CHAPTER 1

INTRODUCTION

In recent years the agricultural sector has attracted new attention after years of underinvestment. It has been acknowledged that agriculture is not only important for food production and therefore food security but also for the overall development of certain countries. It can contribute significantly to pro-poor growth, having a four times higher effectiveness of raising incomes than other sectors (The World Bank Group, 2011, p. 3). As a result, governments and international organisations started to strongly support and promote investments in agriculture, particularly for small-scale farmers[1], who build the majority in the agricultural sector and are often among the poorest in the world. In Africa and Asia alone, farms with less than ten hectares are already responsible for 80 percent of the food production (Food and Agriculture Organization of the United Nations, 2013). Smallholder farmers can contribute significantly to solving one of the biggest problems agriculture is currently facing, feeding a growing population under the aspect of declining natural resources and a changing climate. However, small-scale farms are often characterised by limited financial capacities, a low level of mechanisation, irrigation, and input use as well as traditional cultivation methods and a dependency on family labour, resulting in low productivity and profitability (Brugger, 2011). Furthermore, smallholders are often located in remote rural areas with underdeveloped infrastructure, insufficient property rights, and poor market access. Addressing these problems is crucial for a social, ecological and economically sustainable development of the agricultural sector. One part of the solution to improve productivity and profitability of small-scale farmers is to provide them with information and knowledge, as agriculture, in general, has become a more time-critical and information-intensive business (Brugger, 2011, p. 4).

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[1] Small-scale farms are defined different by various organisations and governments. The land size can thereby vary between 1.6-3.2 hectares. According to Amekawa (2016) the Land Reform Office of Thailand refers to small-scale farms as farms operating less than 3.2 hectares (20 rai). In the international context small-scale farms are mostly defined as farms cultivating land of less than 2 hectares (12.5 rai). As there is no clear definition this paper will follow the suggestion of the Land Reform Office of Thailand, as the definitions are often influenced by national characteristics. If used otherwise, it will be stated in the text.

Traditionally information and knowledge are provided to farmers through agricultural extension by governmental agencies or educational institutions. However, it often misses to adress the specific needs of individual farmers at a certain time. Additionally, agricultural extension is often underfinanced and understaffed. Therefore, over the last two decades information and communication technologies (ICTs) have become a popular choice for the dissemination of agricultural information and knowledge. In the beginning, projects have been implemented using television and radios to reach a broader population, but they have not been able to provide information tailored to the individual's need. However, new opportunities are given by the unique and rapid technological development in this sector. Nowadays, mobile devices are one of the best tools to overcome information gaps and asymmetries in the agricultural sector. Furthermore, the development and introduction of smartphones in 2007 has significantly influenced the way people life and work by combining powerful mobile devices with mobile internet access. By the end of 2015 over 7 billion mobile phone subscriptions[2] and 3.2 billion internet users[3] have been recorded, compared to 738 million and 400 million in 2000, respectively (International Telecommunication Union, 2015b). Almost every sector has been impacted by this development resulting in higher productivity, efficiency, and profitability. While a decade ago such technology was limited to developed countries, increasing accessibility and affordability have made it available for people in developing and emerging economies. Although smartphones are still predominant in developed countries and basic phones mainly in developing economies, it is estimated that the next wave of smartphone users will come from rural or remote areas (Ericsson, 2015, p. 2), which includes the majority of the agricultural community. The use of smartphones can thereby have a significant impact on the future agricultural development. Despite the fact that smartphones are a relatively new phenomenon in agriculture, there are already numerous applications targeting different

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[2] Refers to the subscriptions to a public mobile telephone service and provides access to Public Switched telephone Network (PSTN) using cellular technology, including number of pre-paid SIM cards active during the past three months. This includes both analogue and digital cellular systems (IMT-2000 (Third Generation, 3G) and 4G subscriptions, but excludes mobile broadband subscriptions via data cards or USB modems. Subscriptions to public mobile data services, private trunked mobile radio, telepoint or radio paging, and telemetry services should also be excluded. This should include all mobile cellular subscriptions that offer voice communications (International Telecommunication Union (2010).

[3] The estimated number of Internet users out of total population. This includes those using the Internet from any device (including mobile phones) in the last 12 months. International Telecommunication Union (2010).

aspects of agriculture (Hoffmann, Al Askari, Hoang, & Doluschitz, 2014). Connecting mobility with internet access and useful tools such as cameras and global positioning systems (GPS), smartphones can be a powerful tool for sustainable agricultural development.

Several countries already have acknowledged the potential of new ICTs in agriculture and developed ICT frameworks accordingly. In Thailand, the Ministry of Information and Communication Technology adopted a new strategic framework in 2011, called Smart Thailand 2020, promoting the development and use of information and communication technologies across all sectors, including agriculture. "Smart Agriculture" aims to increase the productivity and efficiency while strengthening cooperatives, smallholder farmers, and young farmers. Additionally, the development of a risk and knowledge management system shall reduce agricultural losses and increase the exchange of knowledge together with the participation of farmers (Ministry of Information and Communication Technology, 2011, p. 19).

The number of smartphone users increased significantly over the past years in Thailand, resulting in the development of agricultural smartphone applications[4]. Thereby, the apps are provided not only by governmental agencies but also the private sector which increasingly invests in agriculture, such as the mobile phone provider Total Access Communication PLC. (dtac). In the case of dtac, the application , called "Farmer Info", provides market information and knowledge videos to improve farmers market access and agricultural knowledge to strengthen the overall situation of farmers in Thailand (Total Access Communication PLC., 2014a, p. 2).

This thesis aims to analyse the impact of this application on the livelihood situation and agricultural practices of farmers. Thereby a mix of quantitative and qualitative methods is used, including a survey and in-depth interviews to better cover different aspects arising with new ICTs in agriculture. Following this introduction, a background of the study will provide a better understanding of its purpose and significance but also its limitations. The literature review in chapter two will give a

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[4] https://play.google.com/store/apps/details?id=com.app.moac.appcenter
https://play.google.com/store/apps/developer?id=NECTEC
https://play.google.com/store/apps/details?id=com.trueit.android.farm
https://itunes.apple.com/th/app/farmer-info/id541507104?mt=8

deeper understanding of the subject and lead to the theoretical foundation in chapter three. The methodology used in this thesis is discussed in chapter four, including a description of the research area before the results are analysed in the next chapter. A discussion in chapter six will link the results with the theoretical framework and current research. The last chapter will then provide a conclusion of the results and recommendations for further studies in the field of ICT for agricultural development and extension

1.1 Research Problem

The biggest problem concerning the use of information and communication technologies for agricultural development and extension is that it is a relatively new phenomenon and is subject to rapid changes and developments. Furthermore, despite numerous projects, there has been no conclusive evidence about the positive impact. However, it is inevitable to understand the impact of ICT projects in agriculture. It will help to understand how projects can be scaled up to reach a broader audience and if they address the needs of the target community or have to be adapted to a changing environment. In Thailand agriculture is still important for the national economy and agricultural research has a long tradition. However, knowledge transfer and information dissemination are often neglected or only provided regional to a limited amount of farmers. ICTs offer new possibilities to overcome these problems. The engagement of the private sector, profit or non-profit, can be crucial to the success of such projects, but private investors can fail to analyse the real impacts and benefits of their projects. Therefore it is on the one hand necessary to understand what impact smartphones and their applications can have on farmers, but also to analyse if they meet the needs of the peasants or just provide benefits to the private investors.

1.2 Background of the Study

1.2.1 Thai Agriculture

Thailand is characterised as a "Newly Industrialized Economy", with an average growth rate of 7% over the last decades (Wonglimpiyarat, 2014, p. 466). Although the agricultural contribution to the gross domestic production (GDP) dropped steadily from 36% in 1960, the sector still has a share of approximately 10%. Over the last decade, it

was even growing slightly and still contributes significantly to national labour with almost 42 percent of total employment (The World Bank Group, 2016a). According to the national census in 2013 there were 5.9 million households engaged in agriculture (ca. 25% of all households) with an average area of 19.7 rai (ca. 3.1 ha). Therefore the majority of Thai farmers can be characterised as small-scale farmers. Most of them mainly located in the North and North-eastern provinces of Thailand (National Statistical Office of Thailand, 2013, p. 14). The main crop is rice, with over 50% of the area under cultivation followed by field crops (22.5%) (National Statistical Office of Thailand, 2013, p. 16). However, there are regional differences between the North and the South, where rubber and permanent crops are dominating. A significant amount of the agricultural commodities produced is for export, making Thailand one of the biggest exporters of rice and other produce. Agricultural products make up around 25% of the total export (Singhapreecha, 2014, pp. 1–2).

There has been a positive development in the agricultural sector since the mid of the last century, including crop diversification, production intensification, and a stronger market orientation. However, compared to other countries and regions, agricultural productivity in Thailand is low. Several reasons have been identified such as insufficient water resources, poor irrigation systems, inefficient use of fertiliser, low capital inputs and a lack of research as well as development (Aditto, 2011, p. 23). The low productivity and profitability effects directly the income of a vast number of farmers still living below the poverty line (Aditto, 2011, pp. 20–21). A significant share of those farmers is from rural areas operating small-scale farms with insufficient capital for inputs, a low level of education and unsuitable farming practices. Mono-cropping, heavy use of synthetic inputs and deforestation have contributed to declining yields over years and increased the vulnerability of farmers and their communities to poverty and food insecurity (Kasem & Thapa, 2011, pp. 618–619). Furthermore, unsustainable agricultural practices have resulted in soil erosion, loss of soil fertility, flooding and impacted farmers' health. An information gap and a lack of knowledge, for example in the case of integrated pest

management (Riwthong, Schreinemachers, Grovermann, & Berger, 2015, p. 17), are among the reasons for the current state of Thai agriculture. Therefore the

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development plan for the agricultural sector includes the use of scholars and networks for technology transfer, the integration of technology and local knowledge and the improvement of knowledge and information access on a local level (Jongsakul, 2015, p. 16).

1.2.2 ICT Policy Framework and Use in Thailand

Information and communication technologies are an excellent opportunity to target current problems in Thai agriculture and to develop the sector further. While past ICT frameworks in Thailand mainly focused on the introduction and promotion of new technologies, a new strategic framework was presented in 2011. According to the new framework, "ICT is a key driving force in leading Thai people towards knowledge and wisdom and leading society towards equality and sustainable economy" (Ministry of Information and Communication Technology, 2011). "Smart Thailand 2020" is a vision in which ICT is improving all aspects of Thai society by 2020, including agriculture (see Figure 1).

When first published, the report suggested several areas in the agricultural sector which are crucial for a development towards "Smart Agriculture". The four main areas are, the increase of productivity through ICT, improvement of efficiency, risk reduction and knowledge management (Ministry of Information and Communication Technology, 2011, p. 19). Information and knowledge are two aspects which are highlighted consistently in the report and are seen not only as an important part to promote ICT in agriculture but also as crucial for its development. The framework thereby acknowledges the importance of knowledge-on-demand, specific information for different locations and products, the exchange of information and knowledge and the education of the farming communities (Ministry of Information and Communication Technology, 2011, p. 19).
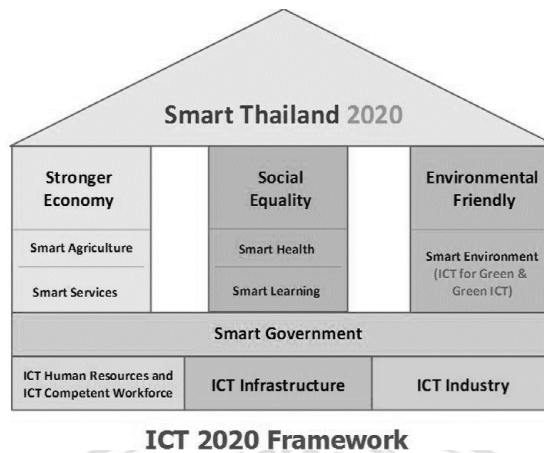
Figure 1 ICT Framework for Smart Thailand 2020

Source: Ministry of Information and Communication Technology, 2011

Although there have been significant changes in Thai politics since 2011, the framework for "Smart Thailand 2020" has been followed up and developed further. Making ICTs basic commodities for the people, improving ICT infrastructure, such as the broadband penetration, and strengthening ICT literacy are some of the key strategies the current government is following (International Telecommunication Union, 2015a). Most recently the government has proposed a new development agenda focusing on a "Digital Thailand" addressing various topics such as the middle income trap, the increase of productivity, the reduction on inequality and preparing for an ageing society (Chamaiporn, 2016). Thereby, the new digital development plan is divided in four phases. The first phase will provide a foundation while the second and third phase will focus on the transformation. At the end of the fourth phase (in 10-20 years) the plan sees Thailand as a developed nation with global digital leadership (Chamaiporn, 2016). Five topics have been identified which were used by the government for the "Digital Economy Master Plan":

a) *Hard Infrastructure*

- *Public-private partnerships for infrastructural development (e.g. expansion of broadband internet)*

b) *Soft Infrastructure*

- *Investment opportunities and confidence in online services*

c) *Service Infrastructure*

- *More online services by governmental agencies*

d) Promotion and Innovation

      - *Business support through the use of ICT by governmental agencies*

e) Society and Knowledge

      - *ICT use for education and provision of online material (Souche, Rueangkul, Sachdev, & Moore, 2015)*

This focus of the current government is a consequence of recent developments in the sector of ICTs in Thailand. Over the past years, a significant share of the Thai population got access to modern information and communication technologies. While the amount of older technologies, such as fixed landlines, televisions or radios is either stagnating or even decreasing, the number of new, in particular, mobile technologies, significantly increased. However, there are still differences between the technologies, the regions and the rural and urban population. Age, the level of education and occupation are other factors determining the use of new ICTs. In 2014 the National Statistical Office of Thailand conducted a survey regarding the use of ICTs in Thai households. According to this inquiry around 77 percent of the total population are using mobile phones with the largest share in Bangkok (89.2%) and the lowest in the Northeast (70.7%). However, only 38.2% of the people in the kingdom are using computers and only 34.95 the internet with only one third through mobile broadband (National Statistical Office of Thailand, 2014b). Although there are differences between the regions and technologies, Thailand has seen a tremendous growth in the area of modern information and communication technologies over the past fifteen years. According to the ITU the mobile phone subscriptions per 100 inhabitants grew from 4.9 in 2000 to 152.81 in 2015 and also the number of internet users grew significantly from just 3.69 percent of the total population to over 39 percentage (International Telecommunication Union, 2016).

1.2.3 Dtac's and Rak Ban Kerd's Engagement in Agriculture

One company which is directly involved in the sector of information and communication technologies is "Total Access Communication Public Company Limited", mainly referred to as "dtac". Dtac is the second largest mobile phone provider with over 23 million subscribers and a market share of around 30% (Total Access Communication PLC., 2016a). As part of their corporate social responsibility (CSR) strategy, dtac uses ICTs to sustainably contribute to society and the environment (Total

Access Communication PLC., 2016a, p. 42). Thereby they have acknowledged the importance of agriculture for Thailand. Not only for the development of the country but also for the livelihood of a large share of the society and the environment. As a result, dtac started to dedicate one part of their CSR campaign towards the farming communities and their development in alignment with the Sufficiency Theory of His Majesty the King[5].

Under the vision of empowering society, Mr Boonchai Bencharongkul, the chairman of dtac, started the project "Samnuek Rak Ban Kerd", or just Rak Ban Kerd Foundation (RBK) in 1997 (Deboonme, 2007). The Foundation is the main partner of dtac in their agricultural engagement. In 2003 dtac in cooperation with Rak Ban Kerd Foundation introduced an SMS-service for farmers and an annual farmers award called "Sam Nuek Rak Ban Kerd Smart Farmer Award" promoting and rewarding innovations within the farming community (Khaled, 2015; Total Access Communication PLC., 2016a, pp. 42–43). Since the introduction of dtac's CSR strategy, it has been developed further following the King's Philosophy of Sufficiency and the ICT framework proposed by the government. Nowadays the project, called "Smart Farmer", not only covers the SMS-based information service and Farmer Award but also includes capacity building and training to promote e-commerce for agricultural products and digital literacy.

In 2013 dtac together with Rak Ban Kerd then introduced a smartphone application, called "Farmer Info" (see Figure 2) acknowledging the rapid expansion of smartphones among society.[6]

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[5] "In this royal statement, His Majesty concerned that modern development which emphasized only the economic expansion might eventually lead the country to crisis. Therefore, he stressed the importance of building a 'good and stable foundation' before further progress could be developed. This means that instead of putting the emphasis on the expansion of the industrial sector prior to development, the stability of the basic economy should be established first, that is, assuring that the majority of rural people have enough to subsist first. This is a method of development that stresses the distribution of income to build the overall economic foundation and stability of the country before going on to a higher level of development" The Chaipattana Foundation (2016)

[6] Appendix 1 will provide further screenshots of the application and the services offered. Farmer Info is an add-on to the previous SMS-service *1677 "Farmer Information Superhighway. It is free of charge to dtac users and provides them with daily prices from selected markets throughout the country and the six main markets in Bangkok. Furthermore farmers can access extension videos and agricultural news as well as an e-commerce platform and cost calculation. Total Access Communication PLC. (2014b, p. 46)

In an e-mail regarding the application Jon Eddy Abdullah, CEO of dtac, stated: "I am confident that dtac will bring even more opportunities for farmers. They can check and compare latest prices so that they can plan ahead when and to whom they should sell their agricultural produce to receive the highest returns. This will certainly lead to a higher standard of living for farmers, which in turn will contribute to the growth of our national economy." (Khaled, 2015). Beside market prices, the application promotes chemical-free and organic farming, the return to traditional practices and making farms more efficient (Tortermvasana, 2014).

Figure 2 Farmer Info Applicaiton Home Screen
Source: Own Illustration based on the Farmer Info Application
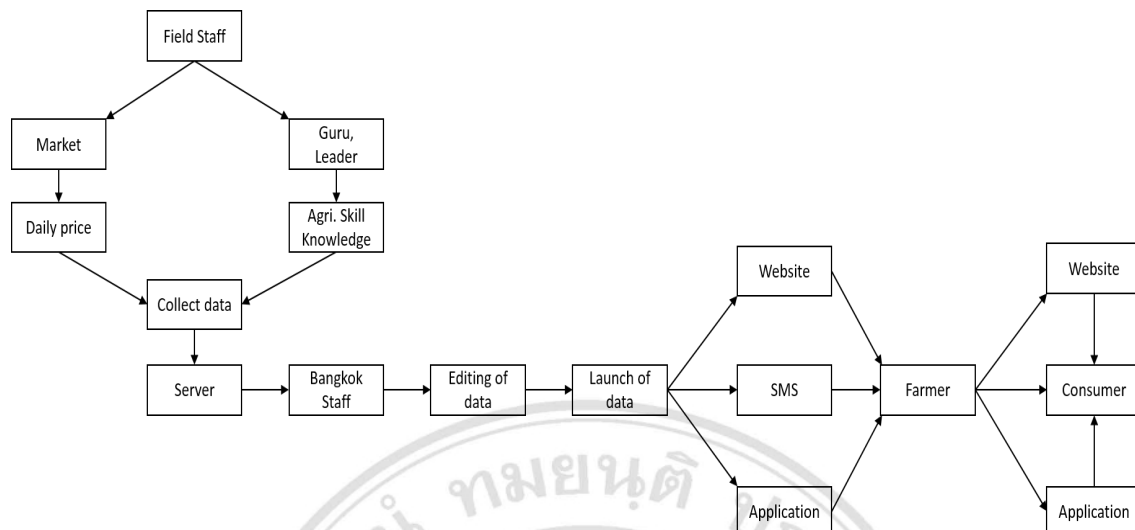
Figure 3 Rak Ban Kerd's Conceptual Work Flow
Source: Own illustration based on in-depth interviews

To achieve the goals given by RBK and dtac, their concept follows a simple approach, which was described in detail during one interview with an official from Rak Ban Kerd (see Figure 3). There are currently seven stations in Thailand which collect daily market prices and agricultural information from farmers in some parts of Thailand. The collected data is then sent to the servers and the staff in Bangkok where it is edited and from where it is disseminated via different channels. The farmer can then use the provided information to adopt his agricultural practices and compare the prices in different markets before selling his products. Additionally, the website and application provide him with the possibility to sell his products online using an e-commerce platform. Furthermore, Rak Ban Kerd provides a call centre for farmers, where all their questions are answered in the best possible way. The success of the concept has been already published via several success stories regarding the, 2003 introduced, SMS-service (see Appendix 10). In these stories, it is pointed out in detail how the service benefits some farmers, mainly by providing them with information and knowledge about agricultural practices. The majority of the farmers reported that they used the distributed information to adopt their practices to switch to a more sustainable and organic form of farming.

1.3 Purpose of the Study

The purpose of this research is to analyse the impact of the newly introduced Farmer Info application on the livelihood and agricultural practices of farmers. For a comprehensive study quantitative and qualitative methods were used, including in-depth interviews with farmers and experts from dtac and Rak Ban Kerd Foundation as well as a survey among farmers in Chiang Rai province. Thereby the study is dividing farmers into two groups, application users, and non-users to better identify differences in the use of pesticides and fertilisers as well as their livelihood situation. The results of the study will help to verify the usefulness of the mobile service and how it can be improved to benefit more rural farmers in Thailand. It is essential for the further development of the Thai agricultural sector to not only understand the needs and problems of the farmers but also to analyse their attitude towards new technologies and the impact these can have.

1.4 Research Question

The involvement of dtac in agriculture under their CSR strategy together with the lack of conclusive evidence regarding the positive impact of mobile phones, smartphones in particular, on the livelihood of farmers and their agricultural practices, leads to the following research question and two sub-questions:

What impact does an agricultural smartphone application have on the farmer's livelihood and practices?

- *Does the application meet the needs of the farmers?*

- *Is the approach sustainable and participatory?*

This research question is guided by the following two hypotheses, which were drawn from the first expert interview with Rawat Sangchuay, the success stories as well as the statement of dtac's CEO:

1. *The FARMER INFO application affects the farmer's livelihood.*

2. *The FARMER INFO application influences the use of chemical fertilisers and pesticides.*

1.5 Significance of the Study

This study can make a significant contribution to the existing literature. Although there has been a growing interest in ICTs for agriculture, the use of smartphones for agricultural information dissemination is a relatively new phenomenon. The increasing affordability and accessibility of this technology, particularly in high and middle-income countries, can make it a valuable tool. The mix of text messages in combination with pictures, audio, and video files can be used to disseminate more complex information in a better and more understandable way. For the case of Thailand, an increasing number of smartphone users, also among the rural and agricultural communities can be observed. The development of smartphone applications for agriculture or other sectors is also in one line with the strategic framework of the Thai government, promoting a Smart Thailand in 2020. Furthermore, to successfully introduce further applications and mobile services across the sectors, it is necessary to understand the impact such technology can have. This study will help to better understand the current situation of ICT in agriculutral, particularly in Thailand, and provides insights for future research in the sector. More specifically it will illustrate what impact an application can have and how it has to be further develop to benefit a larger number of farmers. In the end, it will also help all the farmers who are currently using this technology or will so in the future. Providing indicators of success or highlighting needs for improvement will support the development of the "Farmer Info" application and give incentives for other stakeholders to engage in the sector. The study therefore makes a significant contribution to the vision of a "Smart Thailand" and "Smart Agriculture" as well as to the overall agricultural development and the improvement of farmers' situations.

1.6 Limitations of the Study

There are several constraints in this study. As the data collection in Thailand was mainly conducted in rural areas in the northern part of Thailand, language and cultural barriers have to be considered. All interviews with farmers as well as the survey were conducted in Thai language which required an interpreter at all time. The translation was thereby done by two Thais, one from Chiang Mai and one from Chiang Rai, with excellent English skills. However, questions had to be translated from English

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into Thai and backwards, which might have resulted in some information loss during the process, in particular as the Thai language is a very vivid language. Additionally to the interviews in Chiang Rai province several documents had to be translated from Thai to English as they contained valuable information, such as social media content regarding the smartphone application or background information on the Rak Ban Kerd Foundation. These documents were partly translated by locals and partly by an online translation service. For all the data collected in Thai language, there is no possibility to check for accuracy and the results have to be accepted as they were provided.

Another limitation of the study was the cooperation with the mobile phone provider dtac and the Rak Ban Kerd Foundation. One part of this study required the distribution of a questionnaire among "Farmer Info" users in Chiang Rai province. After elaborating the feasibility of the survey, Rak Ban Kerd Foundation confirmed the viability of a study of 25 rice farmers and 25 longan farmers in Chiang Rai Province. However, due to policy regulations of dtac they were not allowed to provide contact details of the peasants. As a result, dtac and Rak Ban Kerd Foundation collected the data through their call centre. After approximately six weeks, instead of the estimated two weeks, they forwarded the data and assured their validity. After analysing the data, there was no indication that the data was manipulated. However, as the data was collected by dtac and Rak Ban Kerd alone, it has to be mentioned that it cannot be assured that the information is genuine. The sample size is another limitation of this study. The relatively small sample size of 50 app users and 100 non-users is limiting the possibility to generalise the results of this research.

Additionally to the quantitative data and as a balance for the small sample size, qualitative interviews were conducted with major stakeholders in dtac and Rak Ban Kerd Foundation as well as among farmers in Chiang Rai Province. Although it was possible to identify some farmers using the application, there were limitations besides of the language and culture barriers. A significant amount of the farmers declined to participate due to time constraints or provided false contact information.

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