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Original Research Article

A study of factors that affect attitude toward deploying smart-farm technologies in Tanud subdistrict, Damnoen Saduak district in Ratchaburi province

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ABSTRACT

Tanud subdistrict, Damnoen Saduak District in Ratchaburi Province is an area where there are a lot of farms, especially Guava farms. Guava produces both small and medium sizes with fast productivity for harvesting, this brings Guava farmers in good business. However, now Guava and several of agriculture products are imported from many countries such as China, Taiwan, etc. As a result of competition, it causes Thai farmers suffer from its quality supply chain. Therefore, Thai farmers have to involve in adopting of modern, innovative, and high technology for increasing their productivity. The "Smart-Farm Technologies are technologies which help farmers, especially Guava farmers, in order to compete with their potential exported markets. On the other hand, almost Thai farmer in this research had no experience for using any technology before. Thus, this study was focused on the farmer's attitude of adapt this technology in their farm. The research is a Quantitative Research by survey questionnaires including open-end questions to purposive sampling. Starting from awareness session running in parallel with the collection of data through survey questionnaires with farmers, the majority are Guava farmers. Then, analysis has been done by computer program (SPSS) with Multiple Linear Regression Analysis.

The research model is adapted through the theory of TAM (Technology Acceptance Model), consisting of nine hypotheses from three independent factors (Usability Factor, Financial Factor, Area Structure Factor), and three dependent factors (Perceived Ease of Use, Perceived Usefulness, and Attitude for using). According to results, hypotheses are accepted. However, recommendations may be to government for further development of mechanism in two areas; 1) first investment funding and 2) technology standard. Recommendation may also to do survey in wider area than one subdistrict.

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INTRODUCTION

Thailand has the best excellent conditional climate and suitable for cultivation. There are several economic plants and fruits particularly in the Central Part of Thailand where includes Tanud subdistrict, Damnoen Saduak District in Ratchaburi Province. Tanud Subdistrict is an area where there are a lot of farms. Guava produces both small and medium sizes with fast productivity for harvest. This brings Guava farmers in good business. However, now Guava and other farms' products are imported from many countries such as China, Taiwan, etc., which caused Thai farmers suffer from decreasing its quality of supply chain. Therefore, Thai farmers have to involve in adopting of modern, innovative, and high technology for increasing their productivity. The "Smart-Farm Technologies" are technologies which help farmers in order to compete with their potential exported markets. These technologies may help in; 1) Reducing cost and increasing in quantity and quality of products for such high competition segment, 2) Developing new knowledge and wisdom to local farmers in solving existing problems with technologies, 3) Reducing the risk of crops caused from soil, climate and even various plant diseases and 4) Creating awareness for ICT adoption to farms. Thailand is being on Thailand ICT policy framework targeted for 2020, in which Smart Agriculture (Farm) is one initiative as illustrated in Figure1 [MICT, 2011].

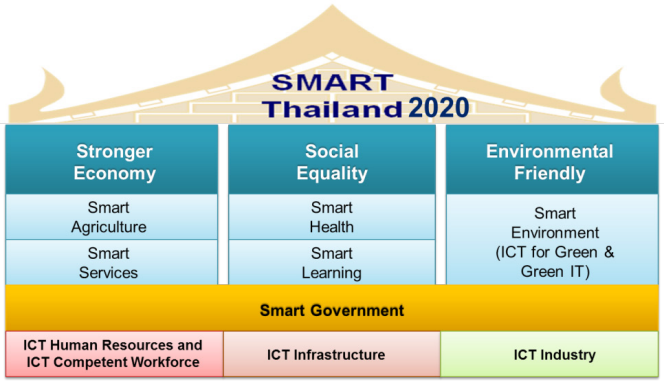

Figure1 Thailand ICT Policy Framework 2020

Then, its concept is highlighted in term of enhancing Supply Chain Process (from Farm to Market) by ICT. On the other hand, almost Thai farmer in this research had no experience for using any technology before. Thus, this study was focused on the farmers' attitude of adopting this technology in their farms. The research methodology is adapted through the theory of TAM (Technology Acceptance Model) [Davis, 1989] which parameters influencing the attitude are;1) Perceived Usefulness and 2) Perceived Ease of Use. Input variables or external factors are as follows; 1) Financing, 2) Usage and 3) Area or Land Structure. If the famers accept this technology model following the theory, they will increase their productivity of their farms. Figure2 presents the possibility in deploying Smart Farm technologies in each process of Farming Supply Chain [Jingjit R., 2013 derived from NECTEC].

MATERIALS AND METHODS

This study proposed in the research model shown in Figure2. It is derived from Technology Acceptance Model (TAM) [Davis et al., 1989]. Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are playing important relationships towards Attitude of Using (AU). In case of external variable factors together with long term involvement in the province, one proposes three parameters; Financing Factor (FIN), Usability Factor (UF) and Area Structure Factor (AS).

1) Financing (FIN) focused mainly on the cost reduction of labor or other related production comparing to new cost such as maintenance cost of technology,

2) Usability (UF) could be the characteristics and advantage of using technology such as Sensors, Smart phones, GIS (Geographic Information System), GPS (Global Positioning System), Convergence, 3G/4G, FTTx, Cloud, Big Data etc.: ease of use, the convenience and facilitation of working, task efficiency, training and rapid delivery, reliability of production,

3) Area Structure (AS) would focus on the size, the number and the diversity of land.

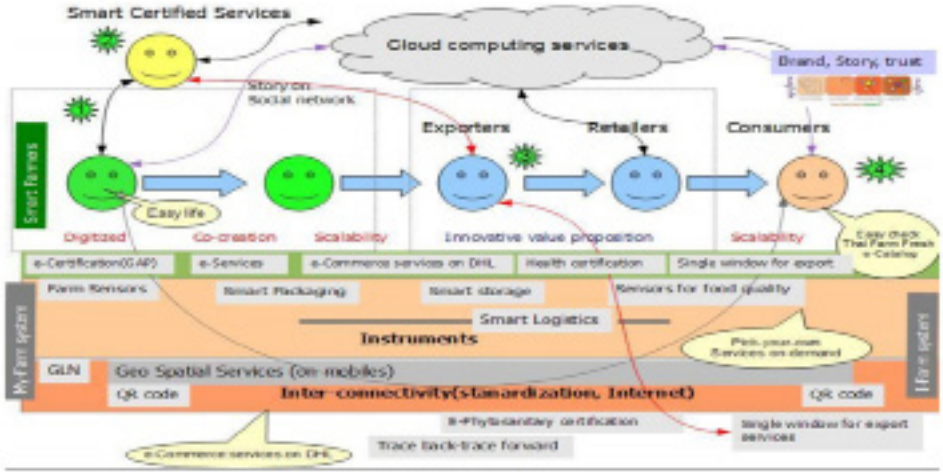

Figure 2 Smart Farm Technologies with Agriculture Supply Chain

However, other factors may also affect the attitude of using such as technology itself including suitable technology and standards or first technology investment. One does not take into account these issues for the purpose of study.

Model and Theory

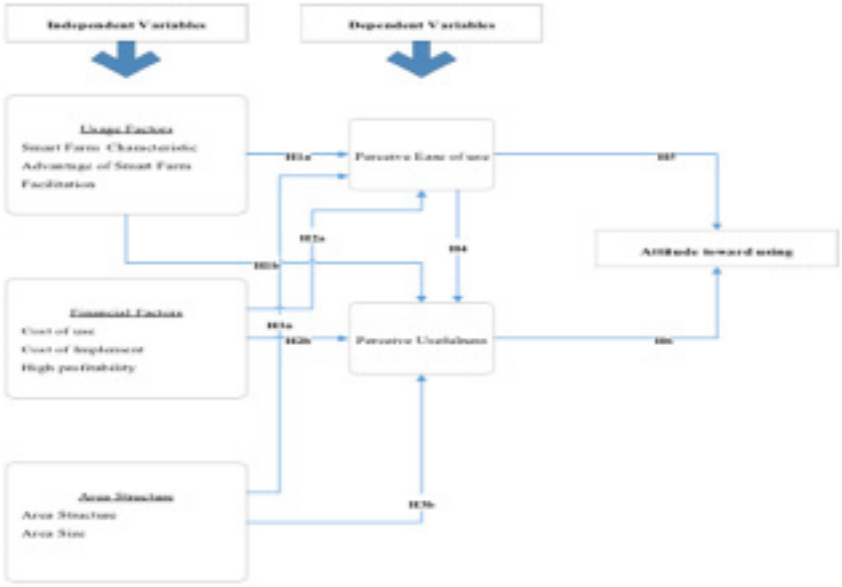

Figure 3 Smart Farm Research Model (Adapted TAM) [Davis et al., (1989)] Where ;

H1a : Relationship from USF to PEOU

H1b : Relationship from USF to PU

H2a : Relationship from FIN to PEOU

H2b : Relationship from FIN to PU

H3a : Relationship from AS to PEOU

H3b : Relationship from AS to PU

H4 : Relationship from PEOU to PU

H5 : Relationship from PEOU to ATT

H6 : Relationship from PU to ATT

Research Tool

This study is a Quantitative Research by survey questionnaires including open-end questions to purposive sampling. The questionnaire consists of 2 parts; 1) Profile and 2) Questions Related to TAM. Part two composes of 7 items according to Factors from the model. Likert questionnaire items were deployed since it is the most widely used approach to scaling responses in survey research. Samples are collected from the population of 7,000 people in Tanud Subdistrict which meet 95 % of confidence [Yamane T., 1967]. Reliability test of this questionnaire through Cronbach Alpha Coefficient is greater than 0.7. Then, this study discovers the results by running SPSS computer software with Multiple Linear Regression Analysis.

RESULTS AND DISCUSSION

Most of respondents are males (57.2 %), farmers (76.8 %) with Guava farmers (53.6 %), no experience in the use of such technologies before (99.2 %) and have education background below bachelor degree (76.4 %).

From the survey questionnaire and test results, it shows that population of Tanud Subdistrict, Damnoen Saduak District in Ratchaburi Province are aware of and believe in Smart Farm Technologies in term of the ease of use and their usefulness. The Smart Farm Technologies unveil the reliability and the reduction of risks from several causes such as weather, soil, diseases etc. Although most of them are farmers without experience in these new technologies, they have learned from news, websites etc. At present, the internet infrastructure in Thailand is growing very fast especially 3G/4G mobiles. Penetration of mobile is more than 130 % of population. The main propose of this research is to study in the attitude for using the smart-farm technologies in their farms which has nine hypotheses. The result is shown in these following tables.

Table 1 shows the results of H4, H5, and H6 including Unstandardized coefficient, standardized coefficient, T, Sig, and VIF.

Table 1 Results of H4, H5 and H6

Hypothesis	Independent	Dependent	R square	Adjusted R square	Unstandardized coefficient		Standardized coefficient Beta	T	Sig.	VIF
					B	Std. error				
H4	PEOU	PU	0.564	0.562	0.014	0.045	0.751	17.905	0.000	1.000
H5	PEOU	ATT	0.566	0.563	0.472	0.071	0.420	6.612	0.000	2.293
H6	PU	ATT	0.566	0.563	0.385	0.066	0.385	6.063	0.000	2.293

Hypothesis 4: **H4**: Relationship from PEOU to PU

The test discovers the fact that Perceived Ease of Use (PEOU) deduces Usefulness because Smart Farm Technologies are perceived to use more conveniently than the traditional one. This brings in the usefulness. Diagnosing from Multiple Linear Regressions found that Perceived Ease of Use related with Perceived Usefulness. Sig is 0.00 that is less than significant value of 0.05. Thus, the hypothesis is accepted.

Hypothesis 5: **H5**: Relationship from PEOU to ATT

This is also confirmed that Perceived Ease of Use has positive impacts to Attitude toward using Smart Farm Technologies before the real implementation. Considering from the result of Multiple Linear Regressions, Perceived Ease of Use related with Attitude toward Using. Sig is 0.00 which is less than significant value of 0.05. Thus, the hypothesis is accepted.

Hypothesis 6: **H6**: Relationship from PU to ATT

This relationship is in advantage when the users aware of PU prior to the actual use. The relationship between Perceive Usefulness and Attitude toward Using is going in the same way. Considering from Multiple Linear Regressions, one discovered that Perceived Usefulness has influence on Attitude toward Using. Sig is 0.00 which is less than significant value of 0.05. So it accepted the hypothesis. However, this research has more results which supported remaining hypotheses. They are shown in Table 2 below.

Smart Farm technologies will reduce cost such as cost of labor, cost of production and reduces some risks. Sig is 0.000 which is less than significant value of 0.05. Thus, one accepted the hypothesis.

Hypothesis 2b: **H2b**: Relationship from FIN to PU

From the results, the hypothesis 2b is confirmed that Finance Factors impacts to Perceived Usefulness. It may come from the reasons of more profitability. Sig is 0.00 which is less than significant value of 0.05. Thus, it accepted the hypothesis.

Hypothesis 3a: **H3a**: Relationship from AS to PEOU

The influence of Area Structure to Perceived Ease of Use come from the fact that; 1) the bigger the area is, the more necessity of the technologies. It is to manage complexity and to ease the practice and train the skills required. The technologies themselves ease the development of knowledge and wisdom to users. The relationship from Area Structure to Perceived Ease of Use has shown in the Multiple Linear Regressions in Table 2. Sig is 0.00 which is less than significant value of 0.05 confirming the hypothesis.

Hypothesis 3b: **H3b**: Relationship from AS to PU

According to the results obtained, Area Structure brings in Perceived toward Usefulness. It facilitates more productivity when the area is bigger. This hypothesis is accepted according to Sig value of 0.00. It confirmed the relationship of Area Structure with Perceived Usefulness.

Table 2 Results of H1, H2 and H3

Hypothesis	Independent	Dependent	R square	Adjusted R square	Unstandardized coefficient		Standardized coefficient Beta	T	Sig.	VIF
					B	Std. error				
H1a	USF	PEOU	0.472	0.468	0.372	0.053	0.422	7.010	0.000	1.695
H1b	USF	PU	0.554	0.354	0.419	0.053	0.438	7.907	0.000	1.695
H2a	FIN	PEOU	0.479	0.473	0.223	0.053	0.272	4,193	0.000	1.992
H2b	FIN	PU	0.554	0.550	0.341	0.049	0.384	6.931	0.000	1.695
H3a	AS	PEOU	0.479	0.475	0.432	0.059	0.473	7.295	0.000	1.992
H3b	AS	PU	0.527	0.523	0.410	0.061	0.415	6.712	0.000	1.992

Hypothesis 1a: **H1a**: Relationship from USF to PEOU

According to tested result, it is confirmed clearly that Usability Factor induces Perceived Ease of Use). The reasons from open-end questions are as follows; 1) the Smart Farm technologies are more reliable and flexible, so these make more understanding to use, train and practice them. Sig is 0.000 which is less than significant value of 0.05. So, it accepted the hypothesis.

Hypothesis 1b: **H1b**: Relationship from USF to PU

Usability has influence to Perceived Usefulness from the perspective of; 1) rapid and on-time processes, 2) efficiency and productivity and 3) potentiality. Sig is 0.000 which is less than significant value of 0.05. Thus, the hypothesis is accepted.

Hypothesis 2a: **H2a**: Relationship from FIN to PEOU

This is real or (This can be proved) because respondents believe that

Form the Multiple Linear Regressions shown in Table 1 and 2, all of the hypotheses are accepted. This means the study proceeded in the right way. The study also confirms the forecast from the Ministry of Agriculture and Cooperatives that the productivity from Smart Farm Technologies implementation will bring more prosperity to the targeted population. Current revenue per household with traditional farming is 132,000 TH Baht yearly. It will be at least 180,000 TH Baht per year in case of new technologies adoption [Jingjit R., 2013] [Limlaemthong Y., 2012]. However, Tanud Subdistrict people still concern in the first investment and standards of new technologies.

The government may take the lead in the following strategies;

1) Making Awareness and Knowledge of new technologies through the diversity of means such as Smart Phones apps, Internet, Call Centers etc, In parallel, in- depth of the studies in wider area and throughout the supply chain (from customers to productions) shall be done appropriately,

2) Supporting Financial Assistance to the potential users nationwide by starting from certain targeted area. New financial models may be initiated by duplicating the model of energy renewal subsidiary

3) Assigning appropriate units to consider and study the standards the standards of equipment and technologies, it will facilitate the interworking, the implementation and boost up the scale. In the same time, standards bring down the cost of materials.

CONCLUSION

Thailand is under the implementation of Digital Economy and ICT Policy 2020 Framework of which Smart Agriculture is a key strategic area. Smart Farm Technologies are main players to achieve that target. This study selected the farmers in Tanud Subdistrict to explore the possibility to deploy such technologies because these farmers face the threats from the competitors especially from China. They do need to find the new way in doing business. This study just surveys to learn whether they have the attitude in adopting Smart Farm Technologies. It has been proven that they agree upon the hypotheses. This report also uncovers other population besides farmers have positive to the Smart Farm Technologies implementation. Finally, recommendations for further studies and strategies to government and related units are provided.

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