onion than the strategy on no adaptation ($p=0.016$ vs $p=0.097$). They also demonstrated the onion grower with higher investment in the production and household income (their interaction) would choose the strategy on the request to postpone importation of onion into the country from February to August or no adaptation [The interaction between production cost and household income was statistically and negatively associated with the strategy on the request to postpone importation of onion ($p=0.036$). It was statistically and positively associated with the strategy on the request to postpone importation of onion and no adaption ($p=0.038$ and $p=0.036$).

Table 10 The Parameter Estimated and Associated Statistics of Factors Influencing Adaptation Strategy of Onion Grower under Thailand-China FTA during 2010-2018 when the Reference Strategy is No Adaption

Adaptation Strategy	Parameter Estimates			
	B	Wald	Sig.	Exp(B)
Strategy 1: Production or marketing adjustment				
Intercept	-1.915	1.800	0.180	
X_1 = Production cost				
Production Cost (100,000 baht per year)	1.144	4.096	0.043	3.140
X_2 = Household income				
Household income (100,000 baht per year)	0.262	1.953	0.162	1.299
X_3 = Access to Thailand-China FTAs information of household head				
Access to Thailand-China FTAs information of household head	0.844	2.762	0.097	2.326
X_1 (Production cost) * X_2 (Household income)	-0.137	4.382	0.036	0.872
Strategy 2: Request to postpone import period				
Intercept	0.819	0.605	0.437	
X_1 = Production cost				
Production Cost (100,000 baht per year)	-0.368	0.765	0.382	0.692
X_2 = Household income				
Household income (100,000 baht per year)	0.113	0.883	0.347	1.120
X_3 = Access to Thailand-China FTAs information of household head				
No access to Thailand-China FTAs information of household head	-0.273	0.245	0.620	0.761
X_1 (Production cost) * X_2 (Household income)	-0.004	0.014	0.905	0.996

Note: The reference category is: No Adaptation

Table 11 The Parameter Estimated and Associated Statistics of Factors Influencing Adaptation Strategy of Onion Grower under Thailand-China FTA during 2010-2018 when the Reference Strategy is Production or Marketing Adjustment

Adaptation Strategy	Parameter Estimates			
	B	Wald	Sig.	Exp(B)
Strategy 1: Production or marketing adjustment				
Intercept	2.734	4.147	.042	
X_1 = Production cost				
Production Cost (100,000 baht per year)	-1.513	7.103	.008	.220
X_2 = Household income				
Household income (100,000 baht per year)	-.149	.777	.378	.862
X_3 = Access to Thailand-China FTAs information of household head				
Access to Thailand-China FTAs information of household head	-1.117	5.812	.016	.327
X_1 (Production cost) * X_2 (Household income)	.133	4.299	.038	1.142
Strategy 2: Request to postpone import period				
Intercept	1.915	1.800	.180	
X_1 = Production cost				
Production Cost (100,000 baht per year)	-1.144	4.096	.043	.318
X_2 = Household income				
Household income (100,000 baht per year)	-.262	1.953	.162	.770
X_3 = Access to Thailand-China FTAs information of household head				
No access to Thailand-China FTAs information of household head	-.844	2.762	.097	.430
X_1 (Production cost) * X_2 (Household income)	.137	4.382	.036	1.147

Note: The reference category is: Production or marketing adjustment

Conclusion and discussion

This study tried to describe the adaptation of onion growers that face with the limitation of onion production from the Thailand–China free trade agreement. The study found that onion growers adopted five strategies to cope with the impact of Thailand-China FTA including no adaptation as they had no idea to do. Multinomial logit regression model used to analysis of the factors influencing the three choices of adaptation strategies (regrouping from the six strategies found in the study area). There were 3 variables, consists of production cost (X_1), household income (X_2), and access to FTAs information of household (X_3) fitted in the best

model. In details, onion grower with higher investment in the production or household head had access to Thailand–China FTAs information would choose to strategy on adjusting the production or marketing activities. On the other hand, the onion grower with higher investment in the production and household income (their interaction) would choose the strategy on the request to postpone importation of onion into the country from February to August or no adaptation.

Many studies and research revealed that there was impact of FTAs on agriculture sector. Wongmetha *et al.* (2015) found that free trade agreement has affected to onion growers of Chiang Mai province in Thailand. He recommended that Thai government should have a crucial role in productivity improvement and reduced production cost and ask to farmers before implementing any policy which negatively affects to their livelihood. Nirathorn (2007) found that adaptive strategies of Thai farmers were namely cost reduction, increase production and some farmers turned to casual workers. Legesse, Ayele, & Bewket (2013) explained that the adaptation strategies were crop diversification and the use of soil and water conservation practices. For factors determining adaptation strategy, they found that agro-ecological locations, sex, family size, plot size, off-farm income, livestock holding, frequency of extension contacts and training are the determinant factors influencing adaptation strategies. The findings of the study of Singh *et al.* (2018) found that four factors consist of timeliness, accuracy, relevancy, and economy of information of the Agro-Advisory Services (AAS) of agro - advisory system in Northeast India (m4agriNEI) have played a vital role in innovating Climate-Smart Agriculture (CSA) practices among the registered farmers. Moreover, factor regarding 'relevancy of information' was significant at 10% with respect to the medium and high categories of adaptation intention to enhancing CSA practices.

Recommendation

From finding results, which can recommend the ways as the government or policies maker would help growers reap more benefits from FTAs. The government should put more effort into disseminating information related to the FTAs among growers and agriculture cooperatives, especially the growers who were not members of any agriculture cooperatives. Policy makers also should be concerned about farmers' adaptation to FTAs in response to both positive and negative effects and what strategies or policies and resilience plan should be implemented. And the last one, the government should negotiate with the FTA partners in order

to accelerate tariff reduction and prepare for further liberalization in order to exchange concessions with FTA partners by continuously monitor preference utilization under the FTAs.

Further Study and Limitations

The limitation of this study depends on the adaptation of small-scale growers and how they face with the impact of the FTAs which not adequate for the decision making for the whole production system and lack of information on preferential tariff treatment. However, the information obtained from the surveys and interviews would be helpful to the government in identifying problems and finding proper solutions. Further research should comparison the adaptation strategy of the growers with China and other countries in aspect of FTAs and other trade agreements. On the other hand, the awareness of the impacts of COVID -19 to domestic and international trade and find the proper ways or adaptation strategies to face the impacts are also valuable to help the growers' decision making on agricultural production and developing a roadmap toward further liberalization.

References

- ASEAN Briefing. (2021). *ASEAN's Free Trade Agreements: An Overview*. ASEAN Briefing. Retrieved from <https://www.aseanbriefing.com/news/aseans-free-trade-agreements-an-overview/#aseanchinafreetradeareaHeader>
- ASEAN China Expert Group on Economic Cooperation. (2001). *Forging Closer Asean-China Economic Relation in the Twenty First Century*. Retrieved from <https://asean.org/wp-content/uploads/2021/09/File01.pdf>
- Bank of Thailand. (2017). *Foreign direct investment classified by country*. Retrieved from <http://www2.bot.or.th/statistics/BOTWEBSTAT.aspx?reportID=654&language>
- Bayard, B., Jolly, C. M., & Shannon, D. A. (2006). The Adoption and Management of Soil Conservation Practices in Haiti: The Case of Rock Walls. *Agricultural Economics Review*, 07(2), 28-39. Retrieved from <https://pdfs.semanticscholar.org/c8ed/7bee041c73cfe56202c4f5483fdfaa6a187e.pdf>
- Chiangmai Provincial Agricultural Extension Office. (2019). *Agricultural statistic database of Chiang Mai Province*. Retrieved from <http://www.chiangmai.doe.go.th/reports/Plant%20calenda%20chiangmai.pdf>
- Department of Cooperative Promotion. (2015). *Statistic of Onion Cooperative of Thailand*. Thailand: Department of Cooperative Promotion.
- Greene, W. H. (2002). *Econometric Analysis*. 5th Edition, Prentice Hall, Englewood Cliffs, NJ.

- Hosmer D. W., & Lemeshow, S. (2000). *Applied Logistic Regression*. Wiley: New York.
- Legesse, B., Ayele, Y., & Bewket, W. (2013). Smallholder Farmers' Perception and Adaptation Variability and Climate Change in Doba District, West Haraghe, Ethiopia. *Asian Journal of Empirical Research*, 3(3), 251-265. Retrieved from <http://aessweb.com/journal-detail.php?id=5004>
- Lim Li Ching. (2013). *The Importance of International Trade, Trade Rules and Market Structures*. Trade and Environment Review 2013. Third World Network, and Martin Khor, South Center. Retrieved from https://unctad.org/en/PublicationChapters/ditcted2012d3_ch5_en.pdf
- Medina, A. F. (2021). *ASEAN's Free Trade Agreements: An Overview*. ASEAN Briefing. Retrieved from <https://www.aseanbriefing.com/news/aseans-free-trade-agreements-an-overview/#aseanchinafreetradeareaHeader>
- Mustapha, S., Mohammed, T., & Iddrisu., A. (2017). Application of Multinomial Logistic to Smallholder Farmers' Market Participation in Northern Ghana. *International Journal of Agricultural Economics*, 2(3), 55-62. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2954954
- Nirathron, N. (2007). *"Farmers in the FTA regime: Adaptive strategies of onion farmers in Fang district, Chiangmai"*. Faculty of Social Administration: Thammasat University. Retrieved from <http://agris.fao.org/agris-search/search.do?recordID=TH2008000452>
- Office of Agricultural Economics. (2018). *Agricultural Statistics of Thailand 2018*. Bangkok: the office of Agricultural Economics. Retrieved from <https://oaezone.oae.go.th>
- Onion cooperative of Thailand. (2018). *Onion Production cost 2018*. Thailand: Onion cooperative of Thailand.
- Singh, S.P., Singh, R.J., Chauhan, J.K., Ram Singh. & Hemochandra, L. (2018). Multinomial Logistic Regression Model in Identifying Factors of m4agriNEI in CSA Innovations. *Indian Journal of Hill Farming*, 31(2), 344-347. Retrieved from http://www.kiran.nic.in/pdf/IJHF/ Vol_31_2/23%20Edited.pdf
- Sosina, B., Holden, S., & Barrett, B.C. (2010). Activity Choice in Rural Non-farm Employment (RNFE): Survival versus accumulative strategy. *MPRA Paper*, No. 55034. 2014. Retrieved from <https://mpra.ub.uni-muechen.de/55034/>
- Vanichbuncha, K. 2005. *Advanced Statistics Analysis by SPSS for Windows*. 4th Edition. Bangkok: Dharmasarn Printing Company Limited.

- Wongmeta, O., Kaneythipe, J., Promma, C., Rattanaburi, S., Harntawee, M., phuephong, A., Ruengkul, T., & Palakorn. K. (2015). *Competition Analysis of Onion in the Northern Part*. Chiang Mai: Chiang Mai Royal Agricultural Research Center and Chiang Mai Agricultural Research Center and Development Center. Retrieved from <http://www.doa.go.th>
- Yamane, T. 1973. *Statistics: An Introductory Analysis*. Third edition. Harper and Row Publication, New York.