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Matching Farmer Competence and Farm Resources with the Transformation of Agri-Food Marketing Systems

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***Abstract*—**The agri-food market transformation has implied market growth for the fruit industry in Thailand. This article focuses on analysis of farmer competence and farm resources which affect market strategies used by fruit farmers in Chanthaburi province of Thailand. The survey data were collected through the use of face-to-face interviews with structured questionnaires. This study identified 14 drivers related to farmer competence and farm resources of which some had significant effect on the decision to use either high-value markets or traditional markets. The results suggest that farmers who used high-value markets were better educated and they had longer experience and larger sized business. Identifying the important factors that match with the market transformation provides policy with opportunities to support the fruit farmers to increase their market power. Policies that promote business expansion of agricultural cooperatives and knowledge sharing among farmers are recommended to reduce limitations due to limited knowledge, low experience, and small business sizes.

***Keywords*—**Farmer competence, farm resources, fruit industry, high-value markets, Thailand.

I. Introduction

THE transformation of agri-food marketing systems worldwide implies market growth in the developing world [1]-[3]. As with most developing countries, Thailand has witnessed a rapid growth of high-value markets, i.e. modern retail chains and high standard export markets, especially after the Asian financial crisis in 1997-98 [4]. However, [5]-[7] argue that the agriculture sector in Thailand is characterised by small-scale farmers who struggle to take advantage of such opportunities. This is because selling to high-value markets usually requires standard certification in good farming practices and in particular for fresh produce such as fruit and vegetables [8], [9]. Consequently, characteristics of small farm and farmers in Thailand such as farmer competence and farm resources they used are important in dealing with the transformation of agri-food marketing systems. Available research mostly explains strategies with the internal environment, i.e. farmer competence and farm resources, from individual farmers' perspectives in developed countries, such as USA [10], [11], Sweden [12], [13], Ireland [14], the Netherlands [15], Germany [16], Australia [17] and New Zealand [18]. A large amount of research work emphasises the impacts of agri-food market transformation on small-scale farmers, providing policy implications for high-value market access in developing countries, such as India [19], Thailand [5], Kenya [20], Mexico and Central America [21] and other countries in Asia [3]. However, the research work in developing countries rarely address strategies with the internal environment from farmers' perspectives as found in developed countries. This study aims to analyse fruit farmer competence and farm resources that match with the transformation of agri-food marketing systems in Chanthaburi province of Thailand.

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II. Background

Thailand's geography and climate is suitable for agriculture and the agriculture sector has been the foundation of the Thai economy and society for many centuries. Rice is the dominant cultivated crop, in terms of it having the largest share of agricultural land and farmer involvement. Other important crops of the country are natural rubber, sugar cane, cassava and tropical fruit. The agriculture sector in Thailand has undergone rapid transformation in the past three decades, due to the economic boom during 1986 to 1996 and the modernisation of the sector that took place after the Asian financial crisis in 1997/98 [4]. This has brought about the expansion of high-value markets, which have changed the market characteristics of traditional markets. Similar to most developing countries, agri-food products in Thailand are increasingly distributed through high-value markets, i.e. modern domestic markets and high-standard export markets. However, traditional markets are still more dominant [1], [22]:

- *Traditional markets (TMs)*, characterised by supply-driven production, low prices, low awareness of food safety issues, reliance on low cost for competitiveness, and no constraints for participation of small-scale farmers
- *High-value markets (HMs)*, characterised by demand-driven production, high prices, high sensitivity to food safety, reliance on quality, volume, flexibility and innovation for competitiveness, and well-organised farmer inclusion, such as high-standard export markets and modern retail chains [22].

TMs in Thailand are comprised of many players. Agricultural produce is usually collected by local collectors and then supplied to several types of market intermediaries, i.e. provincial wholesalers and central wholesalers. The produce is sold to Thai consumers by traditional retailers at fresh (or wet) markets. The transformation of the agriculture sector in Thailand has spurred on an increase of HMs, i.e. high-standard export markets and modern retail chains such as

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supermarkets. Nowadays, the agriculture sector in Thailand has become more modernised and internationalised towards producing high-value products to meet changing consumption patterns, both in domestic and global markets, focusing on quality, safety and convenience [23]. In response to the growth of HMs, Thailand has developed a national Good Agricultural Practices standard, called Q-GAP (Q stands for 'quality'), in line with the international requirements of the Food and Agriculture Organisation (FAO) and the World Trade Organisation (WTO) since 2003. It aims to improve the quality and safety of agricultural products, minimise negative impacts on the environment, and increase consumer confidence in food safety.

One of the key high-value agricultural products produced in Thailand is fresh fruit. Located in the tropical zone in Southeast Asia, Thailand produces a wide range of tropical fruits and it is one of the key fruit producers in the world. In the past 20 years (1994 to 2013), Thailand has been the fifth largest tropical fruit producer after India, the Philippines, Indonesia, and China. As a result, the fruit industry is one of the top ten agri-food industries in Thailand. In particular, from 2001 to 2013, the value of fresh tropical fruit exports increased considerably. Fig. 1 shows that in 2013 Thailand was the world's largest exporter of fresh tropical fruit, followed by Hong Kong, the US, Indonesia and Malaysia. As presented in Fig. 1, from 2001 Thailand had an upward trend in export earnings from fresh tropical fruit, following expansion of its production in 2000. Hong Kong was the second largest exporter, although it is not a country which produces fruit.

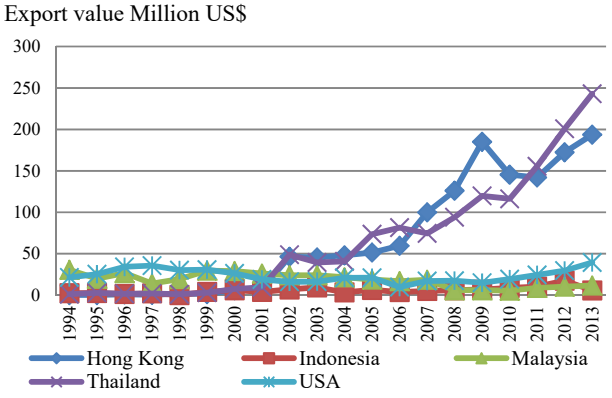


Fig. 1 Fresh tropical fruit value exports from top five exporters, 1994 to 2013 [50]

Based on UN Comtrade data, Thailand exported many types of fruit products (including nuts and melons), averaging 889 million US$ annually, from 2009 to 2013 (see Table I). During this period, the top five export destinations were China (mainland), ASEAN (mainly to Indonesia, Vietnam and Singapore), China (Hong Kong), the US and Japan, with an average share of 39%, 26%, 15%, 4% and 2%, respectively. Other destinations included the EU, Taiwan, UAE, Canada and Australia.

TABLE I
TOP FIVE DESTINATIONS AND VALUE OF THAILAND FRUIT EXPORTS, 2009 TO 2013. SOURCE: UN COMTRADE

Year	China	ASEAN	Hong Kong	USA	Japan	Others	Total
2009	200	101	108	30	17	100	**556**
2010	205	117	92	35	18	108	**576**
2011	463	188	156	37	22	133	**998**
2012	412	469	131	46	23	119	**1228**
2013	447	268	172	48	22	130	**1087**
Average	**346**	**229**	**132**	**39**	**20**	**118**	**889**
%Share	**39%**	**26%**	**15%**	**4%**	**2%**	**13%**	**100%**

Thailand has a wide variety of tropical fruits commercially grown, such as durian, mango, mangosteen, longan, longkong, rambutan, and lychee. Among these types of fruits, durian, mangosteen and rambutan are the main fruit crops grown widely in the eastern and southern regions of Thailand. Based on the general framework of the fruit marketing chain in Thailand presented by [24], approximately 30% of produce was sold from farmers via local collectors. Farmers sold their product directly to provincial or central wholesale markets at approximately 25% of produce. Other intermediaries comprise cooperatives, local markets, export agents and specialist assemblers, with an estimated share of approximately 20%, 10%, 10% and 5%, respectively. Approximately 35% of produce is going to HMs. Fig. 2 presents the fruit marketing chain in Thailand based on [24], [25].

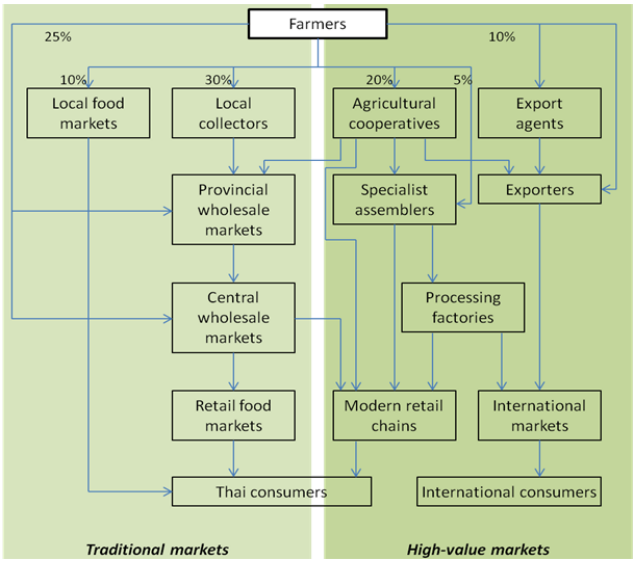


Fig. 2 Fruit marketing chain in Thailand, Adapted from [24], [25]

Current market channels for Thai fruit not only include TMs, but there are also some choices for HMs that focus on domestic modern retail chains and export markets. Particularly, the transformation of marketing systems has occurred in Chanthaburi of Thailand, which is the most important province of the country in terms of tropical fruit production. This province uses 72% of its agricultural area for growing fruit, particularly durian, mangosteen and rambutan, yielding 44%, 38% and 44% of overall production in Thailand, respectively. Thus, changes of the external

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environment due to the transformation of agri-food marketing systems have impacted Thai fruit farmers' strategies in selling their produce, particularly in Chanthaburi province.

III. Farmer Competence and Farm Resources

A well-defined strategy is formulated based on internal and external environments. Reference [26] explained that strategies are determined, in order to set direction, focus effort, define the organisation, and provide consistency in response to the business environment. Reference [27] classified the business environment as following:

- *External opportunities and threats*—factors that are uncontrollable for a single firm, including demographic, political, economic, social, technological, environmental, and competitive trends and events that could significantly benefit or harm the firm in the future;
- *Internal strengths and weaknesses*—factors that a firm can control, referring to the firm's resources and competences that are determined, relative to competitors, and they arise in management, marketing, operations, finance and other activities of a business.

It is generally accepted that strategy relates to achieving goals by matching the internal environment, i.e. firm's resources and competence with external threats and opportunities [28], [29]. Many business firms usually employ the Resource-Based View (RBV), in order to achieve competitive advantage, by focusing on internal resources. Based on the RBV perspective, organisational performance is determined by internal resources consisting of:

- *Competence*—including knowledge, skills, abilities, experience and intelligence;
- *Firm resources*—including physical resources such as plant and equipment, location, technology, machines and raw materials and organisational resources such as the firm's structure, planning processes, information systems, trademarks, patents and so forth [27], [30].

Research on the association between internal environment and strategies used has demonstrated that many firm resources (e.g. organisational structure, size and performance) and competence (e.g. age, education, cognitive style and personality) are relevant [31]-[35]. For example, [33] pointed out that, within a large firm, strategies relate to the characteristics of the top management team, such as personality (e.g. the need for achievement, attitude towards risk and degree of aggressiveness) and some demographic characteristics (e.g. number of years with the company and level of education). Reference [36] reported that managers who are older tend to be risk averters, whereas younger managers are likely to choose higher risk strategies. Consistent with the general strategic management research, the internal resources in agriculture consist of:

- *Farmer competence* such as education, experience and know-how;
- *Farm resources* such as land, buildings, machinery and other capitals [16], [17], [37].

IV. Methodology

This study is a quantitative survey-based research conducted in Chanthaburi province of Thailand. Purposive sampling was employed in this study using the following criteria: 1) fruit farmers with main income coming from fruit farming (more than 80% of total incomes); 2) fruit farmers who grew at least one of the three main fruit crops, i.e. durian, mangosteen and rambutan; 3) fruit farmers who had their highest sales from one of their main fruit crops. The sample included 216 respondents, consisting of two sample groups separated by their main markets used: 1) 104 fruit farmers who used traditional markets (TM users) and 2) 112 fruit farmers who used high-value markets (HM users) as their main markets. The survey data were gathered by using face-to-face interviews with structured questionnaires. Before the survey was conducted, the questionnaire was pre-tested with some fruit farmers who were not part of the sample. The final questionnaire included both closed-ended and open-ended questions consisting of some screening questions to recruit relevant farmers into the sample.

The data collected in this study also included variables that can be classified as farmer competence, such as education, experience and membership of agricultural cooperatives, and farm resources such as farm size, number of pick-up truck used, fruit production and sales. Table II presents farmer competence and farm resources included in this study.

TABLE II
Factors Included in this Study

Farmer competence	Farm resources
Age (years)	Total farm size (hectares)
Gender	Fruit farm size (hectares)
Education	Land ownership
Fruit farming experience (years)	Main fruit grown
Income source	Number of pick-up trucks
Household size (persons)	Fruit production (tonnes)
Membership of agricultural cooperatives	Fruit sales (baht)

Descriptive statistics were used for preliminary data analysis and for describing the sample. In addition, the two sample groups, i.e. TM users and HM users, were compared on a number of variables (farmer competence and farm resources). The variables examined in this study are comprised of both continuous variables and categorical variables. The categorical variables in this study (see Appendix, Table X) include gender, education, income source, land ownership, the main fruit grown and membership of cooperatives. Some continuous variables, i.e. age, fruit farm experience and fruit farm size were grouped and analysed similarly to categorical variables. Each categorical variable was statistically tested as to whether it was significantly related to the types of market users, using the chi-square (χ^2) test of independence or Fisher's exact test. Phi (φ) and Cramer's V were also used to estimate the effect size, i.e. the strength of the relationships.

The continuous variables included in this study (see Appendix, Table XI) comprise age, fruit farming experience, household size, total farm size, fruit farm size, number of fruit

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crops grown, number of pick-up trucks used, fruit production and fruit sales. These variables were checked by comparing the minimum and maximum values and examining the means and standard deviations to see whether they looked reasonable. These continuous variables were further analysed, in order to examine the effects of farmer competence and farm resources on market strategies the fruit farmers used (TMs or HMs). Principal component analysis (PCA) with varimax rotation was used to identify underlying factors to see the dimensions of these variables. Then, the underlying factors were tested their effects on the market strategies by using binary logistic regression.

V. Results

A. Description of the Sample

The majority of the fruit farmers in the sample were middle aged males (41 - 60 years, average 52 years). Generally, they had completed primary (49%) or secondary education (32%). Approximately 91% had experienced more than 10 years in fruit farming with the majority (36%) had experience from 21 - 30 years. Approximately 64% depended on only fruit for their income while 36% had other crops or jobs for their supplementary incomes. The fruit farm size was relatively small ranging from 0.1 - 6.0 hectares with an average of 3.07 hectares. Almost all the farmers (92%) fully owned their fruit farm land. They grew many different types of fruit crops. Particularly, durian, mangosteen or rambutan was their main fruit crop, generating the most sales for their fruit farm business. Table III summarises the majority of the fruit farmers included in the sample.

TABLE III
Characteristics of the Fruit Farmers Included in the Sample

Characteristics	All respondents (216)	
	Majority	Percent
Age	41-60 years	63%
Gender	Male	67%
Education	Primary	49%
Fruit farm experience	21-30	36%
Income source	Fruit only	64%
Fruit farm size	0.1-6.0 hectares	88%
Land ownership	100% own	92%
Main fruit grown	Mangosteens	38%
Membership of cooperatives	Non-member	71%

Some farmers were Q-GAP certified (49% of the sample), and they had at least one main fruit crop certified. The remainder (51%) was defined as non-certified farms. The certified farmers indicated that the certification provided them with market opportunities, while the non-certified farmers stated that they were not certified because they did not have enough information and time for the certification process, and because they did not use the certification for selling their produce. Due to the small-size characteristic of the farms, some farmers (29%) were members of an agricultural cooperative. The most important reason to become a member was that agricultural cooperatives were selling fruit to HMs. Another reason was that the cooperatives could provide them with funds for their fruit farm business and could also supply agricultural inputs with fair prices.

B. Comparisons between TM and HM Users

Table IV provides the results of comparisons between TM and HM users by using the chi-square test (χ^2). It shows that the types of market users were related to many variables, i.e. education, fruit farming experience, income source, fruit farm size, main fruit grown and membership of cooperatives.

TABLE IV
Relationships between the Two Types of Market Users and Categorical Variables

Variables	χ^2	p	φ and V	Effect size
Age	3.563	.168	.128	-
Gender	4.682	.211	-.085	-
Education	29.223	.000	.368	Moderate
Fruit farm experience	8.712	.033	.201	Moderate
Income source	7.697	.007	.215	Moderate
Fruit farm size	12.805	.002	.243	Moderate
Land ownership	5.306	.269	.075	-
Main fruit grown	20.056	.001	.258	Moderate
Membership of cooperatives	4.826	.018	.161	Weak

HM users were better educated had completed secondary and tertiary education, compared to TM users, where the majority had only completed primary education. HM users had longer experience in fruit farming and some of them also had other agricultural incomes and worked in other sectors, while TM users generally depended on fruit incomes. HM users mainly grew durian and mangosteen on larger farm areas than TM users, who usually grew all of types of fruit. Furthermore, the fruit farmers who were cooperative members were HM users rather than TM users. Table V compares between the majority of TM and HM users on the significant factors.

TABLE V
Comparisons between the Majority of TM and HM Users on Significant Factors

Characteristics	TM users (104)		HM users (112)	
	Majority	Percent	Majority	Percent
Education	Primary	64%	Secondary	38%
Fruit farm experience	21-30 years	38%	21-30 years	35%
Income source	Fruit only	61%	Fruit only	67%
Fruit farm size	< 2 hectares	54%	2-6 hectares	47%
Main fruit grown	Rambutans	37%	Durians	43%
Coop membership	Non-member	79%	Non-member	64%

The results of these comparisons are informative, as they provide more understanding about the internal environment of fruit farmers who used different types of markets. However, the results indicate factors that were individually significant the two types of market users. In the real situation, all relevant factors simultaneously affect the market strategies used by the fruit farmers. This study also combines the relevant continuous variables in further analysis in order to assess the effects of farmer competence and farm resources.

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C. Effects of Farmer Competence and Farm Resources

Principal component analysis (PCA) and binary logistic regression were used for further analysis. The results of the PCA indicated that there were two underlying latent factors from the observed variables. Based on Kaiser's criterion, two factors were suggested, as their eigenvalues were greater than 1. Table VI indicates that these two factors explained a total of 74% of the variance.

TABLE VI
TOTAL VARIANCE EXPLAINED IN THE ORIGINAL VARIABLES

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.497	49.953	49.953
2	1.714	24.492	74.445
3	.699	9.981	84.426
4	.632	9.035	93.461
5	.264	3.776	97.237
6	.137	1.961	99.198
7	.056	.802	100.000

A varimax rotation was required, in order to identify a simple structure for simplicity of factor interpretation. These two factors could be interpreted as 'business size' and 'experience' which were uncorrelated to each other. The results in Table VII present loadings of the original variables on these two factors, communalities, h^2, the eigenvalues after factor rotation, and percentages of variance explained by the two factors. The variables were grouped for these two factors, ordered by size of factor loadings, and omitted loadings less than .40 (the cut-off value for 216 cases of sample size), in order to facilitate interpretation and improve the clarity of the results.

TABLE VII
FACTOR LOADINGS FROM PCA WITH VARIMAX ROTATION FOR A TWO-FACTOR SOLUTION

Variable	Factor loading		h^2
	Business size	*Experience*	
Fruit farm size	.907		.823
Fruit sales	.867		.751
Total farm size	.854		.732
Fruit production	.852		.727
No. of pick-up trucks used	.670		.450
Age		.929	.864
Fruit farming experience		.926	.864
Eigenvalues	3.486	1.726	
% of variance	50%	25%	

Note: Loadings < .40 are omitted.

The first factor seemed to indicate the business size of the fruit farms, which had strong loadings on the first five variables: fruit farm size, fruit sales, total farm size, fruit production and number of pick-up trucks used. The other factor seemed to indicate experience of the fruit farmers, and it had high loadings on the two next variables—fruit farming experience and age. The communalities achieved medium to high values, thus indicating that all the variables were relevant.

In order to assess the effects of these two underlying factors on market strategies (TMs or HMs) used by the fruit farmers, logistic regression was employed. The results provided the model represented as: t*he HM user type may be predicted by business size and experience factors.* The Wald statistic with the *p*-value less than .05 indicated that the logistic coefficients of these significant factors were different from 0, pointing out that the exponentiated coefficients were not equal to 1 (see Table VIII).

TABLE VIII
STATISTICAL TESTS FOR THE LOGISTIC COEFFICIENTS OF THE MODEL

	B*	S.E.	Wald	df	*p-value*	Exp(B)*
Business Size	.978	.243	16.240	1	.000	2.659
Experience	.371	.152	5.993	1	.014	1.449
Constant	.168	.151	1.231	1	.267	1.183

*B = logistic coefficient, Exp(B) = exponentiated coefficient

The overall model proved its significance from the null model (χ^2*=29.76, p=.000*). The goodness-of-fit statistic -2 log likelihood (*-2LL*) equated to 169.38. The Cox & Snell R^2 and Nagelkerke R^2 were .33 and .37 respectively, so the model explained 33% to 37% of the variation in the dependent variable ($Logit_{HM}$). The overall predictive accuracy of the model was 69% (see Table IX).

TABLE IX
CLASSIFICATION TABLE

Observed		Predicted		
		Market users		Percentage Correct
		TM	HM	
Market users	TM	73	31	70.2
	HM	36	76	67.9
Overall Percentage				69.0

The results of the binary logistic regression showed that both business size and experience were positive significant factors to the probability of being HM users. This means that larger business size and higher experience of the fruit farmers increased possibility to utilise HMs as their main markets. It is not surprising for the business size to be a positive significant factor, because the competitiveness of the HM depends mainly on efficient and effective supply chains [22]. According to [38], modern supply chains normally prefer large volumes of supplies, in order to reduce transaction costs. Generally, the HM not only buys quality produce, but also considers consistency and quantity of supplies to enhance cost efficiency [1], [39]. Correspondingly, this study's results indicate that the larger business size of the fruit farmers, the higher possibility to utilise HMs. The business-size factor was a combination of many farm resources, i.e. total farm size, fruit farm size, number of pick-up trucks used, fruit production and fruit sales. They indicated that business size was measured by both inputs (farm size and number of pick-up trucks) and outputs (fruit production and sales). This suggested that there were a number of ways to increase business size. Generally thinking, in order to increase business size, farmers usually increase their farm land to grow more fruit. However, fruit farmers in

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Thailand generally limit their farm business in term of land size due to lack of labour [4]. Therefore, another way that can help them increase their business size is to increase productivity, so that they can obtain more tons of fruit production and sales. Furthermore, farmers can also increase their business size via collective actions, such as being members in an agricultural cooperative that can increase the volume of fruit to sell to HMs. Collective actions can be an effective way for coping with limitations due to small business size, because farmers can act collectively in negotiations, investments and other activity involvements [40]. A large amount of research work has confirmed that collective actions can bring advantages for small-scale farmers, from HM access to marketing performance improvements [41]-[44].

The farmer experience factor is the combination between age and number of years in fruit farming. Considerable recent work on marketing decisions in agriculture, such as [5], [45], [46], also found that farmer experience affected their market choice decisions. A study on HM access of Thai fruit and vegetable farmers by [5] points out that farmers, who had longer experience in fruit and vegetable production, were more likely to adopt the GlobalGAP standard and participate in HMs. In order to produce high quality horticultural products, skilled labour is needed [7]. Farmers with longer experience usually have higher skills to produce fruit that matches HM requirements, rather than those with less experience. Apart from farming skills, farmers need ability in management, so that they can control the quality of their produce and work together within the supply chain. According to [47], the experience of the farmer is the major factor associated with managerial ability, because farmers with longer experience gain more opportunities to learn from their mistakes. In other words, experience provides the fruit farmers with the ability to gain more knowledge that can improve their farming skills and managerial ability. Consistent with the effect of experience, the results of this study also indicate that HM users have generally achieved a higher level of education than TM users. These results imply that both education and experience provide more knowledge for the fruit farmers, thus increasing their capability to participate in HMs. Based on these results, in order to gain more knowledge, farmers need to take a long time to gain more experience. However, according to [48], farmers can also effectively gain more knowledge from other farmers, so-called peer-to-peer knowledge sharing, where newer farmers can learn from experienced farmers. This notion complements the way of collective actions discussed previously. Reference [40] recommends that networking should be undertaken with respect to management of the group (e.g. balanced leadership and collective responsibility) and the collective learning process (e.g. learning to improve group performance). Furthermore, [49] points out that learning from others provides development of the ability for farmers to assimilate knowledge from the environment, which is positively related to innovativeness and profitability.

VI. Conclusions

Fruit production in Thailand has increased significantly since 1999 due to the transformation of agri-food marketing systems especially in Chanthaburi province of Thailand. High-value markets that require good farming practices have become important market channels for Thai fruit. This study analyses the characteristics related to farmer competence and farm resources that affected market strategies (TMs or HMs) of fruit farmers in Chanthaburi province of Thailand. The results indicated that there were some differences between the TM and HM users. The HM users were better educated having completed secondary and tertiary education, while the majority of TM users had only completed primary education. The HM users had greater experience in fruit farming; some of them also had other agricultural incomes or worked in other sectors for supplementary incomes, while the TM users depended mostly on their fruit income. Regarding farm resources, the HM users mainly grew durian and mangosteen on larger farm areas than the TM users, who usually grew mixed types of fruit. Moreover, the fruit farmers, who were cooperative members, were HM users rather than TM users. This is because agricultural cooperatives play a role in buying fruit from their members and coordinating with HM players, such as exporters and modern retail chains.

The results of this study also reveal that experience is the key farmer competence and business size is the key farm resource which matches with market opportunities in Chanthaburi province of Thailand. Based on these results, larger business size and greater experience of the fruit farmers lead to higher probability for farmers to make the choice to use HMs. Accordingly, the fruit farmers who have relatively smaller business sizes and less experience at fruit farming are more likely to sell their produce at TMs. In order to increase capability of the fruit farmers to participate HMs, they need to increase productivity, so that they can obtain more tonnes of fruit production and sales. Alternatively, farmers can also increase their business size via collective actions, such as being members in an agricultural cooperative for increased market power. Collective actions bring about networking and knowledge sharing among farmers. Newer fruit farmers can learn from other's experiences, such as leading farmers, in order to establish good farming practices. This study also recommends policy makers to promote business expansion of agricultural cooperatives together with knowledge sharing among their members, in order to alleviate the limited competence (knowledge and experience) and small business size of the fruit farmers.

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APPENDIX

TABLE X
CATEGORICAL VARIABLES AND DESCRIPTIONS

Variables	Categories
Age	1 = 40 years or less 2 = 41 - 60 years old 3 = 61 years or more
Gender	1 = males 2 = females
Education	1 = below primary 2 = primary 3 = secondary 4 = tertiary
Fruit farm experience	1 = 10 years or less 2 = 11 - 20 years 3 = 21 - 30 years 4 = 30 years or more
Income source	1 = fruit incomes 2 = fruit + agri. incomes 3 = fruit + agri+ non-agri incomes
Fruit farm size	1 = 2.00 hectares or less 2 = 2.01 - 6.00 hectares 3 = 6.01 hectares or more
Land ownership	1 = own land 2 = own and rented land
Main fruit grown	1 = durians 2 = mangosteens 3 = rambutans
Cooperative membership	1 = non-members 2 = members

TABLE XI
CONTINUOUS VARIABLES AND PRELIMINARY ANALYSIS

Variable	Min.	Max.	Mean	S.D.
Age (years)	24	90	52.44	11.16
Fruit farming experience (years)	1	60	25.94	11.26
Household size (persons)	1	10	4.15	1.58
Total farm size (hectares)	.16	32.00	3.55	3.40
Fruit farm size (hectares)	.16	28.80	3.07	3.00
Number of fruit crops grown	1	7	2.69	1.23
Number of pick-up trucks used	0	4	1.18	.65
Fruit production (tons)	1.0	150.0	19.63	22.00
Fruit sales (baht)	9,000	6,840,000	525,087	821,175

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