Adoption of Thai rubber Smallholders' household on the use of ICT: A case of Southern Thailand.

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Abstract
Rubber is one of economic crops which create high economic values for Thailand apart from rice. Under the uncertain socio-economic and environment situation, governments have attempted to overcome some of the perceived information failures related to production via agricultural extension services for example technology transfer program, e-service and e-library. Thailand is still very young in term of Information and Communication Technology (ICT) adoption in agricultural sector, however. This study aims to examine empirically whether socio-economic variables and farmer's perception have a systematic link with the adoption of ICT service by employing the Technology Acceptance Model (TAM). Data were gathered from a distributed questionnaire in the South of Thailand during December -May 2014 made up of 264 small rubber farmers. The findings reveal the socio-economic variables have indirect effects on the ICT adoption via the perceptions on rubber smallholders household. The significant perceptions are perceived of usefulness, perceived quality, social influence and facilitating condition. Possible policies to promote more ICT adoption among rubber smallholders were also discussed.

Keywords: ICT adoption, Perceived usefulness, Perceived quality, Rubber smallholders, Thailand

Introduction

Agriculture can serve as an important engine for economic growth in developing countries. Among economic crops, rubber is one of them which create high economic values for Thailand apart from rice. At the end of 2011, Thailand is the world's largest producer of natural rubber (OAE, 2011) and also the world leader in rubber wood production and export. Moreover the rubber plantation area has been increasing in Thailand and plantations have started to spread from the South to new areas in the East and Northeast of Thailand. The rubber plantation area in Thailand is much larger than the area of forest plantations in the country. According to OAE (2011), the total area of rubber plantations in Thailand was 3,001,760 hectares (ha) in 2011. Majority of rubber farmer is a smallholder and has small rubber plantation which is 95% of total rubber plantation in the country (RRIT, 2010). The Department of Agriculture (DOA) of Thailand has classified smallholdings, medium-sized holdings and estates as those where rubber area is less than 8 ha, 8-40 ha and more than 40 ha, respectively (Pratummintra 2005). Specifically, the smallholding is usually family-owned, managed by the family head and worked by family labour, whereas the medium-sized holding and estates are frequently owned by a company or a government enterprise, and usually professionally managed.

In recent years although latex is still the main product of rubber plantation, wood selling can increase the total productivity and enable reaching a maximum productivity of the rubber plantation earlier. Regarding productivity in the wood industry, there has been rapid growth in the value of rubber wood, which has generated into an industry in its own right (Watcharakuldilok & Vitayaudom, 2008). However, under the uncertain socio-economic and environment situation such as rubber price and climatic variation are effect on rubber product and production change of rubber smallholders household that goal for increase their income and also, negative effect on farm management as labor constraint in both quality and quantity high cost of input factor. The rubber smallholder is intensively supported by the government, in forms of technology and production inputs such as seedlings, land preparation and fertilizer. Moreover, the governments have attempted to overcome some of the perceived information failures related to adoption via agricultural extension services, i.e. technology transfer program, e-service, e-library and etc. Thailand is still very young in term of ICT adoption in agricultural sector, however.

Bailee, Chockchaisawadee, Putthongsri, Jitthaisong and Bailee (2008) showed that the most common form of ICT use by a Thai rubber planter was to access news and information from traditional media such as television and radio. Nikomborirak and Pongsukcharoenkul (2011) also confirmed that productivity of the agricultural sector is low due to four main factors including deteriorating soil quality, an insufficient water source, a suboptimal scale of operation and logistics cost. In each product supply chain case, ICT is applied to enhance the productivity or cut production costs borne by farmers. The water management case does not focus on the use of ICT in any specific agricultural supply chain but rather, illustrates the use of ICT to improve the management of agricultural production.

Considering ICT using by region in 2012, the proportion of using computer, Internet and mobile phone, Bangkok had the highest proportion of computer users at 51.5% and next was the Central region with 35.2%, Southern region with 32.0%, Northern region with 31.6% and Northeastern region had the lowest with 29.1%. For the using

of Internet, Bangkok also had the highest proportion of users at 44.4% and the second region was the Central region at 27.5 Southern region at 25.5%, the Northern region was 25.0% and the Northeastern region had the lowest proportion at 21.5 %(NSO, 2012). NSO reported also indicated that there are gaps between people who work in agriculture industry and other industries in term of using computer and internet usage. Considering possession of mobile phone, Bangkok had the higher percentage of mobile phone owner (80.0%) while Southern and Northern region had 67.8% and 64.1% respectively.

Another important step is education in the use of ICT and according to Nikomborirak and Pongsukcharoenkul (2011), almost 85% of Thai farmers have only completed primary education. Which such little education, Thai farmers are easily exploited by the middleman or other parties in the supply chain. For example, rubber is sold in multiple forms and the determination of its prices depends upon a multitude of factors. The information on prices is often passed down the value chain and cheating is easy during this process but according to De Silva and Ratnadiwakara (2008), mobile telephony can really help make farmers better off.

Hence, this study aims to examine empirically whether socio-economic variables and farmer's perception have a systematic link with the adoption of ICT services, in particular mobile phone, by employing the Technology Acceptance Model (TAM) model. The findings should be of interest both to academics and practitioners. From a theoretical perspective, this study provides a model for identifying antecedents of user intentions as a contribution toward the larger effort to adopt ICT in agricultural sector. From a practical standpoint, the findings should guide an industry that is promoting the ICT as a tool to attract farmers by enhancing usability and accessibility, as well as ensuring quality. The findings will offer insights into the implications of farmer's adoption of the ICT as a tool in their job. Government and policy makers are facing opportunities as well as challenges in developing new forms of ICT in order to promote more ICT adoption in agricultural sector.

Prior studies

There are various competing theories for technologies acceptance in extent literature that are used by information system researchers to assess the user's intention to adopt new technology. Among different models that have been proposed, Giovannis et al. (2012) noted that the technology acceptance model (TAM) suggested by Davis (1989) is the most widely used model for three reasons. First, it is focused specifically on information system use; second, it is based on social psychology theory; and third, it shows parsimony and empirical support from various studies. TAM is adaptation of the theory of reasoned action (TRA) by Fishbien and Ajzen (1975). The key purpose of TAM is to provide a basis for tracing the impact of external variables on internal beliefs, attitudes and intentions. It suggests that perceived ease of use (PEU), and perceived usefulness (PU) are the two most important factors in explaining system use (Legris, Ingham & Collerette, 2003).

Flett et al. (2004) sought to determine whether the TAM could adequately explain adoption and use of dairy farming technologies. Their finding revealed that perceived usefulness (PU) and perceived ease of use (PEU) are significantly greater for farmers using technologies compared to those that are not. Similarly, De Silva et al. (2011) showed that that people at the Bottom of the Pyramid (BOP) are intend to disconnect

if they do see as much economic benefit arising from access to telecom. There are many costs and burdens for the BOP in the agricultural sector. De Silva and Ratnadiwakara (2008) also found that the total transaction costs are 15 percent of total cost that smallholder vegetable farmers in Sri Lanka confront with. They showed that if the farmers use ICT by simple phone call, the transaction cost would reduce substantially. Pick et al. (2013) employed TAM framework to understand factors that influence adoption and use of information technology by farmers. Their results support the dimensions suggested by Rogers: relative advantage, compatibility, low complexity, and observability, while also supporting the TAM factors of usefulness and ease of use. However, Wijerthna (2011) noted that despite the farmer had access and familiar with the telephone, their level of awareness on various existing telephone based agrarian service was low.

Venkatesh et al. (2003) developed the Unified Theory of Acceptance of use of technology (UTAUT) model to explain user intention to use an information system and subsequent usage behavior. Regarding to UTAUT, performance expectancy, effort expectancy, social influence and facilitating conditions are the key determinant factor of usage intention and adoption. At the same time demographic factor (age, gender, experience and voluntariness of use) are mediating factors in the impact of usage intention and adoption. van Biljoin and Kotzé (2008) employed the UTAUT model to examine the mobile adoption. They concluded that mobile adoption is influence by demographic, social, cultural and contextual factors.

Zhou (2012) utilized the UTAUT and privacy risk, to examine user adoption of location-based services. The results indicated that usage intention is affected by both enablers such as performance expectancy and inhibitors such as perceived risk. Lai and Lai (2014) employed a technology acceptance model for m-commerce with five factors is constructed. The acceptance of m-commerce is influenced by factors including performance expectancy, social influence, facilitating conditions and privacy concern; while effort expectancy is insignificant in this case. In additional, Touray et al. (2014) identified relevant elements of Internet adoption at the user level in The Gambia through UTAUT. Their results suggested that Internet adoption at the user level in The Gambia can be viewed as a three-layered pyramid. It consists of seven moderating factors (age, gender, experience, voluntary use, friends' influence, Internet service providers and regulators), four indirect determinants (performance expectancy, effort expectancy, social influence (SI) and facilitating conditions (FC) and three direct determinants (education, behavioral intention and income).

Moreover, infrastructural support or perceived of quality (PEQ) is also another important factor which confirmed by the study of Shin (2012). The intention to accept a new technology is determined by users' perception on relevant quality variables (call, service, mobility and coverage). Thus, the perceived of quality will also be examine in this study.

In sum, the prior studies show that TAM and UTAUT provide an extremely useful theoretical tool for understanding how peoples' technology acceptance level impacts their intention to use. There have been various model developed for integrating TAM. TAM has gained popularity across sectors, but there is a gap for applying TAM in agriculture sector. This study will discover the adoption of ICT, in particular mobile telephony, by investigating ICT usage among rubber smallholders as a case.

From the theoretical and empirical background, the research model, that aims to examine empirically whether socio-economic variables and perceptions have a systematic link with the decision of rubber smallholders household on ICT adoption by integrating the TAM model and UTAUT model is illustrated in Figure 1.

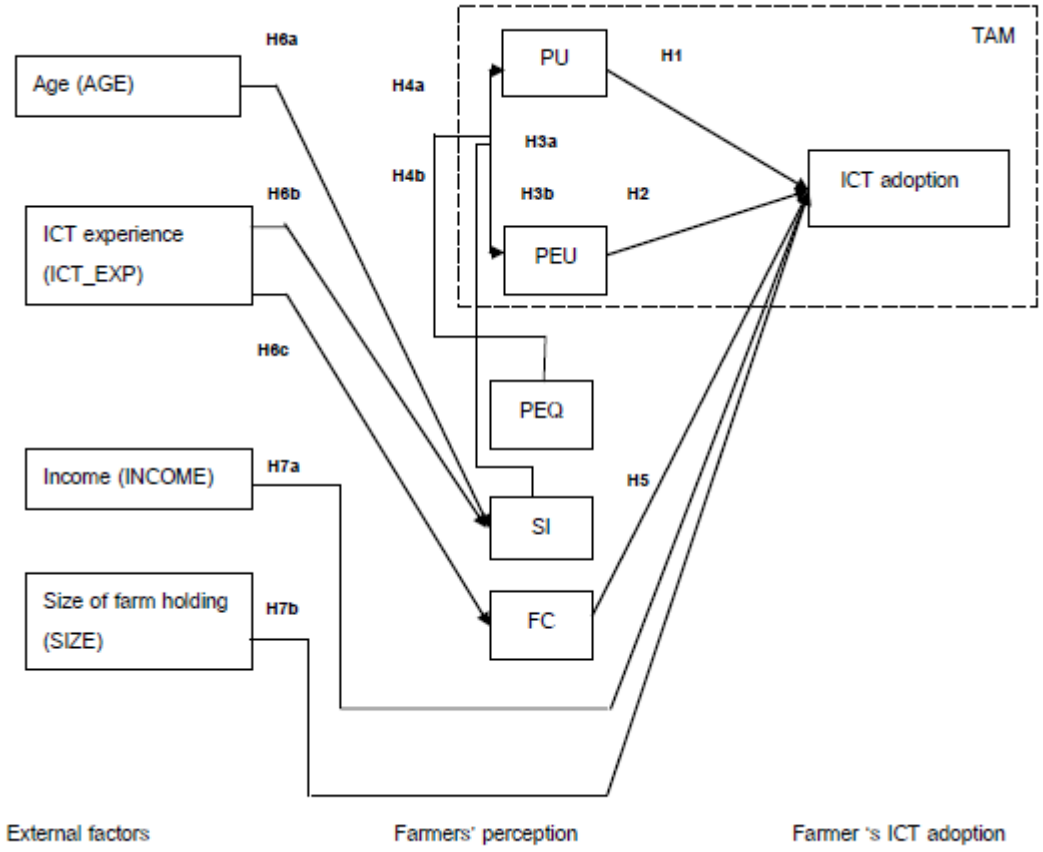

Figure 1: Framework of the study.

Data and method

This study employed the quantitative researcg method. Data was collected from the rubber smallholder's household in three province provinces (SuratThani, Songkhla and Nakorn Si Thammarat) in the South of Thailand. The total distributed questionnaire is 435 samples. A survey was conducted through a semi-structured interview. During the survey questionnaire was comprised of three components, which are a) socio-economic factor, b) experience in using ICT and c) ICT perception and acceptance of rubber farmers.

The Likert scales (1-5), with anchors ranging from "Strong disagree" to "Strongly agree" were used for all belief items to ensure statistical variability among survey responses for all items measured. A questionnaire was designed, measured the reliability and consistency, and distributed to collect data from the small rubber farmers in the selected provinces in the South of Thailand through a semi-structured interview. Finally, 264 usable, complete responses were obtained or 61.0 percent for response rate.

Findings

The survey results show that there are three main services available for respondents and the main ICT service that rubber smallholder's household access most is the mobile phone (98.1.0 percent) and followed by Internet (14.0 percent) and fixed telephony (11.4 percent) respectively. Respondent has a same degree of usage experience both fixed telephony (6.8 months) and mobile telephony (6.9 months), while the experience on Internet usage (4.5 months) is less than those two services. The overall experience of ICT usage among small rubber farmers is 7.9 months.

Overall of adoption on ICT attributes is low. Findings present that rubber farmer rarely uses the ICT services related to their farming activities. Interestingly, the attributes that rubber farmer uses most on average are exchanging information with other farmers and followed by searching the price of product from a middleman and following product price. At the same time, they never or rarely use attribute on getting and searching news on agriculture technology from government agency and followed by contacting and exchanging information with the government office and following input price.

This study employs a path analysis with the framework of TAM to develop a model that represents the relationship of external factor and farmers' perception toward ICT adoption among the rubber smallholder households. The final fit model is presented as shown in Figure 2. Figure 2 shows that the external factors which have influence on the ICT adoption are age, ICT usage experience and farm size. These factors reveal indirect influence the ICT adoption through the perceptions on rubber smallholders household. The significant perceptions are PU, PEQ, SI and FC.

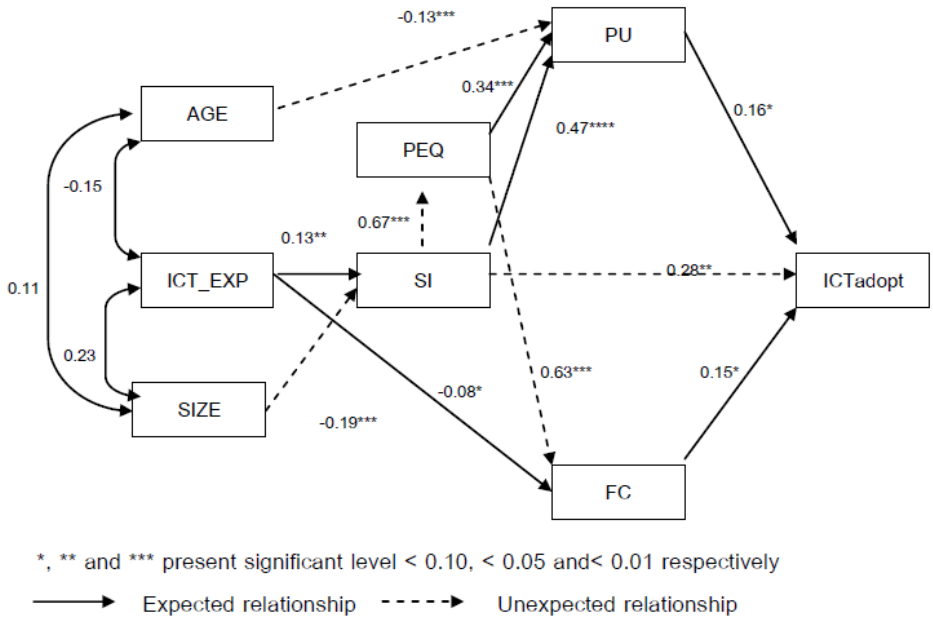

Figure 2: Findings of the study

Discussion

The results of this study consistent with previous studies on technology adoption, the findings show that perceived usefulness (PU) has a considerable impact on ICT

adoption (Flett et al., 2004; Aubert et al., 2012). In particular, it is demonstrated that this variable is greatly influenced by age of rubber farmer, PEQ and SI as confirmed by Shin (2012).These reflect that the effect of PU and perceived quality (PEQ) and social influence (SI) are found to be valid and significant in the study. In addition, facilitating conditions (FCs) also reveals its role on ICT adoption in the study which is similar to the study by Jain and Hundal (2007) and Seneler et al. (2008). The result warrants a consistent model for the drivers of ICT adoption among rubber farmers.

Some of the pre-setting hypotheses do not show the relationship as expected, for example, the relationship between PEU and ICT adoption, PEQ and PEU, and SI and PEU. This may due to the ICT service that majority of rubber farmer use is the mobile telephony. The mobile service is not complicated to use in terms of skilled needed as compared to Internet. Rubber farmers can learn by himself or consult with their friends. Moreover, income and size of farming holding did not have influence on ICT adoption as the literature suggested. One possible reason could be the cost of using mobile phone is not expensive. Age and income may not a main obstacle to adopt the service. While the size of farm holdings has no relationship directly with ICT adoption as earlier research established (Yengoh et al, 2009; Poolsawas & Napasintuwong, 2013; Kakuru et al., 2014), but it has indirect influence through other variables.

Interestingly, there are unexpected relationships from the path analysis. Firstly, the relationship between AGE and PU which shows that age has a negative direct effect on perceived usefulness. This refers that the younger rubber farmer, the greater perceived usefulness of ICT service. This will also impact the ICT adoption. Secondly, size of farm holding has negative influence on social influence (SI). This may imply that rubber farmer who owns a smaller size of the rubber farmers need more supports from their society, including friend and colleagues. Thirdly, the impact of SI on perceived of quality (PEQ) shows positively significant relationship. This suggested that PEQ, i.e. call, service, mobility and coverage, is determined by social influence of user. Friends or colleagues can provide a suggestion on the ICT service that suite farmer needs. Fourthly, PEQ has the positively significant impact on facilitating conditions (FC). This may indicates that farmer still needs the facilitating means in order to adopt ICT service though the quality of service is good. Lastly, SI has the positively significant effect on ICT adoption. This suggests that the ICT adoption of the rubber farmer depend on friend and colleagues. It may reflect the network effect phenomena. If farmer uses the service under the same service provider, the more valuable the service is to each owner.

Considering the significant variables, the role of policy makers and regulator are needed. The government together with related units needs to encourage and support for ICT usage among farmers. This support will make rubber farmers realize that using ICT service will help them to gain higher performance if they use the useful related applications. Availability of ICT service through the public community shared can be another alternative. In terms of accessibility, farmer will adopt more ICT service if the facilitating environment is well-provided. Training course on ICT knowledge and technology could be one of the examples. In addition, Elderly farmer needs special assistance on using ICT. Hence, the facilitating conditions are important in this case. At the same time, regulator also plays an important role to guarantee the quality of service and to protect consumer interests through promoting fair, efficient

and sustainable network competition. Findings confirm that quality of service is a crucial factor for adoption, though it has an indirect effect on ICT adoption in this case. Regulator should be well-prepared to address and consider the following issues; signaling network coverage, changing of price plan without notification, Internet speed guarantee. This will ensure that ICT adoption is beneficial to rubber farmer**.**

Conclusion

This study aims to examine empirically whether demographic variables and farmers' perception has a systematic link with the decision of rubber smallholders household on ICT service adoption by integrating the TAM model and UTAUT model. The questionnaires are distributed to collect data from the small rubber farmers in the selected provinces in the South of Thailand through a semi-structured interview during December 2013-May 2014.Completed questionnaire were 264 or 61.0 percent for response rate. Path analysis are utilized for hypotheses testing.

Findings show that the external factors which have influence on the ICT adoption are age, ICT usage experience and farm size. These factors reveal indirect influence the ICT adoption through the perceptions on rubber smallholders household. The significant perceptions are perceived of usefulness, social influence, facilitating condition and perceived of quality. These factors affect the ICT adoption among rubber farmers. Government need to consider the possible policies to promote more ICT adoption among rubber smallholders.

Future research is also needed to fulfill the knowledge in this study. Availability of longitudinal data is necessary and will be benefit or future research. It offers an opportunity to gain a deeper understanding. This study provides the overview picture of ICT adoption, which mainly represents mobile adoption. Future study could elaborate more on this issue by focusing on specific service such as mobile Internet. The mobile Internet can be considered as an emerging technology which may suit with the lifestyle of rubber the farmers rather than other technologies.

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