Chapter 8
Acceptance and Readiness of Thai Farmers Toward Digital Technology

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Abstract Recently, mobile applications have been continuously released in the market to solve the consumer problems. In agribusiness and farming, the Ministry of Agriculture and Cooperative proposes AgriMap mobile application (AMMA) that provides integrated information to help farmers in deciding which plant they should grow in certain areas. This paper conducted a random survey with 727 farm households in Ang Thong province in May 2018 within three districts (Phothong, Wisetchaichan and Samko). This study analyzes the digital literacy of the farmers via skills, understanding and usage of social media applications including AMMA. Technology acceptance model (TAM) was applied to capture the attitude and perception of the farmers. The influence of society and behavioral intention, which contributes to the acceptance of digital technology, on Thai farmers was also included. This study found that the majority of farmers have smart phones, but less than 30% uses social media and only 10% of the farmers know AMMA. Although the farmers show positive attitude and perception toward using digital technology, the adoption rate of social media and other applications is still significantly low. This comparative analysis indicates the conflict between acceptance and readiness aspects in Thai farmers. Therefore, other supportive approaches should be involved to promote the usage of digital technology in Thai farmers.

8.1 Introduction

In 2017, Thai government initiated a policy to transform the country toward digital era. This policy extended Industry 4.0 concept and was called Thailand 4.0. It has

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been cascaded through all government service units and has stimulated the awareness of Thai society. To steer forward this flagship 4.0, one interpretation is to develop applications or platforms (web-based or mobile-based). This also raised the expectation of creating big data in the purposes of analytics and forecasting. Turning to Thai farmers' aspect, the transformation has been slowly progressing due to certain limitations. One reason is that the Thai farmers are aging people (over 50 years old) who might not consider digital transformation as necessary. On technological aspect, telecommunication infrastructure in Thailand is striving toward digital age as 4G mobile network has been 100% implemented in metropolitan area and being expanded aggressively to remote areas. Considerably, the availability of technology might influence those aging farmers to transform their behavior, that is, throw away their analog or 2G mobile phone and shift to use smart phone instead. However, there is not any guarantee for this change.

Turning to the aspect of smart phone consumer in Thailand, it has been changed constantly due to the convenience of owning smart phone (average ≥ 1 smart phone per person in Bangkok) and high-speed internet access via 4G network. Peoples' behavior change can be obviously observed by looking at the number of audiences of TV shows compared with the number of views of shows on YouTube. This example emphasizes the growing interaction between human and technology. Radically, consumers have recognized their right in choosing not to receive information, in which they are not interested. People will then just swipe through the next news feed or press the next button to view the next video [4].

This phenomenon has drawn attention from both individual and business to apply and use digital technology. One of the main purposes of individual is, of course, for self-entertaining, while an obvious purpose for business is to engage customers. According to the digital aspect, the core element is "ecosystem", which most individual and business use and participate their particular purposes. An instance of ecosystem might be, in other words, called a "platform". For smart phone, there are two major platforms that play dominant roles in the market. They are "Android" from Google Inc. and "iOS" from Apple Inc. In these platforms, application (or we may call "app") is the most crucial element in each platform to serve the consumer demands [1, 5].

According to the popularity of smart phone and the use of apps in daily life, most government organizations (i.e. the Ministry of Agriculture) view this as an opportunity to achieve their mission, in which one of the missions is to support Thai farmers. There are applications in the market, that is, "Know Land", "Fertilizing Calculator" and "Agri-Map Mobile Application (AMMA) and so on. In this paper, AMMA will be mainly focused. AMMA is an agricultural map application that offers integrated data from various sources, that is, the department of land development, the department of agricultural support, and so on. For example, this app synthesizes soil information, area-based weather by introducing constant update and analytical interface. The government unit which offers this app expects Thai farmers to use the app features in making more accurate decisions on plant planning. However, AMMA has yet to properly be introduced to the farmers. Owing to the competitiveness in the smart phone ecosystems, consumer has been bombarded with newly introduced

apps every day. It has been more difficult for users to choose an app to serve their needs. To obtain user awareness and acceptance for an app, there are tools, tasks and activities to be implemented. For example, customer acquisition and activation processes in AARRR matrix [9] will be useful in helping to promote AMMA to Thai farmers or to predict the intention usage of AMMA.

8.2 Research Model

In exploring this phenomenon, technology acceptance model (TAM) [2, 10] was applied to evaluate the intention to use AMMA in connection with attitudes and perception of Thai farmers. Subjective norms were also included in the model due to Thai society considered as collectivism. According to TAM, perception was measured in aspects of usefulness, ease of use and result demonstrability. The structural model (adapted from TAM) is shown in Fig. 8.1. The model also illustrates the relationship between constructs and can be presented in the list of hypotheses as follows.

– **H1**: Attitudes toward using AMMA has influence on intention to use AMMA.
– **H2**: Subjective norms have influence on intention to use AMMA.
– **H3**: Perceived usefulness has influence on intention to use AMMA.
– **H4**: Perceived ease of use has influence on perceived usefulness of AMMA.
– **H5**: Result demonstrability of AMMA has influence on perceived usefulness of AMMA.
– **H6**: Attitudes toward using AMMA mediates the relationship between perceived usefulness of AMMA and intention to use AMMA.
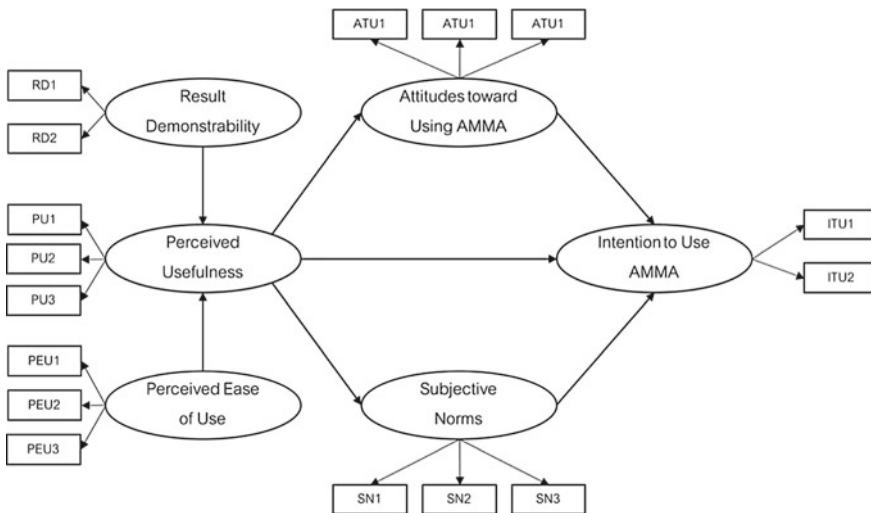

Fig. 8.1 Structural model demonstrates intention to use of AMMA for farm management

– **H7**: Subjective norms mediate the relationship between perceived usefulness of
AMMA and intention to use of AMMA.

8.3   Method

This research collected data using survey approach with random sampling technique
in 2018. A total of 727 farming families were visited in three districts in Ang Thong
province (Phothong: 469, Wisetchaichan: 148, Samko: 110), of which 64.6% respon-
dents were female; 33.9% of respondents were in the age between 51 and 60 years
and 30.9% were in the age between 61 and 70. Interestingly, 56.0% of them possess
highest education as grade 4.

8.3.1   Questionnaire Instrument

The questionnaire consists of four parts. Part one includes demographic questions;
part two includes questions assessing digital skills and technology possession, that is,
smart phone, tablet or laptop. Digital skills include awareness, perception and use of
popular social media apps, that is, Facebook, Line, Twitter, Instagram and Whatsapp
categorized by three levels (aware and use, aware but never use and no aware). Part
three assesses the acceptance of AMMA using TAM question items: two items assess
intention to use AMMA, three items assess perceived usefulness, three items assess
perceived ease of use, three items evaluate attitudes toward using AMMA, three items
question subjective norms and two items obtain result demonstrability. All items in
part three were obtained using 5-point Likert scale. Part four assesses awareness and
use of chosen 10 agriculture apps: (1) Project plants, (2) Digital farmer, (3) Know
land, (4) Farmer info, (5) Fertilizer usage calculator, (6) Thai farmer, (7) OAE Agri-
Info, (8) Rice production technology, (9) WMSC and (10) Go forward by the division
of academic farming categorized by three levels (aware and use, aware but never use
and no aware).

8.3.2   Data Analysis

This paper uses descriptive statistics (in the form of percentage, frequency and aver-
age) to summarize the trend of using AMMA. The analysis also includes the influ-
ence of psychological factors on intention to use AMMA, that is, attitudes of farmers
toward using AMMA, perception of usefulness and ease of use of AMMA, including
result demonstrability according to support farm management aspect. Those factors
were tested and analyzed by using confirmatory factor analysis (CFA). The purpose

of applying CFA in this analysis is to evaluate the relationship between observed variables and also mediating effects. Then, the identified relationship will be used to create the structural model according to the structural equation modeling (SEM) technique (see path diagram in Fig. 8.1). The model includes six TAM constructs: intention to use, attitudes, subjective norms, perception of usefulness, ease of use and result demonstrability of AMMA. Both CFA and SEM analyses apply maximum likelihood estimation (MLE) as the main estimating technique. Five indexes, that is, Chi-square, goodness of fit index (GFI), Tucker–Lewis index (TLI), comparative fit index (CFI) and root mean square error of approximation (RMSEA) were used to access the fitness between the structural model and the survey data, which indicate the validity of the structure model. Hair [6] suggests thresholds for the analysis with large sample size and observed variable between 12 and 30 variables. Those thresholds are Chi-square ($p < 0.05$), GFI, CFI, TLI > 0.95 and RMSEA < 0.05, indicating a good fit model.

8.4   Results

The result of the survey indicates digital literacy and digital technology usage (Line, Facebook, Twitter, etc.) of 727 Thai farmers in Ang Thong province in Thailand. The results show that 64.4% possess smart phone but only 8.3% possess tablet, 12.1% own laptop computer and 18.3% have desktop computer. The purpose of having tablet, laptop or desktop computer is mainly to support their children's education. Although more than half of the respondents possess smart phone, still less than 30% use social media app. Line app is the most used app (26.3%) followed by Facebook app (23.8%).

Table 8.1 indicates that the number of farmers who are aware and use social media app is not different from the number of farmers who are aware of social media but never use the apps. Surprisingly, 50% of the respondents do not know Line or Facebook apps, which was significantly different by 99% confidence (Pearson's

Table 8.1 Frequency of smart phone possession, awareness and use of Line, Facebook and AMMA applications

Smart phone	Aware and use	Aware but never use	Not aware	Total
No	Line = 12 Facebook = 10 AMMA = 1	Line = 50 Facebook = 50 AMMA = 20	Line = 197 Facebook = 199 AMMA = 238	259
Yes	Line = 180 Facebook = 162 AMMA = 8	Line = 123 Facebook = 136 AMMA = 47	Line = 165 Facebook = 170 AMMA = 413	468
Total	Line = 192 Facebook = 172 AMMA = 9	Line = 173 Facebook = 186 AMMA = 67	Line = 362 Facebook = 369 AMMA = 651	727

Chi-square [degree of freedom (df) = 2] = 134.5) and the number of samples who possess smart phone is significantly different from the number who do not possess smart phone at 99% confidence (Pearson's Chi-square (df = 2) = 129.5). For the perception and use of AMMA, the results show that only 76 farmers were aware of AMMA, which was 10.5% of overall samples. Furthermore, nine farmers have used AMMA. According to the Chi-square test, it indicates the number of farmers who possess smart phone and who are aware is not different (Pearson's Chi-square (df = 2) = 3.07), see Table 8.1.

The evaluation of theoretical constructs found that attitude toward using AMMA is the only high influential factor, while other constructs: perceived usefulness, perceived ease of use, result demonstrability, subjective norms and intention to use have medium influence (see Table 8.2). When we consider mode values of intention to use AMMA of the farmers, the value is low (21.05%), while perceived usefulness, result demonstrability and attitudes toward using AMMA show high mode values. This indicates positive perception and attitudes toward using AMMA, which possibly increase intention to use AMMA, as shown in Table 8.2.

When conducting factor analysis, modification indices threshold more than 10 was used as a criterion for model improvement and factor loading more than 0.5 was the criteria for including each theoretical construct accordingly. The result from Chi-square test is 272.8 with 81 df, which indicates that the model is significantly acceptable with 99% confidence (Chi-square = 272.8, df = 81; p = 0.00). The index values are GFI = 0.957, TLI = 0.98, CFI = 0.987 and RMSEA = 0.056, which were acceptable as recommended by Hair [6]. This confirms that the measurement model from factor analysis statistically fits with the empirical data and is appropriate for further developing the structural model.

Next, the SEM analysis indicates that Chi-square value of the model is 207.65 with 81 degree of freedom with 99% confidence (Chi-square = 207.65, df = 81; p = 0.00). The index values are GFI = 0.968, TLI = 0.987, CFI = 0.991 and RMSEA = 0.046, which confirm that this structural model for the factors predicting intention to use AMMA statistically fits with the empirical data. For hypothesis testing, the results show that perceived usefulness of AMMA does not influence the intention to use AMMA (H3: b = −0.046, p = 0.548). This confirms the mediating role of attitudes and subjective norms (H6, H7), which show positive effects toward intention to use AMMA. It is also found that subjective norms have higher parametric value

Table 8.2 Mean, mode and evaluation of TAM constructs

Construct	Mode (average %)	SD	Evaluation*
PU	4 (34.58)	3.31 (1.08)	Medium
PEU	3 (21.90)	2.85 (1.08)	Medium
Result demonstration	4 (26.30)	3.00 (1.20)	Medium
Subjective norms	2 (21.05)	2.78 (1.11)	Medium
Attitudes	4 (26.57)	3.38 (1.09)	High
Intention to use	1 (28.04)	2.43 (1.23)	Medium
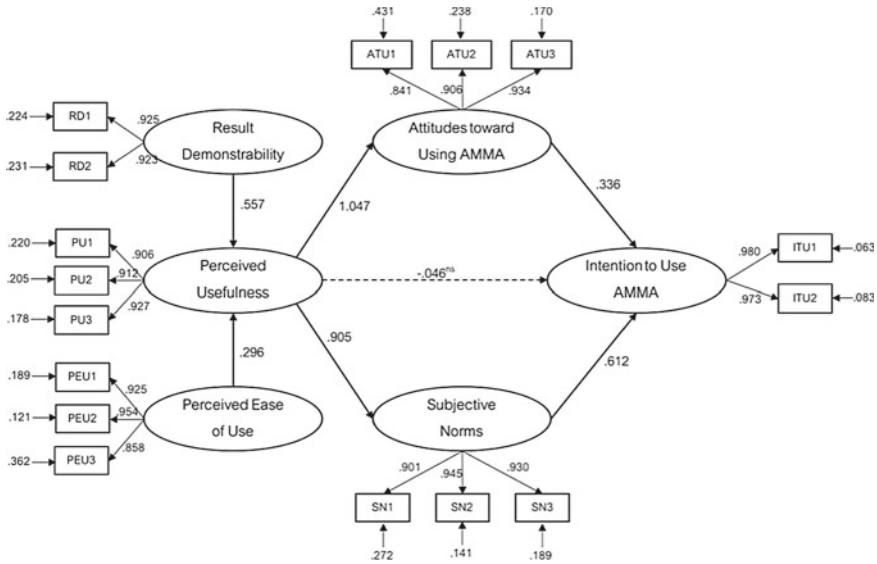
Fig. 8.2 Standardized regression weight of constructs influencing intention to use AMMA for farm management (——▶p < 0.01, - -▶p > 0.1)

than attitudes. When considering indirect/mediating effects, perceived usefulness has highest influence, followed by result demonstrability and perceived ease of use (see Fig. 8.2).

In addition, other apps considered for farm management, that is, Thai farmer (5.7%), WMSC (4.4%) and Go forward by the division of academic farming (3.2%), result in lower awareness compared to AMMA. The reason why farmers do not use or are not aware of these apps might be lower possession of smart phone and tablet. This indicates gap between farmers and technology access (digital divide) [8]. Moreover, farmers raise an issue on the difficulty of using AMMA during the demonstration, although they perceive the benefits of AMMA.

8.5 Conclusion

This study investigates the digital skills of Thai farmers, and the result shows gaps in farming industry. To achieve Thailand 4.0 as mentioned in the introduction section, there is a need in the improvement policy to help effectively transform attitudes and acceptance of digital technology toward sustainable development of Thai farming industry. There are recommendations for further study. Social influence seems to be a dominant factor to stimulate intention to use AMMA or other agri-apps. Design theories related to behavior change should be involved to help promoting digital transformation to Thai farming industry [3]. Furthermore, effective marking

tools/techniques should be included, that is, influencer [7] to foster the adoption of newly introduced technology.

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