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The adoption of Cyber-Extension in Indonesia: Impact of extension agents' perception of Cyber Extension's innovation attributes and Information and Communication Technology (ICT) proficiency

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The adoption of Cyber-Extension in Indonesia: Impact of extension agents' perception of Cyber Extension's innovation attributes and Information and Communication Technology (ICT) proficiency

by

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

Bismillahirrahmanirrahim!

This dissertation is dedicated to:

my late father, Sirajuddin,

my eternal source of inspiration and motivation.

I also dedicate this work to:

my mother, Rahmina,

my beloved wife, Lusiana,

and my son, Abudzarr.

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ABSTRACT

In 2009, the Indonesian Ministry of Agriculture officially launched an ICT-based extension, namely Cyber-Extension, to support extension agents in designing extension modules and delivering agricultural-related information to farmers. Recent studies have revealed that a small number of extension agents have shown interest in using Cyber-Extension. A descriptive design was employed to determine extension agents' perceptions regarding Cyber-Extension and their proficiency using ICT and their impact on the adoption of Cyber-Extension. Extension agents across six regencies in Gorontalo province were invited and 221 agreed to participate. Personal interviews were conducted using a questionnaire.

The findings revealed that the majority of respondents were non-adopters of Cyber-Extension; at the *no knowledge, knowledge,* and *persuasion* stages. Participants in this study had positive perceptions of Cyber-Extension. The most favorably considered attribute was *compatibility*, followed by *relative advantage* and *observability*. The lowest score was found in the *complexity* attribute. Participants had relatively good confidence that they were proficient in using ICT, where participants had the highest confidence in the *internet competencies* followed by *computer skills*. Furthermore, seven predictors (*relative advantage, compatibility*, *complexity*, *trialability*, *observability*, *computer skills*, and *internet competencies*) were simultaneously entered in the logistic regression model to predict the adoption of Cyber-Extension. The model showed that *complexity* variable successfully predicted the Cyber-Extension adoption, significant at .05 level. The odds ratio of complexity predicted by the model was 6.10, meaning that each one-point increase in complexity was associated with the odds of adopting Cyber-Extension increasing by 6.10 multiplicative

factor. This finding substantiates that the less complex the Cyber-Extension is, as perceived by the extension agents, the higher the probability of Cyber-Extension was for them to adopt. Further studies might focus on the communication channels being used as well as preferably to learn about Cyber-Extension or other ICT-based extension. Replicating this study with either extension agents in other provinces as respondents or other ICT-based extension systems across Indonesia is also highly recommended.

CHAPTER 1. INTRODUCTION

Officially called the Republic of Indonesia (Republik Indonesia), Indonesia is a tropical country located in Southeast Asia. Having a total landmass of 1,904,569 square kilometers, it is one of the world's largest countries, as well as the fourth most populous country in the world, with the total population of over 261 million people. For centuries, the primary sources of family income for Indonesian people have been the agriculture and maritime sectors.

Agriculture is a major economic engine in Indonesia, accounting for nearly a third (31.89%) of the total labor force. The three major agricultural commodities in 2015 were rice, corn, and soybeans, with the production of 75.39 million tons, 19.61 million tons, and 963.18 thousand tons, respectively, in 2013 (Balai Pusat Statistik [BPS], 2017). As the base staple food in Indonesia, rice is the most important crop. Rice consumption in Indonesia reached 124.89 kilograms per capita per year in 2016 (Ministry of Agriculture of the Republic of Indonesia [MoA], 2016). This reliance on rice has placed the Indonesian government under pressure to increase production each year.

Satisfying the scale of domestic rice consumption has pushed the Indonesian government into purchasing commodities like rice from other countries. In 2015, the Indonesian government imported food crops with the amount of 19.27 million tons (MoA, 2016). In response to increasing grain and protein demands, attempts have been made to meet domestic needs by scaling up production. Throughout the country, the cultivation area has expanded from 13.45 million hectares in 2013 to 15.04 million hectares in 2016. Additionally, other attempts such as irrigation channel rehabilitation, synchronous planting, controlling the Plant Disturbing Organism (Organisme Pengganggu Tanaman/OPT), and

scaling up agricultural technology have been practiced to increase domestic production. Through agricultural extension services, the MoA has been striving to encourage farmers to adopt technology packages generated by Indonesian Agency for Agricultural Research and Development (*Badan Penelitian dan Pengembangan Pertanian/BPTP*).

Agricultural extension has become one of the major contributors to boosting agricultural production in Indonesia. For more than five decades various models and programs have been implemented, such as the agricultural advisory program called Bimbingan Masyarakat/BIMAS (Mass Guidance) in the 1960s, the Farmer Field School (FFS) in the 1980s, and the Farmer Field School of Integrated Crop Management (ICM-FFS) implemented since 2009 (Kariyasa, 2014). These programs aimed at dissemination of new technologies generated by research centers through a technology transfer approach. Agricultural extension service was established as a non-formal method for the education of adults with the purpose of changing farming management practices.

The technology transfer approach depends highly on the abilities of extension agents in delivering services to farmers. As the agents of change, agricultural extension agents play a significant and vital role as educators, facilitators, and motivators by delivering information related to agricultural technology from the BPTP at the provincial level and disseminating technology packages that suit farmers' specific needs. In Indonesia, extension agents' competencies are developed through training programs (called *Diklat*) held by the Agency for Agricultural Extension and Human Resources Development (*Badan Penyuluhan dan Pengembangan Sumber Daya Manusia Pertanian/BPPSDMP*).

It is expected by the Indonesian government that farmers use better technology to solve field and management problems, and eventually advance domestic productivity. On the

contrary, farmers expect that information and technology provided by the extension agents will help fix their problems. Only accurate, relevant, and updated information delivered by the extension agents is of actual use. Extension is expected to provide reliable research-based information to the clienteles in a timely manner. The healthy flow of information plays an important role in making real agricultural practices and advances.

In recent years, the integration of Information and Communication Technology (ICT) into agricultural extension system in many countries has become prominent. In India, agricultural extension has been revolutionized through ICT integration with the development of a community information kiosk model, called *e-Choupal*, an internet-based agricultural information source. With the support of this program, farmers utilize information to check the commodity prices in local and global market, to learn about alternative farming techniques, and to order agricultural inputs for planting (Kameswari, Kishore & Gupta, 2011). Through a program called *Farmbook* which is delivered by extension agents, ICT integration into agricultural extension system in Southern and East Africa has improved farmers' access to quality information that helps them in planning their business, assessing crop productivity, and analyzing the profitability of agribusiness (Tata & McNamara, 2016). Similarly, rapid advance in the content of ICT offers a better quality of research through extension delivery systems in Indonesia. With the use of ICT on a computer or other technological device, information dissemination at the village level is potentially faster than in the past. Modernization of agricultural extension includes utilizing and integrating ICT into extension strategies, and providing better, reliable and updated information based on the local demands (Amin, 2014; Fatimah, 2013).

Lubis (2012) noted that ICT's implementation in Indonesian rural development as a means to new strategies was pioneered through several projects, such as Microsoft Community Training and Learning Center initiated by Microsoft, Poor Farmers' Income Improvement through Innovation (PFI3) with the Asian Development Bank, and Farmers' Empowerment through Agricultural Technology and Information (FEATI). In 2009, the Indonesian government through the MoA launched a new program based on ICTs implementation in Indonesian agricultural extension, namely "Cyber-Extension" (which can be accessed through cybex.pertanian.go.id). Although initially there was euphoria with ICT being set in action as part of the extension system, the transition from conventional ways to Cyber-Extension as an ICT based extension has not been smooth and has varied by region. To date, there has been no specific data indicating the rate of adoption of Cyber-Extension in Indonesia.

Research findings have indicated that the acceptance level and use of ICT in agricultural extension varies among users in several countries due to different challenges. Jayathilake, Jayaweera, and Waidyasekera (2010) reported that in Sri Lanka, although the number of ICT user was quite high at 60.6%, approximately 76.1% of the users had uptake problems using ICT due to the technological cost associated with ICT. In Iowa, Taylor (2015) revealed that only a fourth (25%) of the extension educators had adopted eXtension due to its observability and trialability issues.

Need for the Study

Various efforts have been made to increase the adoption of Cyber-Extension in Indonesia. For example, extension agent competencies in using Cyber-Extension have been developed through education and training programs (*Diklat*) held by the MoA through

BPPSDMP on a limited basis. Computers and internet access equipment have been distributed to local extension offices in many provinces although in limited numbers. Nonetheless, recent studies have showed that still a small number of extension agents show interest in using the Cyber-Extension (Adriana 2015; Ardiansyah, Gitosaputro, & Yanfika, 2014; Dzakiroh, Wibowo, & Ihsaniyati, 2017; Helmy, Sumardjo, Purnaningsih, & Tjitropranoto, 2013; Tolinggi & Hadjaratie, 2014). Therefore, there has been a need to study the challenge implementing Cyber-Extension, especially regarding the impact of the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT. This may be an important stepping-stone in successfully disseminating Cyber-Extension to and among extension agents.

Research Purpose and Objectives

The purpose of this study was to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. The following eightfold objectives were formulated to inform this research:

1. Describe selected demographic data of Indonesian extension agents;
2. Identify extension agents' current positions in the stages of innovation-decision process of Cyber-Extension;
3. Describe extension agents' perceptions of Cyber-Extension's innovation attributes;
4. Compare extension agents' perceptions of Cyber-Extension's innovation attributes across different selected demographic data;
5. Describe extension agent's use of ICT devices and the Internet;

6. Describe extension agents' ICT proficiency based on self-efficacy test of computer skills and internet competencies;
7. Compare extension agents' ICT proficiency across different selected demographic data; and
8. Determine whether extension agents' perceptions of Cyber-Extension's innovation attributes and ICT proficiency predict the adoption of Cyber-Extension.

Significance of the Study

To date, few studies have focused on the evaluation of Cyber-Extension as it relates to the current state of Cyber-Extension adoption by Indonesian agricultural extension agents, as well as the extension agents' proficiency to adopt Cyber-Extension. It is hoped this research study will contribute to the improvement of Cyber-Extension in Indonesia, specifically studying the adoption of Cyber-Extension that comes from agricultural extension agents' capacities for that adoption. The results of this research may be used to contribute to implementing policy that is relevant to ICT integration into agricultural extension services. Furthermore, the findings of this research can be used to support stakeholders in Indonesia in designing proper and efficient strategies to improve implementation of ICT-based extension services.

Definition of Selected Terms

The following terms and acronyms were defined for this study:

***Agricultural extension*:** A process that involves the use of information and communicates it to provide support for people in exploring alternative solutions while forming opinions and generating decisions (Van den Ban and Hawkins, 1996).

***Agricultural extension agent*:** A change agent who plays a vital role as a teacher for farmers in the non-formal setting, helping them in identifying problems, analyzing the problems and finding solutions (Adams, 1982).

Attributes of innovation: Five characteristics describing an innovation (including: relative advantage, compatibility, complexity, trialability, and observability) that may predict the innovation's rate of adoption (Rogers, 2003).

Bakorluh/*Badan Kordinasi Penyuluh (Extension Coordination Agency):* A local department of agricultural extension working under the Ministry of Agriculture at the provincial level

BPTP (Badan Penelitian dan Pengembangan Pertanian): Indonesian Agency for Agricultural Research and Development /BPTP).

BPS (Balai Pusat Statistik): Indonesian Statistics Beurau

BPPSDMP (Badan Penyuluhan dan Pengembangan Sumber Daya Manusia Pertanian): The Agency for Agricultural Extension and Human Resources Development

Cyber-Extension: An ICT-based Agricultural Extension in Indonesia which has been implemented since 2009.

Compatibility: "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and the needs of potential adopters" (Rogers, 2003. p. 240).

Complexity: "the degree to which an innovation is perceived as difficult to understand and use" (Rogers, 2003. p. 257).

Farmer group (kelompoktani): An organization established by several farmers (usually 20 to 25 farmers) based on their homogeneity of interests, environment (social, economy, and

resources), and solidarity, in order to improve the members' livelihood (Peraturan Menteri Pertanian [Permentan], 2007).

Farmer-supporting/voluntary extension agent (penyuluh swadaya): Farmers who have been successful in their farming activities and were deemed suitable to motivate other farmers in technology adoption who were recruited by the government.

Freelance extension agent (penyuluh THL-TB): A non-civil servant extension agent recruited by the government whose salaries and operational costs are paid by the government.

ICT: Information and Communication Technology

ICT proficiency: Expected sets of skills to make use of ICT tools in ICT-based agricultural extension which include computer skills, and internet competencies.

Innovation: An idea, practice or object that is perceived as new by an individual or other unit of adoption (Rogers, 2003)

Innovation-decision process: "…the process through which an individual passes from first knowledge of an innovation to the formation of an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision." The innovation-decision process is known as five main steps: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation (Rogers, 2003, p. 20).

MoA: Ministry of Agriculture of the Republic of Indonesia.

No Knowledge: "when potential adopters have no knowledge about the innovation at the very beginning of their adoption behavior" (Li, 2004, p. 170).

Observability: "…the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 258).

Province: A principal administration division under the national level. There are 34 provinces in Indonesia.

Public extension agent (penyuluh PNS): Public extension agents are those who are recruited by the Ministry of Agriculture as civil servants.

Regency (kabupaten): A local territorial unit under the provincial level, equal to an administrative city under the province. There are five regencies and one administrative city within the Gorontalo provincial government.

Relative Advantage: "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 2003, p. 229).

Self-efficacy: A concept in social cognitive theory, which postulates that behavioral changes are achieved through a cognitive mechanism that is induced by mastery experience derived from effective performance (Bandura, 1977).

Trialability: "…the degree to which an innovation may be experimented with on a limited basis" (Rogers, 2003, p. 258).

Summary

Agricultural extension is currently one of the major factors in increasing agricultural production in Indonesia. With the technology transfer approach, various models and programs have been implemented with the aim of their being significant components in increasing the yields of essential domestic crops. Agricultural extension agents play a particularly vital role as educators, facilitators, and motivators because they deliver information related to agricultural technology from the BPTP at the provincial level and disseminate technology packages that suit farmers' specific needs. In recent years, the integration of ICT into the agricultural extension system in Indonesia has become a

potentially vital addition to what extension has previously offered. In 2009, the Indonesian government launched an ICT-based extension system program in Indonesian agricultural extension named Cyber-Extension.

The transition from conventional methods of sharing agricultural information to ICT based extension was not simple or smooth. Recent studies revealed that after several years a limited number of extension agents showed interest in using the Cyber-Extension system (Adriana 2015; Ardiansyah et al., 2014; Helmy et al., 2013; Tolinggi & Hadjaratie, 2014). Therefore, there is a need to describe the challenge in implementing Cyber-Extension, and a need to conduct research which includes analysis of the current adoption of Cyber-Extension and extension agents' capabilities to use Cyber-Extension. This study aimed to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. This will be an important steppingstone to disseminating Cyber-Extension and other ICT-based extension systems in Indonesia. More broadly, the result of this research may contribute to developing policy relevant to ICT integration into agricultural extension services. Additionally, the findings of this research can be used to support related stakeholders in designing strategies to improve ICT-based extension system.

CHAPTER 2. LITERATURE REVIEW

Agricultural extension is a non-formal way to educate people in implementing new ways of farming. Extension was defined by van den Ban and Hawkins (1996) as a process that involved the use of information and communication to provide support for people who were exploring alternative solutions by forming opinions and making decisions. Adams (1982) defined agricultural extension as a process of assisting farmers to identify problems in farming practices, examine those problems, and become conscious of alternatives for improvement.

Agricultural extension manages the circulation of information in a system and facilitates learning whereby clients can make use of the information to design better solutions and to make better decisions. Gabathuler, Bachmann, and Kläy (2011) underlined the importance of knowledge management in linking research and extension where reliable information was vital to meaningful learning in extension. Röling (1988) held that extension should be looked at as an agricultural information system because agricultural extension collaborates with agricultural research in improving knowledge regarding farming practices and in examining new techniques. It indicated that information is a critical factor in agricultural extension as extension system relies heavily on the quality of information that circulates in the system.

Extension agents play their part as change agents who hold vital roles as teachers for farmers in non-formal settings, help farmers to identify problems, analyze those problems and find solutions (Adams, 1982). To successfully manage information from sources to receivers, an extension agent is expected to have proper communication skills. Van den Ban and Hawkins (1996) held that farmers require information that can be implemented

practically; the information is expected to be regularly updated and technically reliable. In addition, actors expect that information can cite experimental results. The extension agent is challenged with providing information sources that fit the farmer's needs.

The extension agent delivers information to farmers by utilizing several methods and techniques. As there are various delivery methods in disseminating information in the extension system, an extension agent selects which methods best suit the situation encountered. For example, some methods are appropriate with an individual client, while others might suit a small group of clients, or even a wider, larger audience. The benefits and impacts of using each method are varied; therefore, the extension agent must plan carefully before selecting the most appropriate methods that fit specific learning situations (Van den Van & Hawkins, 1996). In recent years, the rapid advance of computer and communication technologies has been a great support in improving delivery methods in agricultural extension systems. Modern media have affected both the accessibility of extension audiences to information sources. Extension activities nowadays are challenged when new communication technology meets with the existing delivery methods. The future of extension requires that communication technology be integrated with the extension delivery system.

ICT in Agricultural Development

ICT integration with agricultural development comes with different names. Leewis and van den Ban (2004) perceived ICT in rural innovation as a "new media" or "hybrid media" that is based on computer technology, emerging as a new form resembling the basic features of mass media and interpersonal communication. Maumbe (2012) addressed ICT implementation to improve the efficiency and effectiveness of delivery methods in agriculture as e-Agriculture.

ICT-based Platform in Agricultural Development across Different Countries

The past decade has witnessed a rapid increase of global interest in ICT integration into agricultural and rural development. Many benefits of ICT use have been observed globally including the increase of farm productivity, more access to information regarding the global markets, transaction cost reduction, and effective communication among actors in agricultural production across different regions (Maumbe, 2012). Most countries have been integrating ICT into their agricultural services to help clients in solving their problems. The implementation, however, varies across countries, depending on the needs of national stakeholders and clients. Some specific examples can be drawn from either developed or developing countries as follows.

In Ghana, ICT applications are commonly used as a bridge for different stakeholders in agricultural supply chain management; ICT is used in accessing information related to supply chain including prices, buyers and sellers, and transportation. Through a program called *mFarms* developed by *ImageAD*, reliable information about the database of actors in the value chain was provided to improve communication among stakeholders in the agricultural value chain. Actors include farmers, buyers, and dealers, transport and hauling companies, and artisanal producers. With these services, farmers are able to identify both sellers and buyers, access location and distance, and receive other information to plan their actions (Debrah & Asare, 2012). With utilization of the web and mobile phone as communication technologies, the *mFarms* application supports smallholder farmers in rural Ghana to reduce transaction cost and improve market transparency helping them to improve farm production planning and product marketing (Abdulsamad, Brun & Gereffi, 2013). Another recent ICT implementation is *Farmbook*, an ICT application developed by Catholic

Relief Services (CRS). *Farmbook*, according to Tata and Namara (2016) is used by extension agents in Southern Africa to help farmers in designing agribusiness plans, assessing crop productivity, and calculating business profitability. With *Farmbook*, extension agents help farmers to improve farming practices and also monitor and evaluate extension programs.

In Asia, India's agricultural sector has been using ICT to transform information circulation among stakeholders over the past decades. In 2000, a private sector company, the Indian Tobacco Company (ITC), pioneered a project called *e-Choupal*, an application that provides information regarding market prices of agricultural products, weather, and farming methods through the Internet (Kim, Chitnis, Vasanti, & Singhal, 2007). The system offered by e-Choupal contrasts with the traditional market system where information and transaction are layered by geographical boundaries causing only a small number of buyers and sellers to participate in the market. The system provided by e-Choupal disrupted this limitation. Information about commodity prices and the database of vendors and customers leads to more transparent transactions that invite wider participation of various stakeholders (Bansal & Sharma, 2012).

In the U.S., extension agents (often addressed as extension educators in the U.S. extension) have been extensively using the Internet as an education strategy. Kwaw-Mensah and Martin (2013) revealed that extension educators found internet and computers to be an effective education tools when implemented in livestock waste management education. A national online program called eXtension was launched in the U.S. in 2006 as a collaborative way to disseminate scientific-based information to a wider audience (Hightower, Murphrey, & Dooley, 2010). eXtension is an integral part of the Cooperative Extension System in the U.S, serving as an online presence of the agricultural extension system. In basic form,

eXtension is an educational tool that broadens the services provided by the U.S. Cooperative Extension system. In traditional extension system, extension educators and clienteles' access to information is limited by the form of communication and outreach. The presence of eXtension enables extension educators and clients to access more educative information (Taylor, 2015).

Japan's history of implementing ICT in its extension system can be traced back to the past three decades. A communication network platform has been utilized by extension agents since 1988 through a program called F-VAN (Fukyu-Value Added Network), where *fukyu* is a Japanese word for extension. Later, after computer networks became more popular in 1992, the Extension Information Network (EI-NET) system was developed by the Japan Agricultural Development and Extension Association (JADEA). This system enabled extension agents to access database service mail and bulletin board services (Fukuda, 2005).

Challenges of ICT Adoption in Agricultural Extension

Over the past few years, the adoption of Information and Communication Technology (ICT) has been a great concern in agricultural extension services throughout the world, particularly due to the role of ICT more efficiently spreading information to clienteles. With ICT, research-based information and knowledge from research centers to farmers flows faster than with conventional mass media. One of the unique characteristics of ICT in agricultural extension, as mentioned by Leeuwis and Van den Ban (2004), is that ICT tends to have the functional assets of both mass media and interpersonal communication. As such, ICT has the ability to reach a wider audience as well as providing support of a high level of interactivity compared to that of conventional mass media.

These promising features of ICT-based extension system, however, do not align with acceptance of ICT devices and apps by actors who are currently involved in agricultural extension. As ICT implementation is highly dependent on hybrid media system such as computer tools, internet connections, etc., challenges arise. Each region in the world has its own technical, social, and economical complexities, which affect the adoption rates of ICT. These complexities vary across regions, and the emerging problems are not homogenous. Omotesho, Ogunlade, and Lawal (2012) found that in Kwara State, Nigeria, most of the extension agents have not adopted ICT due to the lack of access to the Internet and computer devices. Ndag, Sanusi, and Aigbekaen (2008), however, revealed that extension personnel in Southwest Nigeria were more likely to adopt ICT than those in North-central Nigeria. This was due to a difference in proficiency with computers as indicated by an extension agent's knowledge, ownership, and training access. Findings of study revealed that, as the computer proficiency of extension agents in the Southwest rose, they were more prepared to adopt ICT than extension agents in the North Central region. This led to differences in adoption rates.

Interestingly, even in a country that ranked high on the ICT development index, an adoption rate below 30% was also reported. For example, in the U.S., a country that ranks 15th worldwide in the ICT development index (International Telecommunication Union, 2016), the adoption rate of eXtension (an ICT-based national extension platform) in several states was reported below 30% despite eXtension having been implemented since 2008. Taylor (2015) revealed that, although the majority of Iowa Extension professionals were quite familiar with eXtension, only 25% of them were reported as using the technology. The adoption rate was even lower in Oklahoma, where only 20% of extension employees had used eXtension (Xu & Kelsey, 2012). The adoption rate was below the target, considering

that the expectation of eXtension adoption in one year after its implementation was for at least 75% (Harder & Lindner, 2008).

Although there has been an increasing demand of using ICT in agricultural extension, some challenges should be addressed to reduce adoption barriers. In Ghana and Nigeria, challenges that impaired extension agents in adopting ICT included: lack of knowledge about operating ICT tools, lack of ICT devices at extension offices, lack of ICT device ownership, inadequate supporting infrastructures for using ICT (networks, hardware, and software), high cost of using ICT, and poor electric power (Akpabio, Okon, & Inyang, 2007; Annor-Frempong, Kwarteng, Agunga & Zinnah, 2012). In the USA, lack of adoption has been related to the attributes of eXtension. Taylor and Miller (2016) revealed that, although eXtension was positively valued in enhancing work quality by extension agents in Iowa, neutral perceptions were maintained (neither agree nor disagree) that eXtension is compatible with their work, easy to use, and observable. Other challenges were described by Kelsey, Stafne, and Greer (2011), who revealed that the top two most frequent barriers to implementing eXtension were: (a) not enough time to adopt new technology, and (b) lack of knowledge about eXtension.

Despite the large amount of funding allocated to infuse ICT into agricultural extension in both developing and developed countries, some challenges still emerge and cloud the system. These challenges might lead to low adoption rates among extension agents. Therefore, overcoming these challenges would encourage ICT infusion into extension system and foster rates of adoption.

Indonesian Agricultural Extension

Indonesia is a large country that consists of numerous large and small islands. Most of the population live in rural areas. Agriculture, along with fisheries and the maritime sector are the backbone of economy for local people and the main engine for the national economy. Agriculture is a vital sector, as indicated by the large number of Indonesian people employed in agriculture or agriculturally related fields. In 2016, approximately 32% of the labor force worked in agriculture; the agriculture sector comprised 13% of GDP, making the agricultural sector as the second largest share of the Indonesian GDP after the industrial sector (BPS, 2017).

Historical Background

Indonesian agricultural extension can historically be linked to the era of colonialism, the period before Indonesia gained its independence in 1945. In 1817, a botanical garden, called the Bogor Great Botanical Garden, was built for planting several commercial agricultural seeds such as rice, nuts, palm oil, tea, and cassava. Research centers were established around the site to conduct research related to agriculture. The results were disseminated to farmers to promote the major commodities and to increase their production. This project was known as a pioneer lot for the agricultural extension system in Indonesia. From 1830 to 1870, under the Dutch East Indies colonial government, farmers were forcibly mandated to plant valuable export crops such as sugarcane, tobacco, and indigo. This system was called *tanam paksa*, or *cultuurstelsel* (in Dutch). The real establishment of agricultural extension activities occurred after the Dutch created the Department of Agriculture (*Depertement van Landbouw* in Dutch). From the late 1900s to the beginning of the 1910s, the agricultural extension system became more extensive as the Dutch colonial government

merged research centers and appointed five agricultural advisors who established the Office of Agricultural Extension. This office was established to educate people in using agricultural innovation and technology to increase production (Herianto, Wastutiningsih, Foster, Rimmer, & Callinan, 2010; Jamil, 2006; Lubis, 2012; Riyandoko, Martini, Perdana, Yumn, & Roshetko, 2015; Taryoto, 2014).

In the post-independence era (after 1945), the policy towards Indonesian agricultural development shifted from exporting commodities to producing staple crops, especially rice. This policy was oriented toward fulfilling the basic needs of local people for food security (Herianto et al., 2010). Prior to the 1960s, extension activities were focused on weekly meetings to discuss improving crop yields through agricultural innovation, irrigation, and pest management (Jamil, 2006). One of the prominent agricultural programs during this era was the Kasimo plan (*Rencana Kasimo*), a program conducted to develop perennial crops, fisheries, livestock, crafts and small businesses (World Bank, 2007). However, local conflicts in several areas impaired agricultural extension activities. Later in 1963, a program named *Panca Usaha Tani* (PUT) initiated by the Faculty of Agriculture of the University of Indonesia (which later became Bogor Agricultural University) and the Center of Community Engagement of Higher Education and Science (Pendidikan Tinggi dan Ilmu Pengetahuan-PTIP) was held in Karawang, West Java. This was one of the major breakthroughs of the Indonesian agricultural extension concept where the faculty staffs and students conducted demonstration plots, an approach that promoted and disseminated innovations for increasing rice productivity. The success of the PUT program inspired MoA to establish a new approach in extension services called the Mass Demonstration (*demonstrasi massal* or DEMAS), a prominent program at that time (Hafsah & Sudaryanto, 2004; Taryoto, 2014).

During President Suharto's era (1966-1998), many policies were regulated to increase agricultural production and to improve extension services. The training and visit model (T&V), known as *Latihan dan Kunjungan* (LAKU) in Indonesia was implemented by extension services at the village level (Taryoto, 2014). One of the major policies in the beginning of Suharto's era was Mass Guidance (*bimbingan massal*/BIMAS), a modification of DEMAS. Agricultural extension services were accompanied by a credit system for farmers, subsidies on agricultural inputs such as seeds, fertilizers and pesticides, farmer cooperatives, and market support (Lubis, 2012). The Indonesian government during this period successfully achieved food-sufficiency from 1984 to 1989. However, the overuse of modern agricultural inputs such as chemical fertilizer and pesticides promoted by both agricultural industries and the government, and a strong centralization of extension management with a top-down approach practiced by Suharto were strongly criticized (Braun & Duveskog, 2008; Hafsah & Sudaryanto, 2004; World Bank, 2007). Despite criticism, Indonesia was known to be an example of the successful implementation of a type of farmer-group learning called Farmer Field School (FFS) developed by the Food and Agriculture Organization (FAO) of the United Nations (UN). In response to Indonesian environmental damage from use of toxic pesticides in the late 1980s, an Integrated Pest Management Farmer Field School (IPM-FFS) was held to educate farmers in managing ecology and controlling pest in their fields. Extension agents used this participatory and learner-centered approach rather than the previous top-down approach commonly practiced in the T&V method. Farmers and extension agents conducted field experiments to compare and assess innovation, thereby using learning-by-doing methods that are part of the FFS approach

(Ponniah, Puskur, Workneh, & Hoekstra, 2008; Resosudarmo & Yamazaki, 2010; Waddington et al., 2014).

Suharto's era came to an end in 1998. The post-Suharto period, which was also known as the reformation era, was a crucial turning point in the Indonesian agricultural extension service. In 2001, Indonesian government enacted Law 22/1999 on Local Government (*Undang-undang Nomor 22 Tahun 1999 tentang Pemerintahan Daerah*) which provided more autonomy to local governments both at the district and provincial levels. From 2001 onwards, this policy has influenced the approaches exercised in extension services, providing heads of regions more independence to organize their own agricultural policies including those affecting extension services (Riyandoko et al, 2015). The important role of agricultural extension service in Indonesia was emphasized only after the Indonesian government enacted Law 16/2006 regarding the Extension System in Agriculture, Fisheries, and Forestry (*Undang-undang Nomor 16 Tahun 2006 tentang Sistem Penyuluhan Pertanian, Perikanan, dan Kehutanan*). This regulation clearly defined the role of extension and extension agents, as well as strengthened the position of agricultural extension in agricultural development through the empowerment of stakeholders (Undang-Undang Republik Indonesia, 2006). Extension services at the bottom level (sub-district/*kecamatan*) facilitate the learning process by providing and disseminating information related to technology, production facilities, finance, markets, and marketing as needed by local farmers.

Today, Indonesian agriculture encounters the challenge of providing sufficient food mainly from three major crops; rice, corn, and soybeans. Agricultural extension services offer supports to clients in order to increase productivity in four agricultural subsectors, i.e., crops, horticulture, livestock, and plantation by improving the capacity of major stakeholders

(farmers, cattlemen, planters and their family farms) and agribusiness stakeholders (individuals and corporates) through advocacy, education, and training sessions, along with standardization and certification of human resources in agriculture (BPPSDMP, 2015).

Agricultural Extension Agents

For decades, Indonesia has been facing an imbalanced ratio between production and consumption. As the demand for crops is always higher, Indonesia is forced to import products from other countries. Food sufficiency is one of the major targets of the current Indonesian government. To increase agricultural productivity, innovation in agriculture is encouraged through government-owned research centers. The MoA employs 47,964 extension agents working at five different levels: national, provincial, regency/city (*kabupaten/kota*), sub-district (*kecamatan*), and village levels (BPPSDMP, 2014). Mainly, there are two types of extension agents in Indonesia:

1. ***Public extension agent*** (*penyuluh PNS*). Public extension agents are recruited by MoA as civil servants. Currently there are 27,485 public extension agents in Indonesia, in which only 87 per cent of them are assigned at the sub-district and village level.
2. ***Freelance extension agent*** (*penyuluh THL-TB*). As the number of public extension agents is too small to cover the whole area, the government has recruited 20,479 people who work as freelance extension agents. Freelance agents are not civil servants, although their salaries and operational costs are paid by the government.

However, not all agents are working at the village level. Out of 47,964, only 32,299 (67%) are working directly with farmers and farmer groups as major clients. Currently, there are 71,479 villages throughout the country; most of them are agriculturally based. Local

people really depend on agriculture, so MoA expects each village to have at least one extension agent providing extension services at the village level (a movement called "one extension agent for each village" or "*satu penyuluh untuk satu desa*"). As the number of both public and freelance agents is limited, the government encourages local people to play the role of extension agents in providing extension services in rural areas. Farmers who have been successful in their own farming activities were recruited as suitable to motivate other farmers in technology adoption. This type of extension agent was called a ***Farmer-supporting/voluntary extension agent*** (*penyuluh swadaya*). Currently there are 16,596 farmer-supporting extension agents in Indonesia. Figure 2.1 illustrates the hierarchical structure levels of extension agents from national to local.

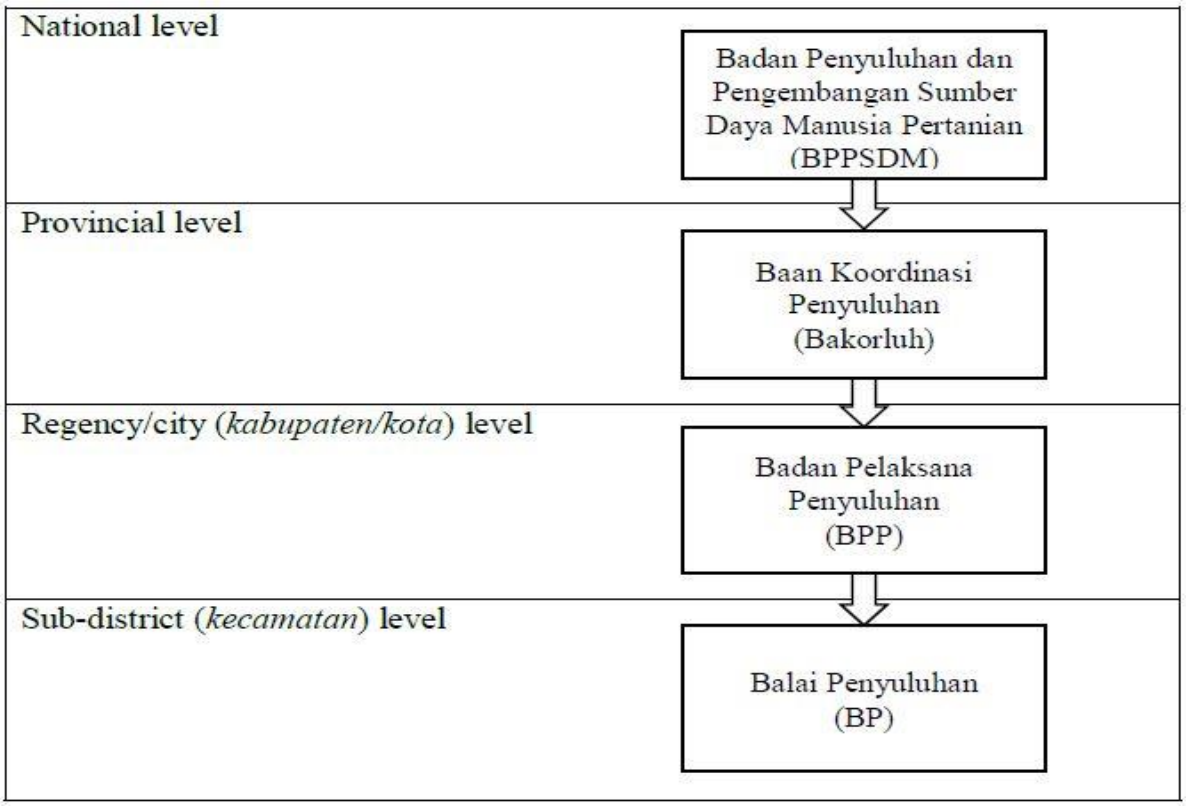


Figure 2.1. Hierarchical organizational structure of agricultural extension in Indonesia

Cyber-Extension: ICT-based Agricultural Extension

The agricultural sector in Indonesia was introduced to communication technology when ICT implementation in agricultural development was pioneered through several development projects, including: Microsoft Community Training and Learning Center (CTLC-Microsoft), Partnership for e-Prosperity for the Poor (Pe-PP), Poor Farmers' Income Improvement through Innovation Project (PFI3P), Farmers' Empowerment through Agricultural Technology and Information (FEATI), and the Center for Agricultural Information (Flor, 2008; Lubis, 2012; Sumardjo & Mulyandari, 2010).

In 2009, MoA officially launched a project called Cyber-Extension, an implementation of ICT into agricultural extension (Dzakiroh, Wibowo, & Ihsaniyati, 2016). Cyber-Extension is an ICT-based agricultural extension system, aimed at improving extension agents' services through the preparation of extension materials by utilizing information that is accountable, periodically updated, and relevant to solving problems; it could support extension agents' decision-making in disseminating data and information to farmers and farmer groups (BPPSDMP, 2015). Cyber-Extension adopted the success of ICT implementation in various countries such as e-Choupal and Village Knowledge Centre in India and Extension Information Network (El-net) in Japan. Figure 2.2 displays Cyber-Extension website (Cyber-Extension, 2017).

Cyber-Extension is designed to improve extension agent's performance through information sharing mainly in two ways; first, Cyber-Extension provides data and information that could help extension agents to improve their knowledge of agricultural problems. The information provided is often used by extension agents in designing extension

Figure 2.2. Cyber-Extension (Cybex) webpage (http://cybex.pertanian.go.id/)

materials and modules aligned with local needs and used by farmers and/or farmer groups. Second, Cyber-Extension provides space for information exchange between and among extension agents and farmers. Using features in the website, share experiences and knowledge by uploading documents showing clients' activities and practices thereby gaining feedback from other farmers and experts (BPPSDMP, 2015). MoA strongly expects that Cyber-Extension will improve the performance of extension agents.

Problems related to Cyber-Extension

There is no official data citing the amount of budget allocated specifically for Cyber-Extension, however, MoA states total budget spent by BPPSDMP to strengthen the agricultural extension system is around USD 48 million in 2015 (BPPSDMP, 2016). This includes the budget spent to utilize Cyber-Extension. Nevertheless, studies in the last four years have found that Cyber-Extension has not been widely adopted by extension agents

(Adriana 2015; Ardiansyah et al, 2014; Helmy et al 2013; Tolinggi & Hadjaratie, 2014). This section aims to elaborate problems and challenges faced by extension agents in adopting Cyber-Extension. The previous discussion revealed that several factors can come into play regarding adoption, including rate of adoption of ICT. Adoption of innovation of Cyber-Extension revealed that there are several factors perceived by extension agents as problems hindering implementation. These problems are elaborated as follows.

Equipment and facilities

A majority of the research (Adriana 2015; Ardiansyah et al., 2014; Fatimah, 2013; Helmy et al., 2013; Praza, 2017; Sumardjo & Mulyandari, 2010; Tolinggi & Hadjaratie, 2014; Veronice, Yelfiarta & Darnetti, 2015) mentioned that lack of technology equipment supplies was the major problem in implementing Cyber-Extension. ICT equipment such as computer devices was required to operate Cyber-Extension. Therefore, limited access to the facilities would hinder Cyber-Extension application. It is expected that the extension agents would independently utilize the website using computers and smartphones. However, not all extension agents own or have access to computer and smartphone devices as they have different needs and incomes. Fatimah (2013) remarked that some of extension agents in Sumedang regency used their personal devices to access information on the website despite their limited incomes.

According to Veronice et al. (2015), not all extension agents can afford to own ICT devices. Their research study revealed that most extension agents in Limapuluh Kota regency who had funds to purchase a personal computer were public extension agents, whereas most of freelance extension agents did not own devices due to differing financial constraints. It was widely known that public extension agents received larger salaries than freelance agents,

restricting ownership of ICT devices. On the one hand, extension agents expected the government to provide computer equipment, at least one per extension office at the sub-district level (*Balai Penyuluhan*). On the other hand, MoA's budget to purchase computer devices for extension offices was limited. Although each year the national government distributed computer and the internet equipment for extension offices at the sub-district level to support Cyber-Extension implementation, many offices failed to get them due to a restricted agricultural extension system budget (Fatimah, 2013).

Another problem was infrastructure limitations, such as electrical power outages and poor access to an internet connection. Tolinggi and Hadjaratie (2014) revealed in their study that, although the extension agents in Gorontalo regency were able to operate Cyber-Extension, continuous use was often difficult in areas where electrical power was not reliable, and the Internet connection was slow. A similar problem was reported by Adriana (2015), who mentioned that, although extension agents in Riau province were interested in using Cyber-Extension, slow Internet connection became a problem that stopped its use. Sumardjo and Mulyandari (2010) mentioned that some villages, particularly those located in remote areas in Indonesia had uneven Internet connectivity and electricity.

Competencies and Cyber-Extension

The second problem hindering Cyber-Extension implementation relates to the extension agents' competencies including skills in using ICT. These skills were computer and internet skills. A second set of skills were those required to integrate online resources and designing extension modules. Both Ardiansyah et al. (2014), and Sumardjo and Mulyandari (2010) found that although some of extension agents owned devices for access to Cyber-Extension, not all knew how to use them or were not able to operate computers and

the Internet. This argument was confirmed in other studies (e.g., Helmy et al., 2013; & Veronice, 2015) which revealed that having a computer at home did not guarantee that extension agents would have operational skills to operate the computer or software. These studies demonstrated that the computer was most likely to be used by children in the home for homework rather than being used by the extension agents, themselves.

Furthermore, several studies revealed that older extension agents more frequently lacked computer and internet skills compared to the younger ones. Adriana (2015) mentioned that in Riau province, extension agents who were 50 years old or older did not know how to use a computer. A great number of extension agents in some provinces in Indonesia can be considered as aging extension agents. For example, in West Java province, more than 82% of extension agents were above 46 years old (Helmy et al., 2013). In addition, BPPSDM (2015) stated that nearly half of public extension agents (approximately 49%) at the national level could be categorized as seniors who will enter retirement. Another cause of limited skills in operating Cyber-Extension is lack of training sessions, which deters extension agents' use of Cyber-Extension. Although each year the government provides education and training (*Diklat*) for extension workers, not all have participated in training, especially related to ICT and operating Cyber-Extension (Ardiansyah et al., 2014). In Gorontalo regency, most agents reported a preference for conventional media such as leaflets, booklets, and magazines provided by extension offices rather than the web as a source of information (Tolinggi & Hadjaratie, 2014).

In addition, extension agents' competencies might be related to their capacities in designing extension materials by using online resources. Regarding disseminating agricultural technologies, agricultural extension agents are expected to have the competency

to identify the relevant information and technology needed by farmers by accessing information from various resources, and making use of this information to design extension materials with support from Cyber-Extension (BPPSDMP, 2015). Nevertheless, Helmy et al. (2013) noted that most extension agents lacked skills in preparing and designing modules and extension materials that are used as online resources such as Cyber-Extension.

Information provided by Cyber-Extension

Several studies addressed challenges in practicing Cyber-Extension related to the contents and features provided by the website. According to BPPSDMP (2015), Cyber-Extension is designed as an online resource that provides reliable and relevant information for both extension agents and farmers. The government's purpose in establishing Cyber-Extension is to provide information that is periodically updated, accountable, and relevant in supporting extension agent's decisions to disseminate technology to farmers, as well as to improve communication interaction and deepen two-way communication, thereby extending coverage that could be reached anywhere. Contrary to this statement, Helmy et al. (2013) revealed that extension agents who had the opportunity to try Cyber-Extension found that the information provided on the website was often outdated and unrenewable. Cyber-Extension material perceived as not relevant was not utilized by extension agents. Most of the information agents found on Cyber-Extension had already been learned either from training or other offline resources.

Furthermore, most of the information on the website was found to be too general (not specific) and sometimes irrelevant to farmers' current problems and needs. The extension agents were often asked about recent specific problems by farmers (Helmy et al., 2013). The need for specific information always seemed to arise during an extension meeting at an

extension office at the lowest level (*kecamatan*). Such a meeting was not only a melting pot of various stakeholders discussing local problems pertaining to agriculture, but also a place to design and assemble local specific technologies that would contribute to problem solving at the local level (BPPSDMP, 2015). This argument was supported by Fatimah (2013) who mentioned that most of information, according to extension agents, was not demand-driven. This has been a problem since the extension agents were expected to use the information gained through various online resources including Cyber-Extension to design extension materials that fit the current needs of farmers.

Theoretical Framework

The theoretical framework in the current research was built to serve as a lens that guides this study. The two prominent theories employed in this study were: the theory of diffusion of innovation (Rogers, 1995) and self-efficacy theory (Bandura, 1977). Diffusion of innovation theory framed the adoption of Cyber-Extension as the major innovation in Indonesian agricultural extension services. This theory is widely practiced in research related to technology adoption, for example in revealing the adoption process of a specific innovation in a population. Adoption of an innovation is often assessed by using the five stages of the innovation-decision process. Analysis of different perceptions on the adopted innovation's attributes has been regularly used for determining the barriers to adoption.

This study also described the proficiency of extension agents in accepting and infusing ICT into their work. Several researchers (Cheon, Lee, Crooks, & Song, 2012; Copriady, 2015) defined ICT aptitude to address skills, knowledge, and attitudes of users toward ICT. In this research, the proficiency of agricultural extension agents to use ICT into

their work was measured with an instrument involving self-efficacy beliefs (Bandura, 1977). Thus, self-efficacy theory was used to assess the current ICT proficiency.

Rogers' Theory of Diffusion of Innovation

In the field of agricultural extension and rural innovation, diffusion of innovation theory has been widely used to assess how agricultural innovations diffuse in a social unit (e.g., Leeuwis & Van den Ban, 2004; Van den Ban & Hawkins, 1996). The theory of diffusion of innovation introduced by Rogers (1995) describes the innovation-decision process, providing a model that explains how individuals respond to an innovation as well as how they make a decision about adopting an innovation.

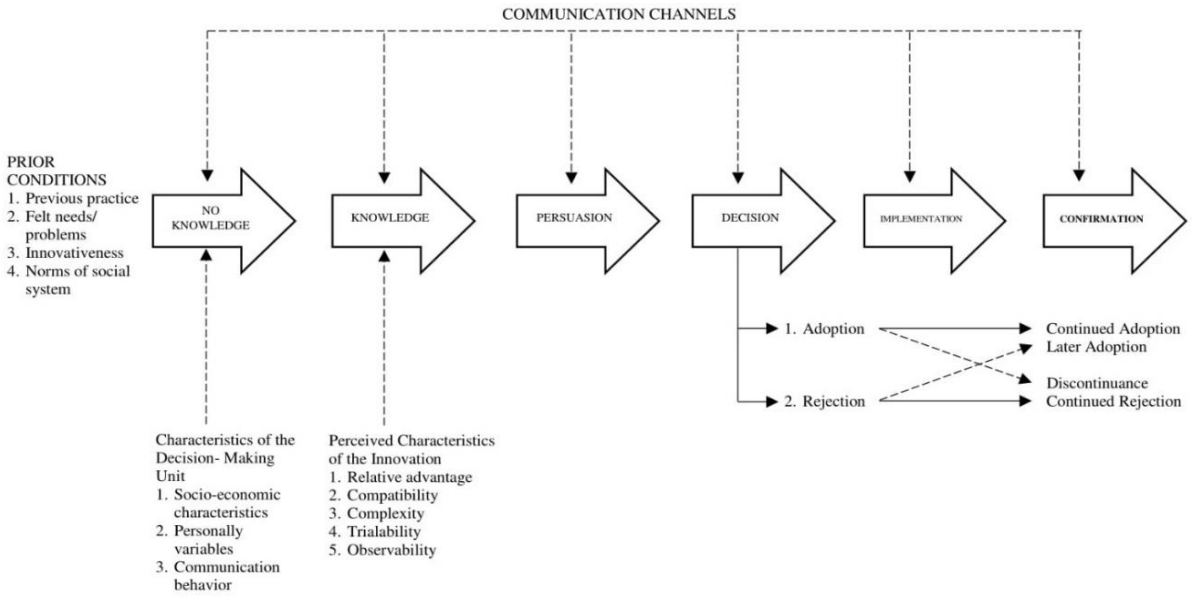
Innovation-decision process

Rogers (1995) noted that individuals do not make a decision instantly but, rather, through continuous processes and actions that influence their evaluation of whether to adopt or reject an innovation. One's final decision could lead to either adoption: a situation where one accepts an idea and makes full use of it, or to rejection: a condition where one decides to ignore the innovation. Rogers conceptualized five stages that describe behavioral acts of individuals during an innovation-decision process as specified:

1. *Knowledge,* a stage that occurs when an individual is aware that an innovation exists but shows no interest due to lack of information about the innovation.
2. *Persuasion*, a stage when an individual shows an indication of interest in an innovation by searching for details that explain more about the innovation.
3. *Decision,* a critical stage in the innovation-decision process. It is the phase when an individual is engaged in a process of analyzing the advantages and/or disadvantages of an innovation leading to a decision whether to adopt or reject it.

4. *Implementation*, a stage that occurs when an individual decides to use a new idea and puts it into use, and searches for more information to strengthen his/her decision.
5. *Confirmation*, a stage that takes place when an individual confirms his/her decision to adopt an innovation. In this stage, an adopter searches support to validate the decision already made, but still has a chance to reject it should there be a conflict found in the innovation.

In addition to the five stages of Rogers, Li (2004) offered another stage preceding the stage of "knowledge", which is called "no knowledge" stage (see Figure 2.3). This stage is built to capture a state when an adopter (or potential adopter) is not aware or has no knowledge about the innovation at the start of innovation-adoption process in his/her social unit.



Source: Li (2004) adapted this model from *Diffusion of Innovations* (Rogers,1995) by adding "No Knowledge" as the beginning stage in the model.

Figure 2.3. A model of stages in the innovation-decision process

Rogers (1995) explained that the innovation-decision process is an act of searching, analyzing, and processing information where one receives information to eliminate uncertainties about a specific idea or innovation. It must be noted that the five stages usually come in an ordered sequence over time. Studies connected the innovation-decision process and ICT implementation in agricultural extension in order to provide recommended strategies in promoting ICT in extension. For example, research conducted by Taylor (2015), who studied the adoption of eXtension across Iowa Extension professionals, revealed different attitudes of extension professionals in each innovation-decision stage. The highest frequency was at the persuasion stage (32.6%), while the lowest percentage was at the decision stage (0.7 percent). The current study is important to provide recommendations toward designing strategies to enhance the promotion of eXtension to extension professionals or other stakeholders related to eXtension. Leeuwis and Van den Ban (2004) argued that clients may require different sources of information for each stage. Clients at the earlier stage (knowledge stage) may ask for information clarifying the existing risks in implementing the innovation, while those who are at a later stage (such as the *implementation* stage) may request information related to practical experience to convince themselves to confirm continuation of applying the innovation. Acknowledging the distribution of adopters (or potential adopters) helps to initiate appropriate strategies.

Attributes of innovation

One of the common questions asked by researchers in agricultural extension is about how the characteristics of an innovation affect the adoption rate (Leeuwis & Van den Ban, 2004). Rogers (1995) explained that some innovations were adopted faster than others, due to the different characteristics of the innovation. The theory of diffusion of innovation explains

that in the dissemination of new innovations (including new technologies, groundbreaking methods, etc.), there are several factors that could be affecting an individual's decision whether to adopt or not-adopt the innovation. The different attributes of innovation could be the reason for different rates of adoption. The attributes of innovation consist of five attributes: *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*. These attributes are commonly used to assess the perceptions of adopters on the existing innovation. The five attributes of innovations were used in the current research to analyze Cyber-Extension, in order to offer recommendations on improving Cyber-Extension to increase the rate of adoption.

Relative advantage

According to Rogers (1995), relative advantage is the point where an innovation is seen by an adopter as being better than the previous idea or practices. Relative advantage reflects the strength of reward and punishment as the result of practicing innovation. However, although it often happens that the variable of relative advantage is connected to the economic profitability of the innovation, the relative advantage could be diverse depending on the social system of the potential adopter. In some cases, the decision on adopting innovation could be seen as part of the process of increasing social status, often chosen by those in the innovator, early adopter, and early majority categories. Social status is considered less important by those in the late majority and laggard categories. Another important point is that relative advantage in terms of economic benefit, is not always significant to the adopter from with lower economic status. Adams (1982) argued that agricultural clients in developing countries, especially those from the low-income category,

are less likely to refuse innovations because of the lack of economic profitability gained, but rather to avoid the risks that might exist form the innovation implementation.

Compatibility

Compatibility is defined as the stage to which an innovation is seen as aligned with the existing sociocultural values and beliefs, previous experiences and ideas, and needs of the potential adopter (Rogers, 1995). This attribute reflects that the more compatible the innovation, the more likely it is to be accepted and adopted. Practicing a new idea or innovation could possibly be against local norms, or even lifestyles, which would be a barrier to disseminating the idea. For instance, a study conducted by Pandey and Yadama (1992) regarding the adoption of improved cook stoves in Nepal, revealed that the compatibility issue is the major factor in not adopting the new stoves, as nearly half (48%) of the respondents refused to use the technology. One of the causes was that the different types, sizes and shapes of cooking pots women used were not compatible with the design of the new stove. Another example was revealed in a research study carried out by Al-Jabri and Sohail (2012) related to mobile banking adoption in Saudi Arabia. The current research concluded that one of the major factors that supported a high rate of adoption was the compatibility issue, where mobile banking was seen as aligning with the lifestyle of the adopters.

Complexity

The third attribute is the attribute of simplicity of using an innovation, which is called the attribute of complexity (Rogers, 1995). Complexity is defined as the degree to which an innovation is perceived by a potential adopter as relatively difficult to understand and put into use. Adopters may reject implementing a new technology merely because the procedures

of implementation are complex and difficult to master. In a study conducted by Ndag, Sanusi, and Aigbekaen (2008) related to ICT adoption across extension agents in Nigeria, the author revealed that the adoption rate was higher in Southwest Nigeria than in North Central Nigeria due to higher computer proficiency of extension agents in Southwest Nigeria. Adopting ICT at work could be very complex for novices who lack computer skills as learning to use a computer would involve more work.

Trialability

Trialability is the stage at which an innovation is testable by a potential adopter on a limited scale: it is coupled with risk that assessing for a potential adopter before applying the innovation on a larger scale (Rogers, 1995). Trialability reduces uncertainty about an innovation and makes an innovation more readily adopted by users. Innovation that requires little effort in trial is more likely to be accepted, as the trial will uncover both positive results and potential risks of the innovation. Adams (1982) provided an illustration about farmers who adopted farming inputs. New seeds, fertilizers, or herbicides can be purchased easily in a small amount and tested on a limited basis, while tractors and other agricultural machinery are relatively expensive and, therefore, farmers are reluctant to try them.

Observability

The last attribute, as mentioned by Rogers (1995) is observability, a stage in which the impacts of implementing an innovation are noticeable to potential adopters. If the innovation result is observable, potential adopters may evidence the impact of the innovation leading the adopters to a firm conclusion. Adams (1982) described an example of adopting agricultural innovation. New plant varieties, fertilizer, and cropping techniques are more visible to farmers because they can be viewed simply by providing a demonstration plot

along the road, or a small patch side to side with a crop from existing practices. The benefits can be seen directly without using much effort. On the other side, observing the advantages of a concept such as land reform, a benefit of a farmer cooperative, is more difficult to envision due to its long-term impacts.

For decades, the attributes of innovation have been used to improve strategies in innovation dissemination, such as in product marketing. Rogers (1995) stated that the five attributes of innovation are vital variables in determining adoption of innovation. These attributes explain approximately 49% to 87% of the variance in rate of adoption. Thus, to deal with a low adoption rate, product developers need to consider these five attributes to foster dissemination of their products.

The diffusion of innovation theory has been widely applied in assessing ICT adoption in agricultural extension throughout the world. Studies are related to Asia (Mittal & Mehar, 2016), Middle East (Moghaddam & Khatoon-Abadi, 2013), and Africa (Mugwisi, Mostert, & Ocholla, 2015; Tata & McNamara, 2016). Likewise, in the United States, recent studies related to ICT adoption in agricultural extension were also found in several states (Harder & Lindner, 2008; Taylor, 2015; Xu & Kelsey, 2012). The diffusion of innovation theory is still instrumental in ICT integration in agricultural extension as it helps to evaluate the process and stages of ICT infusion to extension worker activities.

Bandura's Perceived Self-Efficacy Theory

Self-efficacy theory developed by Bandura (1977) and applied frequently in education research, can assess an extension agent's ICT proficiency which includes computer skills and internet competencies as skills in integrating ICT into their extension works. Leeuwis and Van den Ban (2004) believed that, besides the level of trust in the support from

one's social environment, one's practices are also shaped by the person's confidence in his/her personal capabilities to perform a specific task in a certain context. People might refuse to do something that they consider difficult to accomplish, or to perform a task that they believe is beyond their abilities. This variable is called self-efficacy. Bandura (1977) introduced the theory of self-efficacy as a concept in social cognitive theory, which postulates that behavioral changes are achieved through a cognitive mechanism that is induced by mastery experience derived from effective performance.

Sources of self-efficacy beliefs

Self-efficacy beliefs are comprised of four elements: *performance accomplishments*, *vicarious experience*, *verbal persuasion*, and *physiological states*. These elements are the sources of information conveying distinctive messages to an individual about personal abilities, and individual construct beliefs are based on the result of integration of the messages (Bandura, 1977).

Performance accomplishments

Previous experience is believed to be one of the causes of an individual's confidence in engaging in a particular task in a certain context. Maddux (1995) argued that people are self-reflective by being able to assess and evaluate their past experiences and way of thinking. People continuously construct beliefs based on their observation of their own and other people's successes and failures. Bandura (1997) held that an individual raises his/her mastery expectation after experiencing sequences of success, while repeated failures decrease their expectations. Being resilient through tough times, an individual preserves and constructs a stronger sense to meet with incoming obstacles. Personal experience in the shape of successfulness is a major source of self-efficacy belief.

Vicarious experience

Bandura (1977) posited that people do not always depend on their personal experiences to obtain expectations. In some other ways, many expectations are derived from observing other people's performance. Schunk (1991) believed that one obtains capability information from others' knowledge; hence, by observing other peers performing well in a particular task, one can be convinced that he/she can perform the task in a similar way. The strength of the vicarious experience effect, however, depends on factors such as how the individual perceives the similarities of characteristics between him or herself and the person being observed.

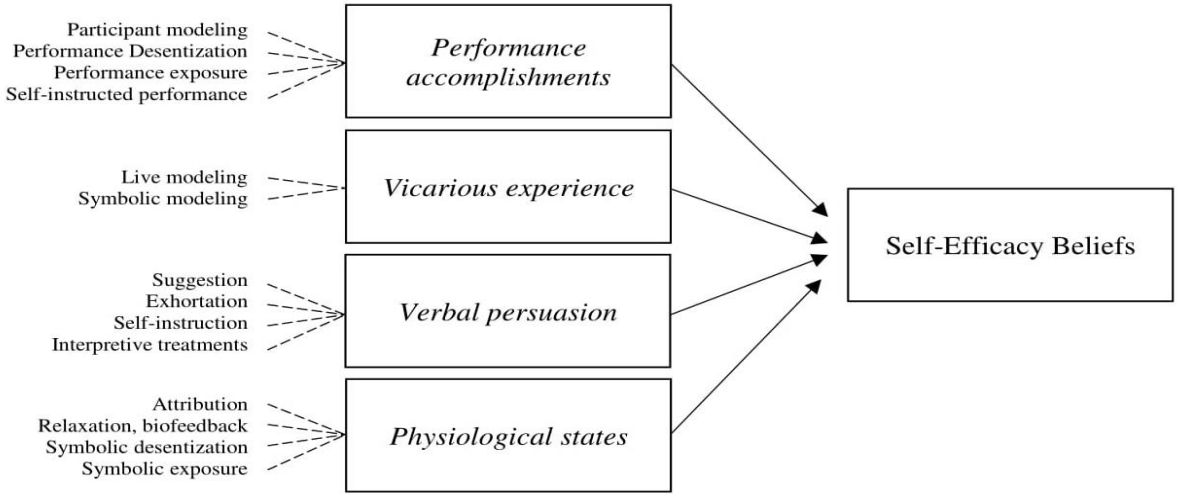
Verbal persuasion

Verbal persuasion is acknowledged to also be a source of self-efficacy. Verbal persuasion is widely used due to its easiness and readiness (Bandura, 1977). Through suggestions, people are led to believe that they have capabilities and are able to perform successfully. Positive verbal persuasion decreases doubts and increases confidence to encounter and overcome problems, although it is considered weaker than efficacy beliefs derived from direct accomplishment and observation of models. According to Maddux (1995), verbal persuasion is affected by several factors such as the skillfulness, reliability and attractiveness of the one who gives the suggestions. Schunk (1991) believed that motivation and positive perception are influenced by attributional feedback after prior successes. However, it is important to note that feedback should be given with excellent timing.

Physiological states

People's measurement of their competencies is influenced by physiological and affective states. Bandura (1977) believed that people are more likely to expect

accomplishment when they are not affected by aversive arousal than when they are strained. Tense conditions generally led to emotional arousal that might influence how people evaluate their personal capabilities. Therefore, by overcoming stressful thoughts, people can elevate confidence and reduce doubts to encounter unpleasant situations (see Figure 2.4).



Source: Adapted from Bandura (1977)

Figure 2.4. Mode of induction in sources of self-efficacy belief

Besides the four sources of self-efficacy, Maddux (1995) added two other determinants of self-efficacy: *imaginal experiences*, which refer to the ability of an individual to image similarities between one's previous experiences and anticipated situations; and *emotional states*, where an individual's positive perception of a situation would likely have self-efficacy beliefs.

Using self-efficacy to indicate ICT proficiency

ICT has become increasingly popular during the last few decades. According to the Internet World Stats (2017), the rapid growth of internet users has occurred worldwide from 587 million in September 2002 (less than 10% of the population) to 3.88 billion in June 2017 (approximately 51.7% of the world population). The increase in internet use and ICT expansion have revolutionized people's lives in many ways, particularly in dealing with time

and space constraints (Pandita, 2017). The Internet and ICT have become major tools used by professional organizations in many sectors, including agricultural extension. The major challenge for organizations related to information use is to prepare their employees to work professionally, including developing proficiency using ICT. Therefore, the need to develop standards to assess ICT proficiency in professional work has become more important to enhance professional workers' skills related to ICT.

In 2003, the Educational Testing Service (ETS) along with seven higher education institutions in the United States established the National Higher Education Information and Communication Technology (ICT) Initiative to plan about the vital need to create future standards of ICT proficiency for higher education. The initiative defined ICT literacy as: "*…the ability to use digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society*" (ETS, 2003, p. 11). The initiative places an emphasis on the importance of cognitive skills, which are comprised of thinking processes, problem solving, and learning, as a vital necessity in modern technology-rich society.

It should be noted that self-efficacy is bound to a domain-specific skills assessment. Therefore, self-efficacy in this study was applied to associate ICT proficiency with the Cyber-Extension implementation in Indonesian agricultural extension. A review of recent literature revealed that the utilization of a self-efficacy test for improved ICT infusion into works and education in various settings has been noted in studies concerning ICT competency (Aesaert & van Braak, 2014; Lau & Yuen, 2014; Rohatgi, Scherer, & Hatlevik, 2016), computer literacy and skills (Ariff, Yeow, Zakuan, Jusoh, & Bahari, 2012; Kass, 2014; Kurbanoglu, Akkoyunlu, & Umay, 2006), information literacy (Ross, Perkins, &

Bodey, 2013; Usluel, 2007), and internet skills (Kass, 2014; Kurbanoglu et al., 2006; Lai, 2008).

Conceptualization of ICT proficiency

Several studies addressed competencies of incorporating ICT into professional work and to organizational activities as ICT skills (Giotopoulos, Kontolaimou, Korra, & Tsakanikas, 2017; Karpati, Torok, & Szirmai, 2008; Kounenou, Roussos, Yotsidi, & Tountopoulou, 2015), while other studies used the term ICT literacy (Mac Callum, Jeffrey, & Kinshuk, 2014; Nor, Razak, Abdullah, Malek, & Salman, 2011), or ICT proficiency (Gelb & Voet, 2009; Sweeney & Drummond, 2013; Taragola, Van Lierde, & Gelb, 2005). Several studies closely associate both terminologies or use them interchangeably (Kuo, Tseng, Lin, & Tang, 2013; Lau & Yuen, 2014; Verdegem & Verhoest, 2009). The current study conceptualized the ICT proficiency of extension agent as having the set of skills and knowledge for working professionally in managing information with the utilization of the ICT platform. Bandura's self-efficacy theory was the framework used to assess ICT proficiency.

Utilizing self-efficacy beliefs enabled the current researcher to focus on assessing ICT proficiency of Indonesian agricultural extension agents. ICT proficiency is considered as the main aspect of aptitude in operating ICT-based advisory and information dissemination in Indonesian agricultural extension services. ICT-based extension, such as Cyber-Extension is designed to improve extension agent's performance in preparing agricultural information that is relevant to their needs in developing extension materials demanded by farmers (BPPSDM, 2015). Adopting ICT requires specific competencies in operating ICT devices, finding appropriate information, and managing information to prepare extension modules. Self-

efficacy was employed to measure the confidence of users in ICT implementation. Based on the research conducted by Lau and Yuen (2014) regarding the measurement of ICT proficiency, the conceptual framework of ICT literacy developed in the current study encompassed *internet competencies* and *computer skills* as the major components of literacy in ICT. The three components are vital to encourage Indonesian extension agents' motivation in adopting Cyber-Extension. Studies regarding ICT proficiency have been found in various journals of formal education, most of which are linked to young learners in school settings. Studies on ICT literacy in agricultural extension services are scarce; therefore, the need to explore responses about ICT proficiency in agricultural extension is paramount.

Although there is no single definition of ICT, it is widely accepted that ICT is a process of organizing information using modern technology devices. The Internet, computers, laptops, or smartphones enable information to disseminate quickly. Information sharing is the key component in ICT, making skills in managing information vital. Information about agricultural innovation is dispersed in the farming community through various communication channels. As agricultural extension is expected to provide reliable information to farmers for improving decisions (Gabathuler et al., 2011), enhancing extension agents' information literacy through the use of ICT devices impacts information delivery. American Library Association (ALA) defined information literacy as an ability to "…*recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information*" (ALA, 1989). Information literacy, which includes the skills to evaluate, select, synthetize, and use information, is necessary as competency and confidence about these skills will improve willingness to engage with tasks related to information problem solving (Kurbanoglu et al., 2006). The instrument developed in the

current study for ICT proficiency incorporated *computer skills* and *internet competencies* to use digital devices and manage online information.

Self-efficacy on computer skills

The capability to use ICT tools often refers to knowledgeable use of computer devices to manage and organize information. While managing and organizing information are always defined as parts of information literacy, Catts and Lau (2008) distinguished information literacy from the ability to use ICT devices. People can be information literate even without computers. Nevertheless, in the digital information era where electronic databases are a major information source, both information literacy (cognitive) and the skills to use ICT devices (technical) are vital aspects of adult competencies. The current study conceptualized the capability to use ICT as *computer skills* needed by extension agents to work with Cyber-Extension.

Durodolu (2016) defined computer skills as the comfort state achieved from using computer applications and other applications related to computers. The rapid global adoption of computer technology has led many organizations and workers to rely on computer application use as the best way to accomplish complex tasks. Ariff et al. (2012) revealed that computer self-efficacy has a positive effect on user acceptance of new information technology, which is indicated by the user perceiving usefulness of the technology. High self-efficacy on computer skills increases the chance of adopting ICT-based application.

Self-efficacy on internet competencies

Several studies related to self-efficacy tests have included internet literacy in computer literacy (Kass, 2014; Kurbanoglu et al., 2006) or to incorporate both terms as ICT literacy or ICT skills (Rohatgi et al., 2016; Torkzadeh, Chang, & Demirhan, 2006). Various

definitions of internet literacy address the broad scope of processing information by using the Internet. For example, Livingstone and Helsper (2009) defined internet literacy as "…*a multidimensional construct that encompasses the abilities to access, analyze, evaluate and create online content*" (p. 311). The definition of internet self-efficacy is more specific. For example, Tsai and Tsai (2010) defined internet self-efficacy as a perception held by an individual about his/her capabilities in using the Internet, which is divided into the two dimensions: *online exploration* and *online communication*. While the former refers to the self-confidence of searching out information on the Internet, the latter refers to the aptitude to communicate via the Internet. Figure 2.5 displays the framework of ICT proficiency used in the current study.

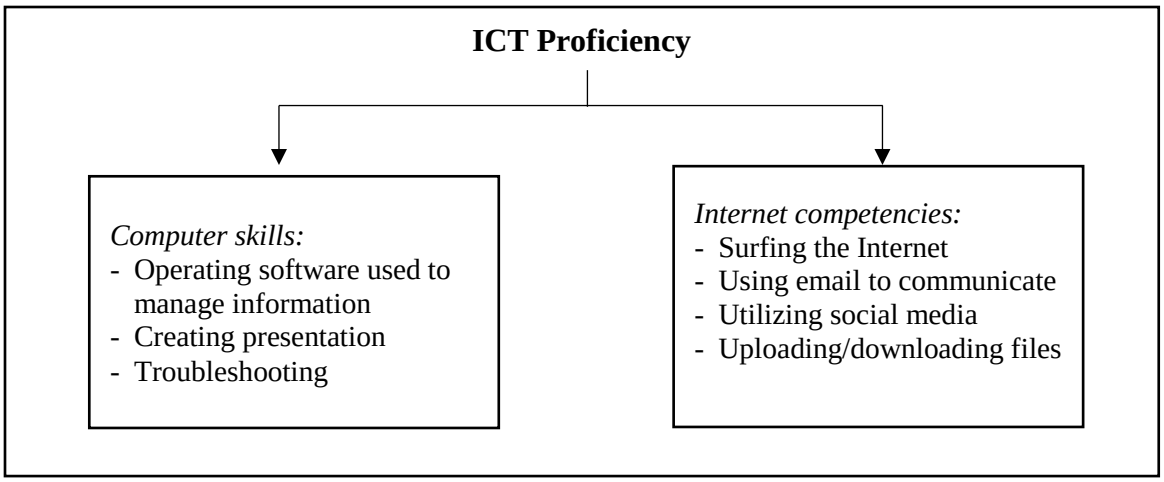


Figure 2.5. Framework of ICT proficiency

Research Questions

The purpose of this study was to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. This study was conducted to answer the following questions: (1) What are the selected demographic data of Indonesian extension agents? (2) What are the extension

agents' current positions in the stages of innovation-decision process of Cyber-Extension? (3) What are the extension agents' perceptions of Cyber-Extension innovation attributes? (4) To what extent do the extension agents' perceptions of Cyber-Extension vary across different selected demographic data? (5) How do extension agents' use of ICT devices and the Internet? (6) What are the extension agents' proficiency in using ICT based on self-efficacy tests on computer skills and internet competencies? (7) To what extent does the extension agents' ICT proficiency vary across different selected demographic data? (8) Do the extension agents' perceptions of Cyber-Extension and ICT proficiency simultaneously predict the adoption of Cyber-Extension?

Summary

Agricultural extension manages the circulation of information in a system and facilitates learning where clients can make use of information to design better plans and to make decisions regarding their farming problems. Extension agents are challenged with providing information sources that fit farmers' needs. Extension agents deliver information to farmers utilizing several methods and techniques, and select which methods suit a situation they encounter. In recent years, the rapid advance of computer and communication technology has been a great motivator for developing improved delivery methods in agricultural extension system. ICT has been a great support for agricultural extension services throughout the world, particularly due to ICT's vital role in spreading information to clienteles. With ICT, research-based information and knowledge from research centers to farmers brought by extension agents flows faster compared with the former use of conventional mass media. ICT in agricultural extension is unique, as it tends to have the functional assets of both mass media and interpersonal communication, in a way that ICT is

able to reach a wider audience while also providing support for a high level of interactivity compared to that of conventional mass media. The promising features offered by ICT-based extension system, however, do not align with acceptance of ICT by actors involved in agricultural extension. Although there is an increasing demand for using ICT in agricultural extension, some barriers and challenges regarding adoption remain.

In 2009, the MoA launched Cyber-Extension project as a part of ICT implementation in agricultural extension. Cyber-Extension is designed to improve extension agent's performance through information sharing by providing data and information that could improve agents' knowledge on problems pertaining to agriculture, and by opening more space to exchange information and ideas across extension agents who share their experiences and knowledge and gain feedback from other farmers and experts. Nevertheless, a review of the literature revealed that, to date Cyber-Extension has not been mainly implemented by agricultural extension agents. In-depth analysis of several studies and reports related to adoption of innovation of Cyber-Extension revealed that there are several factors perceived by extension agents as problems hindering Cyber-Extension's implementation. These include lack of equipment and facilities, poor competencies in operating Cyber-Extension, and lack of accuracy of the information provided by Cyber-Extension.

The purpose of this study was to assess the implementation of Cyber-Extension in Indonesia by determining the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT. This study employed the theory of diffusion of innovation invented by Rogers (1995) and self-efficacy theory (Bandura, 1977). The diffusion of innovation theory frames the adoption of Cyber-Extension as the major ICT innovation in Indonesian agricultural extension services. This theory can be applied to reveal the stages of adoption by

utilizing the five stages of innovation-decision process and analyzes the barriers to adoption by addressing the different characteristics of the adopted innovation's attributes. Self-efficacy can be applied to assess the proficiency of agricultural extension agents to use ICT in their work.

CHAPTER 3. METHODS AND PROCEDURES

The purpose of this study was to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. Eight objectives were formulated to inform this research:

1. Describe selected demographic data of Indonesian extension agents;
2. Identify extension agents' current positions in the stages of innovation-decision process of Cyber-Extension;
3. Describe extension agents' perceptions of Cyber-Extension's innovation attributes;
4. Compare extension agents' perceptions of Cyber-Extension's innovation attributes across different selected demographic data;
5. Describe extension agent's use of ICT devices and the Internet;
6. Describe extension agents' ICT proficiency based on self-efficacy test of computer skills and internet competencies;
7. Compare extension agents' ICT proficiency across different selected demographic data; and
8. Determine whether extension agents' perceptions of Cyber-Extension's innovation attributes and ICT proficiency predict the adoption of Cyber-Extension.

Design of the Study

This research study employed a descriptive research design. According to Ary, Jacobs, Sorensen, and Razavieh (2010), descriptive statistics are used to describe, organize, and summarize quantitative information. This study aimed to describe the population without intervention in or manipulation on research variables. In addition, the study also provides the background and characteristics of extension agents, the extension agents' positions on the

stages of innovation-decision process, their perceptions of Cyber-Extension, and their ICT proficiency indicating their preparedness to implement Cyber-Extension. Furthermore, the researcher investigated the differences of each variable across different characteristics. Last, this study was conducted to predict the adoption of Cyber-Extension through extension agents' perceptions of innovation attributes and their ICT proficiency.

One potential threat to validity for this research was that a respondent might give 'safe answers' they believe are 'true' according to a technical guideline, rather than matching their satisficing perceptions. To minimize such a potential threat, the researcher emphasized the protection of respondents' confidentiality by informing participants before they filled out the instrument, to reduce respondents' hesitations in expressing their honest responses. This aspect of the survey was shared both orally and in a written letter.

Data Source

The population of this study was comprised of the agricultural extension agents working in Gorontalo province in Indonesia. A list comprised of the names of the extension agents and their contact information was taken from *https://bakorluh.gorontaloprov. go.id/ simbangluh*, a website owned and managed by the Extension Coordination Agency (*Bakorluh*), a bureau working under the MoA at the provincial level. Considering that this study was expected to contribute to the future training and other capacity development for extension agents, only public extension agents were invited to participate. The initial data from the *Bakorluh* website revealed that there were 455 active public extension agents in Gorontalo province, working in six districts (five regencies and one city) within the province. The data were validated through visiting regional offices in each city/regency to obtain the precise number of active public extension agents as well as their permission to use the data.

Validation before the data collection indicated that there were 372 active extension agents in the province. Considering that all subjects in the population are accessible in terms of resources (time and budget), this research employed census. All potential respondents were asked via telephone and a personal visit to their offices for asking their permission to participate in this study.

Instrumentation

A survey was conducted in the form of a structured questionnaire containing closed-ended questions and statements. Ary et al. (2010) posited that closed-ended questions are appropriate when all possible answers or responses can be a defined set and the number of answers was limited. The questionnaire was designed by adopting and modifying several instruments, such as those used by Harder (2007), Lau and Yuen (2014), Li (2004), Livingstone and Helsper (2009), Taylor (2015), and Torkzadeh et al. (2006). Questions and statements taken from their instruments were modified and reworded to adjust them to the objectives in this study. Several revisions were made during the conceptualization of the instrument.

All of the items in each part in the questionnaire used a uniform scale. Various types of responses, such as those from a Likert scale with either unipolar and bipolar scales, multiple answers, and selecting one best answer were used in this questionnaire. Participants responded by checking (√) the box that indicated their best answer. In constructing the instrument, a panel of experts consisting of two professors in the Department of Agricultural Education and Studies at Iowa State University reviewed and revised the questions and statements to improve the content validity of the instrument. Additionally, consultation was made with an expert on agricultural extension agents working for Indonesian government to

review the terms used in the questionnaire. Inasmuch as the questionnaire was comprised of questions/statements related to subjective perceptions, opinions, or beliefs, a validation of the questionnaire was conducted to clarify the content of the instrument to omit irrelevant questions or statements, as well as to finalize the questionnaire. Before data collection, the questionnaire was translated into the Indonesian language to increase ease of responding to the questions and statements as all respondents spoke the Indonesian language. The translation was conducted carefully in order to prevent language bias while clarifying misleading, and ensuring respondents' understanding about the core concepts used in this research study.

The questionnaire in this study was comprised of four sections. In the first section, participants were asked about their access to ICT. This section included basic information and responses such as access to ICT devices, access to the Internet, and familiarity with using ICT devices. Questions in this section used dichotomous scales, three-point scales, and five-point scales. A description of the questions is displayed in Table. 3.1.

Table 3.1. Questions and scales in Section 1: Access to ICT

Questions	Scale
Do you own or have access to a computer?	Yes No
How often do you use the computer?	Seldom/monthly Often/weekly Very often/daily
How long have you been accessing the Internet at home?	Do not use Less than 1 year Between 1-3 years Between 3-5 years More than 5 years

The second section of the questionnaire consisted of questions and statements related to Cyber-Extension as an innovation. The design of the second section was based upon the theory of diffusion of innovation (Rogers, 1995). This section was divided into two parts: the first part covering respondents' current positions in the stages of innovation-decision on Cyber-Extension with respondents indicating their current level of involvement in Cyber-Extension utilization. The diffusion of innovation theory explained by Rogers (2003) mentioned that there are five stages of innovation-decision process: *knowledge, persuasion, decision, implementation,* and *confirmation*. Li (2004) created the stage *no knowledge* to indicate the absence of knowledge toward an ongoing innovation dissemination in a certain social system. This stage was added to Rogers' five stages, giving six stages to the model. The stage of *decision* was divided into two choices: decision to *adopt* and decision to *reject*. These choices clarified whether there were respondents rejected the innovation after they had tried it. This division was conducted to include those who rejected the technology as it is acknowledged that rejection is a valid part of technology dissemination process, which is useful to evaluate Cyber-Extension adoption. The final model in this part is comprised of seven stages of innovation-decision process as shown in Figure 3.1.

In the instrument, statements were designed to reflect the respondents' positions in the given stages of the innovation-decision process. Each stage contains only one statement, where a respondent selects one statement that best fits with his/her position in the stage of the innovation-decision process.

The second part of the Cyber-Extension section asked about respondents' perceptions about the attributes of Cyber-Extension as an innovation (part 2B). The attributes included *relative advantage, compatibility, complexity, trialability,* and *observability*. Each attribute

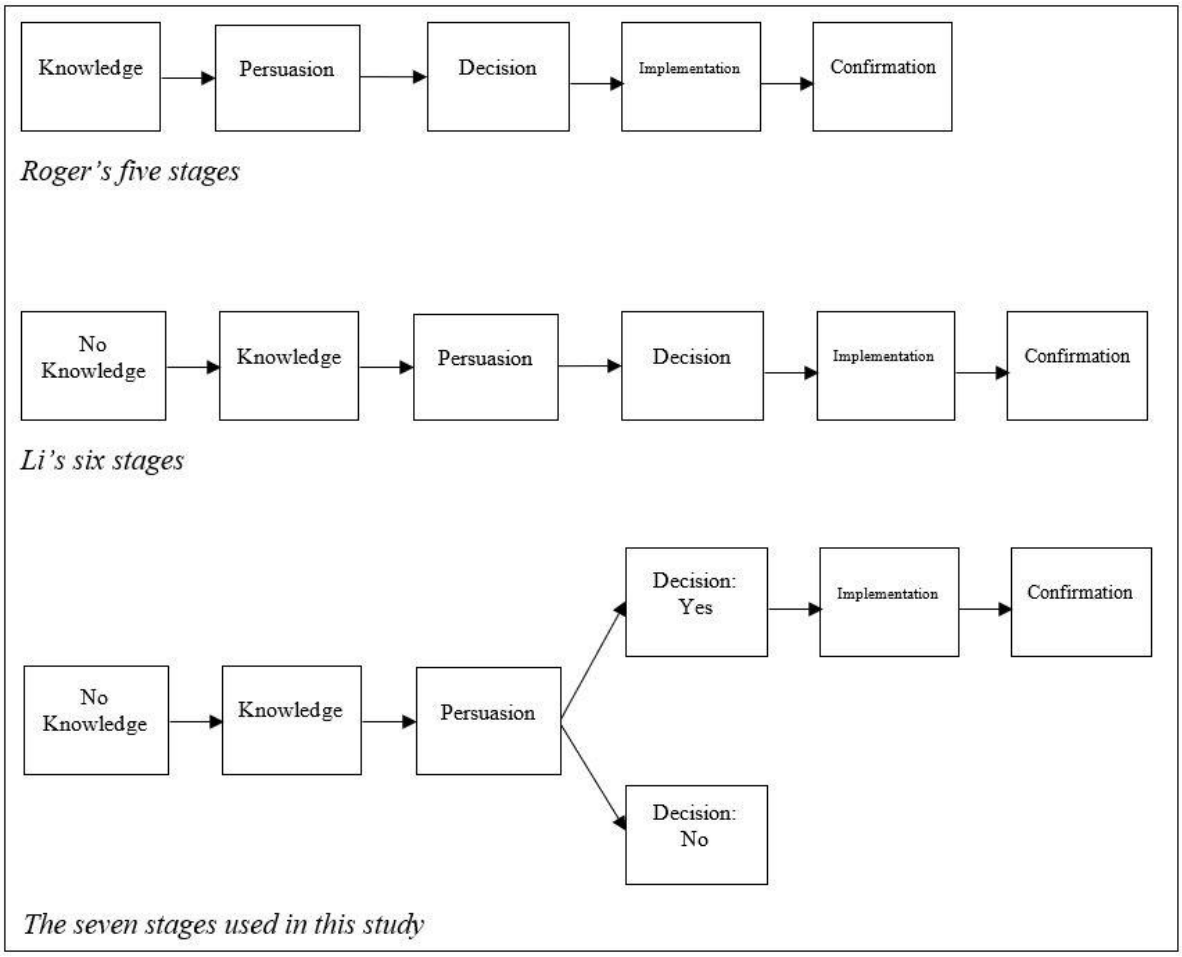


Figure 3.1. Stages of the innovation-decision process used in this study

was comprised of several items measured with a four-point bipolar scale from *strongly disagree* to *disagree* to *agree* to *strongly agree*. The four-point Likert scale was selected due to its appropriateness for this study in evaluating the positive or negative perceptions of users. According to Bertram (2013), a four-point Likert scale was used to produce a forced choice measurement. Participants provided only one response for each statement that best fit his or her rating. Table 3.2 provides a description of questions and items in the section related to perceived innovation attributes.

Table 3.2. Questions and items in Section 2, Part 2: Innovation attributes

Questions	Items
Relative advantage	Cyber-Extension enhances the quality of work I do Cyber-Extension is a useful tool in delivering educational outreach to farmers Cyber-Extension increases the accessibility of extension programming for farmers I can find information I need in Cyber-Extension more quickly The quality of information provided by Cyber-Extension is better than brochures Cyber-Extension costs me less money than other media
Compatibility	Cyber-Extension supports my work as an extension agent Cyber-Extension fits into my needs in finding information to prepare extension materials My vision for the future of extension includes Cyber-Extension Cyber-Extension helps me deliver programs based on the needs of farmers Cyber-Extension fits well with the way I often do my job
Complexity	Accessing information in Cyber-Extension is easy for me I can find the information I am looking for using Cyber-Extension I do not need extensive training on how to use Cyber-Extension I have no difficulty teaching others how to use Cyber-Extension
Trialability	I have tried Cyber-Extension I am able to experiment with Cyber-Extension I can easily select any features of Cyber-Extension that I want to use I can test key features of Cyber-Extension It doesn't require much time to explore Cyber-Extension Cyber-Extension can be tested without obligation to continue further
Observability	I have heard a lot about Cyber-Extension I have seen how other extension agents use Cyber-Extension in their work I have seen Cyber-Extension help extension agents in finding important information for clients I have seen Cyber-Extension help extension disseminate research-based information for farmers I am aware of the benefits of Cyber-Extension for extension agents or farmers

The third section is comprised of questions and statements to assess respondents' ability to use Cyber-Extension as measured by their confidence in using ICT devices in finding and managing information (ICT proficiency). This section measured the respondents' level of knowledge required to practice and adopt web-based extension such as Cyber-Extension. There were two important components of ICT skills measured: *computer skills* and *internet competencies*. Each component consisted of several items that reflect the participants' responses toward the perceived self-efficacy statements. The self-efficacy test (Bandura, 1977) was employed to assess respondents' ICT proficiency. This theory pinpointed statements in this section pertaining to ICT proficiency since utilizing Cyber-

Extension is a specific domain competence. Measurement of confidence in this section used unipolar five-point scales. The following scales were used; *not confident*, *slightly confident*, *moderately confident*, *very confident*, and *extremely confident*. Respondents rated their degree of confidence in using computer and the Internet by indicating their best responses toward the statements as provided in Table 3.3.

Table 3.3. Questions and items in Section 3: Degree of confidence using a computer and the Internet

Questions	Items
Computer skills	I am able to quickly type in word processor software (e.g., Microsoft Word). I am able to insert pictures using word processor software I am able to make table using spreadsheet software (e.g. Microsoft Excel). I am able to plot a graph and chart using spreadsheet software. I am able to create presentation with presentation software (e.g. Microsoft PowerPoint) I am able to edit the size and type of fonts in presentation software. I am able to troubleshoot the printer (e.g. jammed paper, failure connection)
Internet competencies	I am able to set a homepage for an internet browser (e.g., Mozilla, Opera, Internet Explorer). I am able to search for information on the Internet using a search engine (e.g., Yahoo, Google, Baidu). I am able to use email to communicate. I am able to use social media (e.g., Facebook, Twitter, Instagram). I am able to download files from the Internet. I am able to upload files to the Internet.

The last section in the questionnaire asked the participants about their demographic backgrounds and characteristics which included participants' ages, genders, education levels, areas of employment, number of villages and farmer groups being covered, and years of employment.

A pilot test was carried out with 30 extension agents as participants, resulting in 21 responses. The number of respondents in the sample was considered adequate as Isaac and Michael (1995) suggested that the sample size should be 10 to 30 to gain a practical advantage. Responses from the pilot-study were used to perform reliability tests of the items in the instrument and to validate the statements. The reliability of the instrument was tested

for its internal consistency by using Cronbach's *alpha*. Ary et al. (2010) stated that Cronbach's *alpha* is appropriate in measuring scales in research; therefore, it was used to improve the instrument before finalizing the questionnaire. Morgan et al. (2012) argued that the alpha value of the Cronbach's coefficient (α) should be positive and greater than .70 to provide a strong support for its reliability. Table 3.4 shows the results of the reliability test to measure internal consistency between items in each construct.

Table 3.4. Pilot test results of Cronbach's alpha coefficient

Construct	Reliability test
Perceptions of Cyber-Extension	
Relative advantage	.600
Compatibility	.709
Complexity	.733
Trialability	.837
Observability	.663
Self-efficacy test	
Computer skills	.960
Internet competencies	.939

Note: Alpha coefficient was set at .70.

The results of the reliability test showed that out of eight items, two items (*computer skills* and *internet competencies*) provided a relatively high reliability (.960 and .939, respectively), four items (*compatibility*, *complexity*, and *trialability*) were considered reliable (.709, .733, and .837), and two items (*relative advantage* and *observability*) were not too reliable (.600 and .663). However, according to Ary et al. (2010), a coefficient in the range of .50 to .60 (modest reliability) might still be acceptable if the result was to be used for making decisions and for research purposes. Therefore, the constructs of *relative advantage* and *observability* were still used in this research. Minor modification was made especially regarding the use of difficult terms in the questions/statements in order to make the questions/statements in the survey understandable for the respondents.

Data Collection

Data collection was carried out upon receiving an approval from the Institutional Review Board (IRB) at Iowa State University in February 2nd (see appendix). This study selected personal interviews using a paper-based questionnaire. Two groups of interviewers (each with one research assistant) were employed to conduct data collection from April to August (approximately17 weeks) including inputting the data from paper questionnaires into spreadsheet software. The research assistants had prior experience conducting fieldwork in research and were university graduates recommended by the Head of the Department of Agribusiness in the university where the researcher has worked (Universitas Ichsan Gorontalo, Indonesia). The research assistants distributed the questionnaires in person, conducted the interview, and acted as contact persons.

To improve the credibility of data collection, a training session was held so that interviewers understood the data collection process as well as research ethics such as conveying the contents of consent form clearly and appropriately. For example, although they had agreed to participate in this study, contacts could withdraw from the interview at any time. The training covered three major topics: ethical and legal aspects in research, the Institutional Review Board (IRB) process, and data collection procedures as approved by the IRB. Materials used in this training were taken from multiple resources such as books (for example, *Introduction to Research in Education* by Ary et al. (2010), Chapter 20, sub-chapter "Ethic and legal considerations" on pp. 590-592 and *Educational Research* by Creswell (2015), Chapter 1, sub-chapter "Important ethical issues in conducting research" on pp. 22-24), courses (such as "confidentiality of data", taken from RES EV 580 course, week 5), an online resource (derived from Iowa State University IRB website:

https://www.compliance.iastate.edu/committees/irb), and the dissertation summary and data collection procedures as applied to IRB. The training was conducted in two sessions. The first session consisted of the interviewers reading materials provided by the principal investigator. The second session was subsequent online discussion via *Whatsapp* scheduled after session one had been completed. Online discussion was held to clarify aspects that the research assistants might want to ask as well as to examine their understanding about the research and data collection procedures. The training syllabus was reviewed and approved by the IRB before data collection began. The training syllabus is attached in the appendix.

Personal interviews were selected to increase the response rate. According to Ary et al. (2010), one of the disadvantages of a mailed questionnaire is a low response rate (commonly less than 30%, whereas a more desirable expectation is between 40% to 75% returns); personal interviews may result in a higher response rate (90% or higher). A list comprised of the names and contact information of participants was received from MoA at the provincial level. The interviewers then contacted the potential participants via phone to set a schedule or to arrange a personal and informal visit at their offices. The questionnaires were distributed by the interviewers along with a letter of introduction, a cover letter asking for participation, and a copy of the informed consent form. All interview materials were translated into the Indonesian language before the data collection. The personal interviews were undertaken by interviewers reading the questions and statements to the participants and recording their responses in the questionnaires.

A friendly reminder was sent for those who had not confirmed and had not met the interviewers during fieldwork. The reminder was sent approximately two months after the initial invitation. These two months were given to the interviewers considering their

limitations in communication access, the wide area covered by this research, and due to religious reasons (Ramadhan month) that occurred during the fieldwork period. The second reminder was sent one month after the first. Considering that this research employed census where all populations were invited to participate in this study, the response rate was set at 60%. To improve the response rate, a lottery cash reward was offered of Rp. 100,000, approximately equal to USD 7.5 (based on the exchange rate in January 2018) which was awarded to three participants after the data collection was complete.

A comparison of early to late respondents was conducted to check if the information gained from data collection was reliable (Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983). This technique is frequently used according to several studies (e.g., Clausen & Ford, 1947; Pace, 1939), so there are no significant differences between participants' responses based on different times in follow-up and responses based on return of the survey. Moreover, after consideration, there was no specific definition of either the early and late respondents. Lindner et al (2001) recommended the definition of late respondents as: *"…those who respond in the last wave of respondents in successive follow-ups to a questionnaire, that is, in response to the last stimulus"* (p. 52), with the suggested minimum number of 30. In the Agricultural Education and Studies discipline at Iowa State University, several methods of defining early and late respondents were noted. Paulsen (2011) included the final two waves of contact as late respondents as recommended by Lindner, while Taylor (2015) divided the respondents according to the time questionnaires were sent, whereby those who responded in the first two weeks were included as early respondents, and those who responded in the last two weeks were defined as late respondents. In the current study, late respondents were those who answered to the second and third waves of contact. The means from the early

respondents were compared to those of the late respondents to determine if there was any significant difference. A *t*-test was conducted to check whether there was a significant difference between early and late respondents. If no differences were found, the results were considered as being generalizable to the entire population (Lindner et al., 2001; Miller & Smith, 1983).

Data Analysis

The Statistical Package for the Social Sciences version 25 (SPSS ver.25) software with the license provided by Iowa State University was used to carry out statistical analyses. Descriptive statistics (frequencies, percentages, and mean scores) were used to assess the descriptive data. Tables and figures, with different formats according to the type of description, were used to present the results.

Several statistical tests were applied to elaborate answers in accordance with research questions (see Table 3.5). The study conducted independent sample *t*-tests to measure the difference between two uncorrelated groups (e.g. the difference of perceptions of Cyber-Extension across gender). ANOVA tests were used to analyze the difference between several groups (e.g. the difference in computer skills by age group). Regression analysis was used to determine whether selected variables predicted the adoption of Cyber-Extension. The regression analysis used in this study was logistic regression analysis. This regression was selected to predict dichotomous dependent variable explaining the adoption of Cyber-Extension.

The significant level was measured at .05 alpha. Ary et al. (2010) held that it is very common in the behavioral sciences for the levels of significance to be .05 and .01 alpha

Table 3.5. Statistical tests for each research question

Research question	Statistical tests and analyses
1. What are the selected demographic data of Indonesian extension agents?	Descriptive statistics with frequencies and percentages
2. What are the current positions of extension agents in the stages of innovation-decision process?	Descriptive statistics with frequencies, percentages, and cross tabulations
3. What are the extension agents' perceptions of Cyber-Extension innovation attributes?	Descriptive statistics with frequencies and percentages, mean difference with Analysis of Variance (ANOVA)
4. To what extent does the extension agents' perceptions of Cyber-Extension vary across different selected demographic data?	Mean differences with ANOVA and *t*-tests
5. How do the extension agents' use of ICT devices and the Internet?	Descriptive statistics with frequencies and percentages
6. What are the extension agents' ICT proficiency based upon self-efficacy test on computer skills and Internet competences?	Descriptive statistics with frequencies and percentages
7. To what extent does the extension agents' ICT proficiency vary across different selected demographic data?	Mean differences with ANOVA and *t*-tests
8. Do the extension agents' perceptions of Cyber-Extension and ICT proficiency simultaneously predict the adoption of Cyber-Extension?	Binary logistic regression

levels. The results of the study were analyzed and interpreted based on the research topics and were explained and discussed narratively.

Limitations

The study was conducted with the acknowledgment of the following limitations:

- This study assessed the perceptions of respondents of Cyber-Extension. For many extension agents, Cyber-Extension was relatively new. This was indicated by the relatively small number of responses regarding Cyber-Extension compared to the number of total responses.
- The respondents in this research were taken from one of 34 provinces in Indonesia. The results might not be generalizable to Indonesian extension agents nation-wide.
- Some of the respondents, due to their busy schedules, were not properly interviewed. Some of them asked the interviewers to put the paper questionnaires in their offices

and said that they would fill them after coming back from the field. They also asked the interviewer to return later to pick up the questionnaire.

- Many items in the participants' contact information (phone numbers) provided by the extension offices were not valid, slowing the interviewers' progress.
- Several limitations were encountered by the interviewers in the field such as lack of communication access, especially for respondents who worked in rural areas, because of the wide physical area covered by this research as well as the shorter survey time because of religious reasons (Ramadhan month).

CHAPTER 4. RESULTS

This study was conducted to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. Eightfold objectives were formulated to answer the research purpose and instrumented in a questionnaire delivered to respondents. The specific objectives of the study were to:

1. Describe selected demographic data of Indonesian extension agents;
2. Identify extension agents' current positions in the stages of innovation-decision process of Cyber-Extension;
3. Describe extension agents' perceptions of Cyber-Extension's innovation attributes;
4. Compare extension agents' perceptions of Cyber-Extension's innovation attributes across different selected demographic data;
5. Describe extension agents' use of ICT devices and the Internet;
6. Describe extension agents' ICT proficiency based on self-efficacy test of computer skills and internet competencies;
7. Compare extension agents' ICT proficiency across different selected demographic data; and
8. Determine whether extension agents' perceptions of Cyber-Extension's innovation attributes and ICT proficiency predict the adoption of Cyber-Extension.

The data gained from field work were compiled and analyzed using statistical tests. This chapter presents the findings and results of this study, including reliability analysis and findings based upon the research objectives.

Reliability Test Results

Reliability tests were conducted with SPSS ver.25 to check the internal consistency of the instrument. Cronbach *alpha*'s coefficient was set at .70 to justify acceptable reliability. Morgan et al (2012) supported this justification, noting that the alpha (α) coefficient must be positive and greater than .70 to claim that an instrument was reliable. Table 4.1 illustrates that this study provides a strong reliability instrument. The construct of *computer skills* provided the strongest reliability with a value of .943. Overall, all constructs were reliable.

Table 4.1. Cronbach's alpha coefficient

	Reliability test	
Construct	Pilot study	Main study
Perceptions of Cyber-Extension		
Relative advantage	.600	.834
Compatibility	.709	.822
Complexity	.733	.750
Trialability	.837	.884
Observability	.663	.801
Self-efficacy test		
Computer skills	.960	.949
Internet competencies	.939	.943

α = .70

Dealing with Non-Response

In this study, late respondents were defined as those who responded during the second and third waves of contact. In total, the number of extension agents responded to this study was 221, where 186 participants were early respondents and 35 participants were late respondents. The mean of the early respondents was compared to that of the late respondents to determine if there was a significant difference between the means. A *t*-test was conducted to check the significant difference between the means. Lindner et al. (2001) suggested that the two groups be compared on their responses to the Likert-scale questions in the instrument using a *t*-test. Therefore, a *t*-test was used for checking non-response error to compare the means of the seven constructs built with a Likert-scale, including *relative advantage*,

compatibility, *complexity*, *trialability*, *observability*, *computer skills*, and *internet competencies*. The results are provided in Table 4.2.

The results of the *t*-tests comparing early and late respondents revealed there were no significant differences. If no differences were found, it was concluded that the results could be generalizable to the entire population (Lindner et al., 2001; Miller & Smith, 1983). Therefore, the results of data collection could be generalized to the population in this study.

Table 4.2. Comparison of early and late respondents

	Early respondents		Late respondents		
Construct	M	SD	M	SD	Sig.
Perceptions of Cyber-Extension					
Relative advantage	2.17	.39	2.16	.26	.88
Compatibility	2.23	.40	2.25	.33	.84
Complexity	1.94	.44	1.87	.43	.52
Trialability	1.95	.45	1.97	.43	.79
Observability	2.10	.41	2.13	.41	.68
Self-efficacy test					
Computer skills	2.26	1.15	2.60	1.06	.09
Internet competencies	2.59	1.02	2.81	.87	.22

Significance = .05α

Findings

This section provides analyses and interpretations of the eight objectives formulated in this study. This information was obtained through face-to-face interviews during field work. The results were compiled in this section and organized based on the research objectives. Tables and figures are provided to display the descriptive data and interpretations that include the results of statistical tests.

Selected demographic data (Objective 1)

This section describes the extension agent's demographic data and characteristics as given in ***Objective 1: Describe selected demographic data of Indonesian extension agents.*** The data include age, gender, educational attainment, areas of employment, length of service,

number of villages being covered, and number of farmers groups being supervised. Table 4.3 presents the respondents' distribution across demographic data.

The study revealed that the ages of respondents in this study ranged from 27 to 62, with a mean age of 41.3. The majority of the respondents (*n*=99, 44.8%) were within the age range of 40 to 49 years, while only 5% (*n*=11) were younger than 30. Among the respondents who participated in this study, the majority were female (*n*=119, 53.4%), and the others were male (*n*=103, 46.6%). Most of respondents in this study hold a Bachelor's degree or diploma (*n*=135, 61.1%) and only 1.4% (*n*=3) have a Master's degree or above. The rest of the respondents (*n*=80, 36.2%) have at least a high school diploma. In this study, the geographical location of employment is called regency (*kabupaten*) or city (*kota*), depending on their status as administrative districts under Gorontalo province which has six districts (five regencies and one city). Most of the respondents (*n*=50, 22.6%) worked in *Pohuwato* regency, followed by *Gorontalo* regency (n=49, 22.2%). 38 respondents (17.2%) were in *Boalemo*, 37 (16.7%) in *Bone Bolango*, 28 (13%) in *Gorontalo Utara*, and the smallest number of respondents (*n*=19, 8.6%) were in *Kota Gorontalo*. The majority of respondents belonged to the group with 10 to 14 years of service (*n*=99, 45.8%), followed by 5 to 9 years (*n*=63, 29.2%), and 12 years and above (*n*=24, 11.1%). The smallest number of respondents is in the group with 15 to 19 years (*n*=15, 6.9%) and those who have been working as extension agents for less than 5 years (*n*=15, 6.9%).

The data indicate that some respondents handled just one village and others supervised more than 1 village. It is shown that 108 respondents (50.2%) supervised only one village while the others (49.8%) supervised two or more villages. The MoA sets the ideal ratio between extension agents and villages covered is1:1, meaning that one extension agent

Table 4.3. Responses across demographic data

Demographic	Responses	
	n	*%*
Age range		
≤ 29	11	5
30-39	75	33.9
40-49	99	44.8
50 ≤	36	16.3
Total	221	100
Gender		
Male	103	46.6
Female	119	53.4
Total	221	100
Education		
Highschool	80	36.7
Bachelor/Diploma	135	61.9
Masters or above	3	1.4
Total	218	100
Area of Employment		
Kota Gorontalo	19	8.6
Boalemo	38	17.2
Bone Bolango	37	16.7
Gorontalo	49	22.2
Gorontalo Utara	28	12.7
Pohuwato	50	22.6
Total	221	100
Length of Service		
Less than 5 years	15	6.9
5 – 9	63	29.2
10-14	99	45.8
15-19	15	6.9
20 and above	24	11.1
Total	216	100
Number of Villages		
1 village	108	50.2
More than 1	107	49.8
Total	209	100
Number of Farmers Groups		
Less than 8	55	25.9
8-16	79	37.3
17 and more	78	36.8
Total	212	100

incorporated in farmers groups. A farmers group (*kelompoktani*) is an organization established by 20 to 25 farmers based on homogeneity of interests, environment and solidarity of the members (Permentan, 2007). The majority of respondents (*n*=79, 37.3%) supervised between eight to sixteen farmers groups, 36.8% (*n*=78) supervised more than sixteen farmers groups, and 25.9% (*n*=55) supervised less than eight farmers groups. According to MoA, ideally each extension agent supervises between eight to sixteen farmers groups.

Cyber-Extension (Objective 2, 3, and 4)

Responses related to Cyber-Extension were divided into three parts. The first part asked about the respondents' positions on each stage of the innovation-decision process, and the second part described participants' perceptions of Cyber-Extension. The questions and statements were based upon diffusion of innovation theory (Rogers, 1995). The third part compared different perceptions of the extension agents of Cyber-Extension's innovation attributes against selected demographic data. This section addressed objectives 2, 3 and 4 of this study.

Stage of innovation-decision process

Respondents were asked about their current positions in the stages of innovation-decision process. This part used a model built by Rogers (1995), and adopted studies conducted by Li (2004) and Taylor (2015). Roger's model comprised of six stages: *knowledge*, *persuasion*, *decision*, *implementation*, and *confirmation*. Li and Taylor added the stage of *no knowledge* prior to the first stage in Roger's model. This stage was built to accommodate responses that indicate a respondent's unawareness of an innovation. The researcher in this study modified the model by dividing the stage of *decision* into two parts:

decision to adopt (decision: yes) and decision to reject (decision: no). The purpose of this division is to evaluate the respondents' different attitudes (either to accept or reject an innovation) after experiencing Cyber-Extension. Each respondent indicated which statement was the best fit with his/her current position. The results are provided in Table 4.4.

Table 4.4. Responses by Stage of Innovation-Decision Process

Stages	Descriptions	Responses	
		n	%
No knowledge	I have never heard about Cyber-Extension	40	18.2
Knowledge	I have heard about Cyber-Extension, but I have not used it and have no idea that I will use it or not	80	36.4
Persuasion	I have tried Cyber-Extension but haven't used it in my works because I am still learning about it	49	22.3
Decision to reject	I have tried Cyber-Extension and I have decided that I will not use it	5	2.3
Decision to adopt	I have tried Cyber-Extension and I have decided that I will use it	18	8.2
Implementation	I have used Cyber-Extension and am still exploring the features to know its benefit	20	9.1
Confirmation	I have used Cyber-Extension long enough to understand and evaluate whether Cyber-Extension will be part of my extension activities	8	3.5

Note. Total responses were *n*=220, with 1 missing data.

Table 4.4 indicates the majority of respondents were at the *no knowledge* (*n*=40, 18.2%), *knowledge* (*n*=80, 36.4%), or *persuasion* (*n*=49, 22.3%) stages. There were 23 participants (*n*=23) on the *decision* stage, where those who decided to adopt were larger (*n*=18, 8.2%) than those who decided to reject Cyber-Extension (*n*=5, 2.3%). Other respondents were at the stage of *implementation* (*n*=20, 9.1%) or *confirmation* (*n*=8, 3.5%).

The variation of respondents' current positions in the stages of the innovation-decision process across selected demographic background is shown in Table 4.5. The distribution was obtained through several cross-tabulation analyses using SPSS ver.25. For practical purposes, respondents in the *decision: yes* and *decision: no* were combined in the *decision* stage.

Table 4.5. Respondents by Stage of Innovation-Decision Process across demographic background

Demographics	NK	K	P	D	I	C
Age range						
≤ 29	2	5	3	1	0	0
30-39	16	24	19	4	10	2
40-49	20	35	18	14	6	6
50 ≤	2	16	9	4	4	0
Gender						
Male	17	36	23	18	6	2
Female	23	44	26	5	14	6
Education attainment						
High school	12	40	18	3	6	1
Bachelors	27	37	31	20	14	5
Masters or beyond	0	1	0	0	0	2
Employment area						
Kota Gorontalo	1	6	4	4	3	1
Boalemo	12	15	10	0	0	1
Bone Bolango	0	19	13	1	3	1
Gorontalo	9	21	12	3	2	2
Gorontalo Utara	1	12	5	3	5	2
Pohuwato	17	7	5	12	7	1
Length of services						
≤ 4 years	3	8	4	0	0	0
5-9	16	23	13	5	3	3
10-14	14	31	26	11	14	3
15-19	5	4	1	3	1	1
20 ≤	2	10	5	3	1	1
Number of villages covered						
1 village	17	42	26	13	8	1
More than 1	23	35	21	9	12	7
Number of farmers groups						
Less than 8	7	26	15	5	2	0
8-16	12	28	21	7	8	3
Above 16	20	22	10	10	10	5

KEY: NK=No Knowledge, K=Knowledge, P=Persuasion, D=Decision, I=Implementation, C=Confirmation

Respondents' perceptions of Cyber-Extension

This study describes the respondents' opinions of Cyber-Extension's attributes of innovation. Innovation attributes were explained in the theory of diffusion of innovation by Rogers (1995). The attributes include *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*. These attributes were asked in the questionnaire using the four-point bipolar Likert scale as follows: *Strongly agree*, *Agree*, *Disagree*, and *Strongly*

disagree. Scores were summed in each attribute and calculated to find the mean and standard deviation. The results are displayed in Table 4.6.

Participants had positive perceptions of Cyber-Extension. The most favored attribute was *compatibility* (M=2.23, SD=.38), followed by *relative advantage* (M=2.17, SD=.37) and *observability* (M=2.09, SD=.40). The lowest value was in the *complexity* attribute with a mean score and standard deviation of M=1.93, SD=.44. Overall, participants showed positive opinions about all innovation attributes.

Table 4.6. Extension agents' perceptions of Cyber-Extension's Innovation attribute

	Responses		
Innovation attributes	*n*	*Mean*	*SD*
Relative advantage	113	2.17	.37
Compatibility	114	2.23	.38
Complexity	114	1.93	.44
Trialability	113	1.95	.45
Observability	113	2.10	.40

KEY: 0=Strongly disagree, 1=Disagree, 2=Agree, 3=Strongly disagree.

Relative advantage

The respondents' perceptions of Cyber-Extension's relative advantage attribute were determined by participants' responses to six statements in the questionnaire. Table 4.7 shows that almost all (over 99%) respondents agreed or strongly agreed that Cyber-Extension was a useful tool in delivering educational information to the farmers and Cyber-Extension increased the accessibility of extension programming to farmers. More than 98% believed that Cyber-Extension enhanced the quality of work they do. Around 92% of respondents perceived that they could find the information they needed in Cyber-Extension more quickly, and that the quality of information provided by Cyber-Extension was better than brochures. Approximately 82% respondents agreed or strongly agreed that Cyber-Extension cost them

Table 4.7. Extension agents' perceptions of Cyber-Extension's Relative Advantage attribute

Relative advantage	*n*	Percentage			
		SD	*D*	*A*	*SA*
Cyber-Extension enhances the quality of work I do	113	0	1.8	77.8	20.4
Cyber-Extension is a useful tool in delivering educational outreach to farmers	113	0.9	0	70.8	28.3
Cyber-Extension increases the accessibility of extension programming to farmers	112	0	0.9	67.8	31.3
I can find information I need in Cyber-Extension more quickly	113	0	8	74.3	17.7
The quality of information provided by Cyber-Extension is better than brochures	113	0	7.1	67.3	25.7
Cyber-Extension costs me less money than other media	113	0	17.7	66.4	15.9

KEY: 0=Strongly disagree, 1=Disagree, 2=Agree, 3=Strongly disagree.

less money. Overall, the respondents had a positive attitude toward Cyber-Extension with the mean and standard deviation of M=2.17 and SD=0.37.

Compatibility

The next attribute assessed by this study is *compatibility*. This study measured respondents' perceptions of the compatibility attribute of Cyber-Extension indicated by responses to five statements. As shown in Table 4.8, over 97% of the respondents agreed or strongly agreed that Cyber-Extension supported their work as an extension agent, Cyber-Extension fitted into their needs in finding information to prepare extension materials, Cyber-Extension helped them to deliver programs based on the needs of farmers, and Cyber-Extension fitted well with the way they often do their jobs. The table also reveals that over 92% of respondents believed that Cyber-Extension was included in their vision of the future of extension. The mean and standard deviation regarding perceptions of Cyber-Extension's compatibility were M=2.23 and SD=.38, showing that the extension agents perceived Cyber-Extension as compatible with their extension work.

Table 4.8. Extension agents' perceptions of Cyber-Extension's Compatibility attribute

Compatibility	*n*	Percentage			
		SD	*D*	*A*	*SA*
Cyber-Extension supports my work as an extension agent	113	0	2.7	69	28.3
Cyber-Extension fits into my needs in finding information to prepare extension materials	114	0	2.6	69.3	28.1
My vision of the future of extension includes Cyber-Extension	113	0	7.1	61.1	31.8
Cyber-Extension helps me deliver programs based on the needs of farmers	112	0	2.7	69.6	27.7
Cyber-Extension fits well with the way I often do my job	112	0	2.7	79.5	17.8

Note. 0=Strongly disagree, 1=Disagree, 2=Agree, 3=Strongly disagree.

Complexity

Respondents' perceptions on the complexity attribute of Cyber-Extension was measured by their responses to four statements. As shown in Table 4.9, more than 95% of respondents either agree or strongly agree that they could find information they were looking for by using Cyber-Extension. Approximately 92% of respondents believed that it was easy to access information on Cyber-Extension. About 70% of respondents believed that they have no difficulties in teaching others on how to use Cyber-Extension, and about 62% of them either agree or strongly agree that they do not need extensive training on how to use Cyber-Extension. The mean and standard deviation for Cyber-Extension's complexity attribute were M=1.93 and SD=.44.

Table 4.9. Extension agents' perceptions of Cyber-Extension's Complexity attribute

Complexity	*n*	Percentage			
		SD	*D*	*A*	*SA*
Accessing information in Cyber-Extension is easy for me	113	0.9	7.1	74.3	17.7
I can find the information I am looking for using Cyber-Extension	114	0	4.4	78.1	17.5
I do not need extensive training on how to use Cyber-Extension	113	2.7	34.5	49.5	13.3
I have no difficulty in teaching others how to use Cyber-Extension	113	1.8	27.4	63.7	7.1

KEY: 0=Strongly disagree, 1=Disagree, 2=Agree, 3=Strongly disagree.

Trialability

Five statements in the questionnaire were designed to measure Cyber-Extension's trialability attribute. Participants' responses are summarized in Table 4.10. The table shows that around 86% of participants either agree or strongly agree that they have the opportunity to try Cyber-Extension, that they were able to experiment with using any features of Cyber-Extension that they wanted to use, and that they were able to try Cyber-Extension without any obligation to continue further. Approximately 82% of the respondents stated that they were able to define and select any features in Cyber-Extension and they believed that it did not require much time to explore Cyber-Extension. The mean and standard deviation for Cyber-Extension's trialability attribute were M=1.95 and SD=.45.

Table 4.10. Extension agents' perceptions of Cyber-Extension's Trialability attribute

		Percentage			
Trialability	*n*	*SD*	*D*	*A*	*SA*
I have tried Cyber-Extension	113	0	14.2	74.3	11.5
I am able to experiment with Cyber-Extension	112	0	18.8	71.4	9.8
I can easily select any features of Cyber-Extension that I want to use	112	0.9	17.9	67.9	13.3
I can test key features of Cyber-Extension	112	0	13.4	74.1	12.5
It doesn't require much time to explore Cyber-Extension	111	0	17.1	72.1	10.8
Cyber-Extension can be tested without obligation to continue further	111	2.7	10.8	69.4	17.1

KEY: 0=Strongly disagree, 1=Disagree, 2=Agree, 3=Strongly disagree.

Observability

Five statements in the questionnaire measured participants' perceptions of observability attribute of Cyber-Extension. Table 4.11 shows the summary of the distribution of responses. It shows that around 97% of respondent agreed or strongly agreed that they had heard a lot about Cyber-Extension. It also revealed that 95% of the respondents indicated that they had seen and observed that Cyber-Extension had helped extension agents in finding important information for the clients, had helped extension to disseminate research-based

Table 4.11. Extension agents' perceptions of Cyber-Extension's Observability attribute

Observability	*n*	Percentage			
		SD	*D*	*A*	*SA*
I have heard a lot about Cyber-Extension	111	2.7	11.7	66.7	18.9
I have seen other extension agents used Cyber-Extension in their work	112	0	10.7	75.9	13.4
I have seen Cyber-Extension help extension agents in finding important information for clients	112	0	3.6	75	21.4
I have seen Cyber-Extension help extension disseminate research-based information to farmers	112	0	5.4	74.1	20.5
I am aware of the benefits of Cyber-Extension for extension agents or farmers	113	0	4.4	76.1	19.5

KEY: 0=Strongly disagree, 1=Disagree, 2=Agree, 3=Strongly disagree.

information to farmers, and the respondents were aware of the benefits of Cyber-Extension for extension agents or farmers. Around 90% of respondents had seen other extension agents use Cyber-Extension in their work. The mean and standard deviation of the observability attribute were M=2.10 and SD=.40.

Mean differences of perceptions of Cyber-Extension across innovation stages

A statistical test was conducted to determine the mean differences of respondents' perceptions of Cyber-Extension across the five innovation-decision stages. For this purpose, the five stages were used, and the *no knowledge* stage was left out. To calculate differences in the means, ANOVA was employed. Table 4.12 summarizes the results of the ANOVA test.

As shown in Figure 4.1, the results of the ANOVA test indicated the differences of participants' perceptions of Cyber-Extension's attributes across the innovation-decision stages (*relative advantages*, *compatibility*, *complexity*, *trialability*, and *observability*). The Levene's test for *complexity* was not significant, indicating that the variance was homogenous. Furthermore, as the skewness and kurtosis of the data were normal, the result did not violate ANOVA assumptions. The result of ANOVA showed that the F-ratio for

Table 4.12. ANOVA comparison of perceptions on the attributes of Innovation of Cyber-Extension by stage of Innovation-Decision

Stage	Relative advantage	Compatibility	Complexity	Trialability	Observability
Knowledge					
Mean	2.04	2.08	1.7	1.41	1.72
SD	.30	.29	.26	.48	.39
Persuasion					
Mean	2.06	2.13	1.75	1.89	2.00
SD	.33	.34	.41	.34	.33
Decision					
Mean	2.29	2.4	2.14	2.17	2.24
SD	.39	.40	.47	.28	.28
Implementation					
Mean	2.29	2.3	2.13	2.14	2.31
SD	.32	.37	.32	.26	.34
Confirmation					
Mean	2.28	2.34	2.14	2.23	2.42
SD	.59	.52	.45	.47	.53
ANOVA significance	.037	.015	.000*	.000	.001

*Significant at .01 level, data were normal, homogeneity of variance was not violated

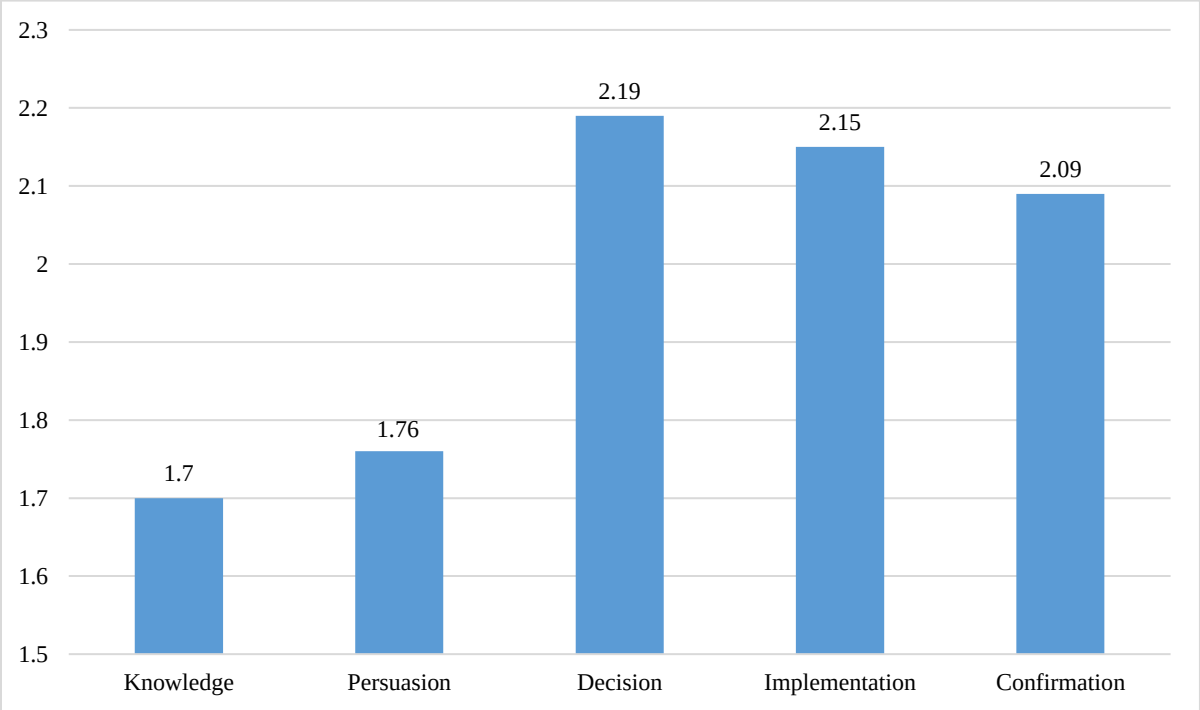


Figure 4.1. Difference between the means of complexity in each innovation-decision stage

complexity was statistically significant (.000, F=7.62, $p < .05$), meaning that the differences of the means between groups was not due to chance, but rather to the independent variable.

A post-hoc analysis using Tukey HSD clarified the differences between the means. The test showed that there was a significant difference at .05 level between participants who were in the *knowledge* stage and the *decision* stage (p=.002), and between the *knowledge* stage and the *implementation* stage (p=.008). A significant difference was also found between the *persuasion* stage and the *decision* stage (p=.001) and between the *persuasion* stage and *implementation* stage (p=.004). The partial eta square (η^2) was calculated at .220. This indicates that 22% of the variance in the respondents' perceptions of *complexity* is explained by the different respondents' position on the stages of innovation decision.

Comparison of perceived innovation attributes across demographic data

Demographic data included in this test were age of respondents, gender, and education attainment. In this study, several statistical tests were conducted to reveal the extent of association between participants' selected demographic data and their perceptions of Cyber-Extension's attributes of innovation. *T*-tests and Analysis of Variance (ANOVA) were used with the *p*-value was set at .05. For the purpose of the statistical test, the variable of education attainment was converted into dichotomous variable: those who have a high school degree and those who have a university degree. As the number of respondents who had completed a Master's degree and above was quite small (n=3), these respondents were combined with the respondents who had earned a Bachelor's degree. Thus, the education attainment variable became a dichotomous variable before conducting the test.

Perceived innovation attributes by age range

Table 4.13 illustrates the mean and standard deviation for participants' perceptions of Cyber-Extension innovation attributes across chosen age ranges. The highest mean rating in the *relative advantage* attribute was found in the 40-49 age range (M=2.18, SD=.386), while the lowest rating was in the M=2.04 with a standard deviation of SD=.159 in the 29 and less age range. The highest mean on the *compatibility* attribute was in the 40-49 age range (M=2.28, SD=.410), and the lowest rating was in the 29 and less age range (M=2.05, SD=.159). In the *complexity* attribute, the highest range was found in the 50 and more age group with the mean and standard deviation being M=1.96, SD=.410, while the lowest rating was found in the 29 and less age range (M=1.81, SD=.473). The 30-39 age range had the highest mean (M=2.00, SD=.383) for the *trialability* attribute, while the lowest (M=1.83, SD=.408) was in the 29 and less age range. The highest mean value in the *observability* attribute was found in the 30-39

Table 4.13. ANOVA comparison of perceived innovation attributes by age range

Age range	Relative advantage	Compatibility	Complexity	Trialability	Observability
29 and less					
Mean	2.04	2.05	1.81	1.83	2.00
n	4	4	4	4	4
SD	.159	.100	.473	.408	.283
30-39					
Mean	2.17	2.26	1.95	2.00	2.15
n	39	40	40	39	40
SD	.400	.434	.450	.383	.457
40-49					
Mean	2.18	2.28	1.91	1.93	2.10
n	51	51	51	51	50
SD	.386	.410	.449	.503	.405
50 and more					
Mean	2.15	2.11	1.96	1.90	2.04
n	19	19	19	19	19
SD	.323	.192	.410	.427	.295
ANOVA significance	.891	.110	.923	.773	.748

age range, with a mean value of M=2.15 and a standard deviation of SD=.457. Further analyses using ANOVA tests showed that there was no significant difference between the means across different age ranges, meaning that the differences between the means were due to chance

Perceived innovation attributes by gender

The differences of perceptions of Cyber-Extension attributes based on gender are displayed in Table 4.14. In the *relative advantage attribute*, the means are equal for both males and females with the mean score of M=2.17 and the standard deviations were SD=.365 for male and SD=.384 for female. Males had higher mean scores for *compatibility* (M=2.24, SD=.401), *complexity* (M=1.96, SD=.425), and *observability* (M=2.12, SD=.410) compared to females (M=2.23, SD=.377, M=1.89, SD=.453, and M=2.09, SD=.399, respectively). For the *trialability* attribute, females had a higher mean rating (M=1.95, SD=.447) compared to males (M=1.94, SD=.447).

Table 4.14. *T*-test comparison of perceived innovation attributes based on gender

	n	Mean	SD	SE	Significance
Relative advantage					
Male	57	2.17	.365	.048	.941
Female	56	2.17	.384	.051	
Compatibility					
Male	58	2.24	.401	.052	.900
Female	56	2.23	.377	.050	
Complexity					
Male	57	1.96	.425	.056	.340
Female	57	1.89	.453	.060	
Trialability					
Male	56	1.94	.447	.059	.840
Female	57	1.95	.447	.059	
Observability					
Male	56	2.12	.410	.054	.719
Female	57	2.09	.399	.052	

T-tests were conducted to assess any statistical differences between participants' gender. The results of the *t*-tests showed that there were no significant differences between these means, indicating that differences in the means were due to chance. This designates that the participants were equal in all perceived innovation attributes despite gender difference.

Perceived innovation attributes by education attainment

Table 4.15 summarizes the differences of means of perceived innovation attributes of Cyber-Extension as held by participants based on their education level. Participants who held university degrees had higher mean values for all innovation attributes compared to those who only have high school degrees. The highest mean value of all, held by participants who had university degrees was found in the *compatibility* attribute with the mean score of M=2.30, SD=.422. The lowest value was found in the *trialability* attribute (M=1.77, M=.469) held by participants who had high school degrees.

Table 4.15. *T*-test comparison of perceived innovation attributes based on education

	n	Mean	SD	SE	Significance
Relative advantage					
High school	38	2.05	.236	.038	.005**
University degree	74	2.23	.418	.048	
Compatibility					
High school	38	2.13	.287	.046	.018*
University degree	75	2.30	.422	.048	
Complexity					
High school	38	1.80	.338	.054	.017*
University degree	75	2.00	.469	.054	
Trialability					
High school	38	1.77	.469	.076	.002**
University degree	74	2.06	.383	.044	
Observability					
High school	38	1.99	.416	.068	.024*
University degree	75	2.17	.379	.043	

* Mean difference is significant at the .05 level.
** Mean difference is significant at the .01 level.

The results of the *t*-tests showed that there were statistically significant differences in all perceived innovation attributes. Statistically significant differences at .01 level were found in *relative advantage* (p=.005) and *trialability* (p=.001) attributes, and at .05 level in *compatibility* (p=.018), *complexity* (p=.017), and *observability* (p=.024) attributes. The results indicated that differences were found between the means of participants who had university degrees and those who had high school degrees, which were not due to chance.

ICT (Objective 5, 6, and 7)

This research study assessed the extension agents' familiarities with ICT devices including their access to ICT, access to the Internet, and ICT proficiency in *computer skills* and *internet competencies*. This part addresses objectives 5, 6, and 7 in this study. While objective 5 seeks to describe the extension agent's use of ICT devices and the Internet, objective 6 provides answers to describe the extension agents' ICT proficiency based on self-efficacy tests on *computer skills* and *internet competencies*. Objective 7 is a comparison of different ICT proficiency against the extension agents' selected demographic data.

Access to ICT and the Internet

The fourth objective of this research study was to describe the extension agents' use of ICT devices and the Internet. The questionnaire asked respondents about their access to ICT devices and their access to the Internet, thereby detailing concerns about access to a variety of ICT devices and different Internet connections including smartphones, personal computers, laptops, and tablets.

Figure 4.3 shows that the smartphones, personal computers, and laptops are all quite popular among extension agents. Approximately 80% of extension agents had access to smartphones and/or laptops, and nearly 70% had access to personal computers. However,

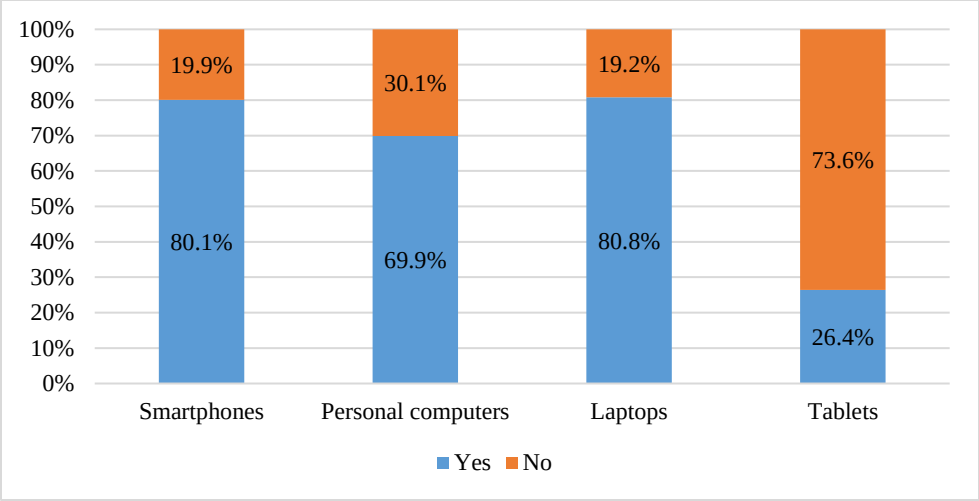


Figure 4.2. Access to ICT devices among participants

tablets were not commonly used. Approximately one fourth (26%) of extension agents had access to them.

The participants were also asked about frequency of use of ICT devices. Respondents were asked to specify frequency of use as: “seldom”, “often”, or “very often”. Figure 4.4 indicates the frequent use of ICT devices across participants. Among those having access, smartphones were the most popular ICT device, with nearly three fourths (72%) of respondents who had access to them indicating they used their smartphones daily. Respondents who had access to ICT devices were quite familiar with all of these devices as

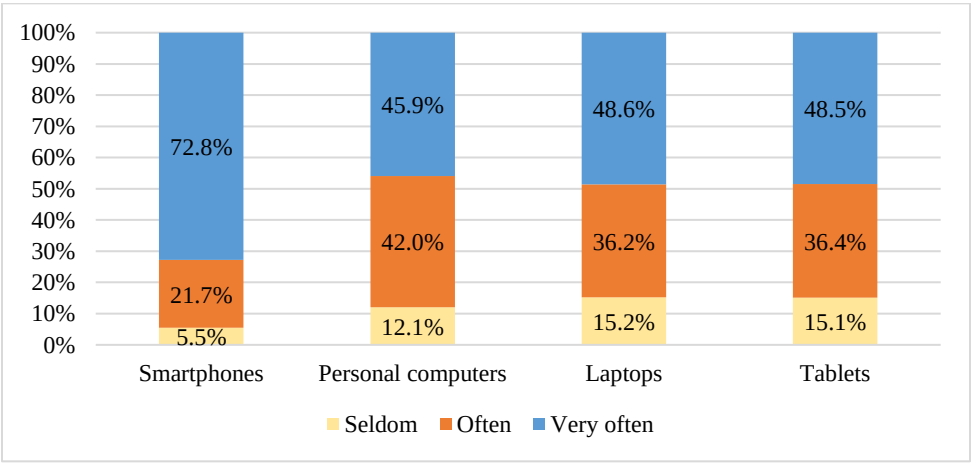


Figure 4.3. Frequency of use of ICT devices among participants

indicated by the data; participants who had access to ICT devices used them often (weekly) and very often (daily).

As shown in Figure 4.4, most respondents (77.5%) accessed the Internet through a SIM card (subscribing to telephone Internet provider). Internet access at home as well as at the office was not common as less than 23% of respondents had the Internet at both places.

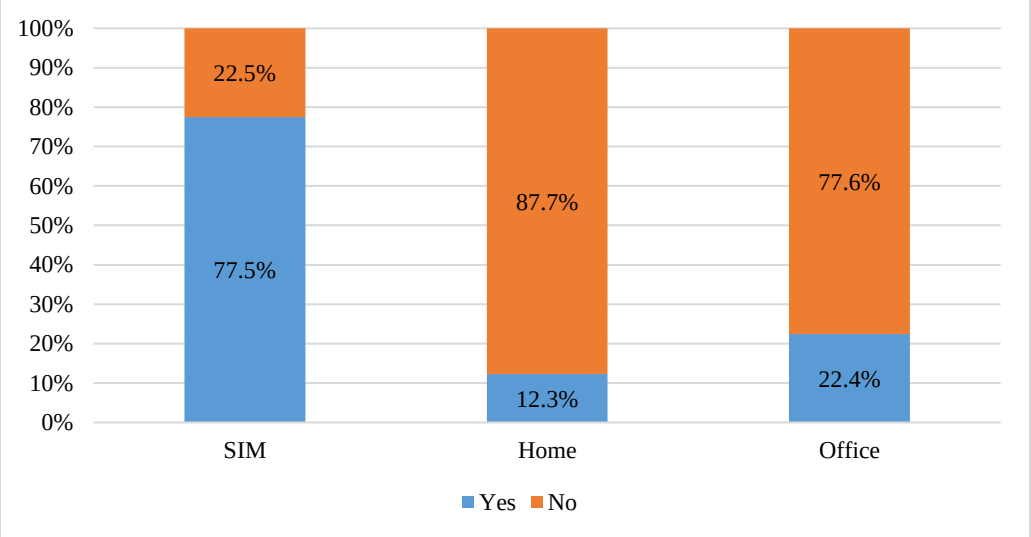


Figure 4.4. Internet access across respondents

Extension agents' ICT proficiency

This research measured participants' proficiency in utilizing ICT with two components; *computer skills* and *internet competencies*. Addressing objective 5 of this research study focused on extension agents' ICT proficiency based on self-efficacy tests of computer skills and internet competencies. The statements related to this measurement were assessed using a five-point unipolar Likert-scale. Self-efficacy theory (Bandura, 1977) was used to design the ICT proficiency assessment. Participants rated their degree of confidence by selecting the most appropriate statements which ranged from *not confident (NC), slightly confident (SC), moderately confident (MC), very confident (VC),* to *extremely confident (EC).*

Table 4.16 reveals that the participants in this study had relatively good confidence in their proficiency using ICT. Participants had the highest confidence in *internet competencies* (M=2.63, SD=1.00) and *computer skills* (M=2.31, SD=1.13). Further elaboration on each component in ICT proficiency is explained later in this section.

Table 4.16. Self-efficacy test of extension agents' ICT proficiency

		Responses	
ICT proficiency	*n*	*Mean*	*SD*
Computer skills	221	2.31	1.13
Internet competencies	221	2.63	1.00

KEY: 0=Not confident, 1= Slightly confident, 2= Moderately confident, 3= Very confident, 4= Extremely confident.

Computer skills

The survey measured respondents' confidence in operating computer devices. Seven statements were designed to assess respondents' confidence in their abilities to use a computer. The statements are displayed in Table 4.17. The results indicated that slightly over two thirds (67%) of the respondents were very confident or extremely confident that they were able to type quickly using a word processor application such as Microsoft Word. More than half (60%) were very confident or extremely confident that they could insert pictures using a word processor and create tables using spreadsheet software such as Microsoft Excel. However, only half (50%) of the respondents were either very confident or extremely confident that they were able to create presentations with presentation software such as Microsoft PowerPoint or edit the size and type of fonts in the presentation software as well as troubleshoot printer glitches. The mean and standard deviation for computer skills were M=2.31 and SD=1.13.

Table 4.17. Extension agents' self-efficacy on computer skills

Computer skills	*n*	Percentage				
		NC	*SC*	*MC*	*VC*	*EC*
I am able to quickly type in word processor software (e.g., Microsoft Word).		10.0	4.1	18.5	46.2	21.2
I am able to insert pictures using word processor software		13.6	6.3	20.4	38.0	21.7
I am able to create a table using spreadsheet software (e.g., Microsoft Excel).		16.3	4.1	21.3	34.3	24.0
I am able to plot a graph and a chart using spreadsheet software.		19.9	9.5	24.9	30.8	14.9
I am able to create a presentation with presentation software (e.g., Microsoft PowerPoint)		19.5	6.8	25.5	31.4	16.8
I am able to edit the size and type of fonts in presentation software.		20.4	4.1	29.0	31.2	15.3
I am able to troubleshoot the printer (e.g., jammed paper, connection failure)		19.9	6.3	28.1	31.7	14.0

KEY: 0=No confidence, 1= Slight confidence, 2= Moderate confidence, 3= Strong confidence, 4= Extreme confidence.

Internet competencies

The third part of perceived self-efficacy in the questionnaire measured the participants' *internet competencies*. Six statements were provided to assess participants' confidence in their internet use. Table. 4.18 reveals that more than 80% of respondents were confident about using social media such as Facebook or Twitter. Seven tenths (70%) of the respondents were very confident or extremely confident that they were able to use a search engine such as Google or Yahoo to search for information, and nearly two thirds (65%) were very confident or extremely confident that they were able to download and upload files from the Internet. The survey also revealed that more than half (60%) of the respondents were very confident or extremely confident that they were able to communicate with emails, while slightly fewer (55%) were able to use internet browsers such as Mozilla or Internet Explorer. The mean and standard deviation for *internet competencies* were M=2.63 and SD=1.00.

Table 4.18. Extension agents' self-efficacy on internet competencies

Internet competencies	*n*	Percentage				
		NC	*SC*	*MC*	*VC*	*EC*
I am able to set a homepage for an internet browser (e.g. Mozilla, Opera, and Internet Explorer).		11.8	8.1	24.9	38.9	16.3
I am able to search for information on the Internet using a search engine (e.g., Yahoo, Google).		9.0	4.5	18.2	47.5	20.8
I am able to use email to communicate.		10.0	8.1	21.3	46.6	14.0
I am able to use social media (e.g., Facebook, Twitter, and Instagram).		4.1	1.4	13.5	46.2	34.8
I am able to download files from the Internet.		9.0	5.9	20.4	41.6	23.1
I am able to upload files to the Internet.		10.9	9.0	15.8	44.8	19.5

KEY: 0=Not confidence, 1= Slightly confident, 2= Moderately confident, 3= Very confident, 4= Extremely confident.

Comparison of ICT proficiency across selected demographic data

In this part, analysis on the relationship between ICT proficiency and selected demographic data which includes age of respondents, gender, education attainment, and area of employment is presented by using *t*-tests and ANOVA. The *p*-value was set at .05 to determine if the difference was significant or due to chance.

ICT proficiency by age range

Participants' ICT proficiency across different age ranges is displayed in Table 4.19. On one hand, highest mean rate in *computer skills* was found in the age range of 29 and less (M=2.82, SD=.764). On the other hand, the lowest value of *computer skills* (M=1.71, SD=1.17) was found in the age range of 50 and more. This was identical with *internet competencies* wherein the highest value was found in the age range of 29 and less, and the lowest in the age range of 50 and more (M=3.14, SD=.819, and M=1.97, SD=1.20 consecutively).

Significant differences between the means across different age ranges were found in both *computer skills* and *internet competencies*, meaning that the differences between the means were not due to chance. Figure 4.6 shows the differences between the means for both

Table 4.19. ANOVA comparison of ICT proficiency by age range

	Computer skills	Internet competencies
29 and less		
Mean	2.82	3.14
n	11	11
SD	.764	.819
30-39		
Mean	2.57	2.93
n	75	75
SD	.967	.734
40-49		
Mean	2.28	2.57
n	99	99
SD	1.19	1.00
50 and more		
Mean	1.71	1.97
n	36	36
SD	1.17	1.20
ANOVA Significance	.000**	.000**

** Mean difference is significant at the .01 level

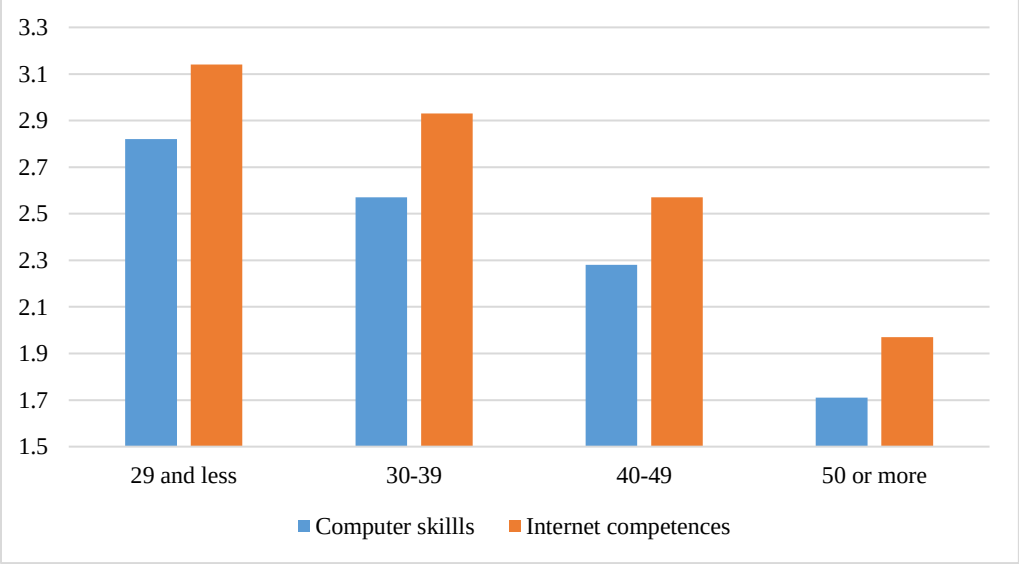


Figure 4.5. Difference between the means of computer skills and internet competencies in each age range group

computer skills and *internet competencies*. For *computer skills*, the *Levene*'s test (.019) was significant, meaning that the variance among the age ranges were not homogeneous. The F-ratio of Brown-Forsythe showed that the p-value was statistically significant at .01 level (.000, F=6.628, p< .01). The partial eta square (η^2) was .073, meaning that only 7.3% of variance in *computer skills* of participants could be accounted for age range groups.

Post-hoc comparisons using Games-Howell indicated that the mean value for the 50 or above age range group (M=1.71, SD=1.17) was significantly different from those of the 20 and below and 30-39 age range groups. The *Levene*'s test for *internet competencies* was .000, meaning the variance was not equal. The results of the Brown-Forsythe test indicated the *p*-value was statistically significant at the .01 level (.000, F=9.300, *p*< .01). The partial eta square (η^2) was .116, meaning 11.6% of variance in *internet competencies* of participants was explained by the different age ranges. A further analysis of post-hoc comparisons with Games-Howell indicated that the mean value for the 50 or above age range (M=1.97, SD=1.20) was significantly different from that of any other age range group.

ICT proficiency by gender

Table 4.20 displays the mean comparison of ICT proficiency across gender. The data showed that the mean value of *computer skills* was higher for the male respondents (M=2.32, SD=1.17) compared to female respondents (M=2.30, SD=1.10), while the mean for *internet competencies* was higher for the female respondents (M=2.70, SD=.913) than for the male (M=2.55, SD=1.096).

Table 4.20. *T*-test comparisons of ICT proficiency on the basis of gender

	n	Mean	SD	SE	Significance
Computer skills					
Male	103	2.32	1.17	.116	.911
Female	118	2.30	1.10	.102	
Internet competencies					
Male	103	2.55	1.09	.108	.276
Female	108	2.70	.913	.084	

T-tests were conducted to analyze the statistical differences of ICT proficiency among different genders. The results showed that the differences between the means were not significant for both *computer skills* and *internet competencies*, indicating that the participants were equal in all perceived innovation attributes despite of gender difference.

ICT proficiency by education attainment

Table 4.21 displays the variation of the mean value of ICT proficiency across different participants' education levels. Participants with a university degree had higher mean values in both *computer skills* (M=2.48, SD=1.02) and *internet competencies* (M=2.73, SD=.929) compared to those who only finished high school (M=2.07, SD=1.25 and M=2.47, SD=1.10) for *computer skills* and *internet competencies* consecutively.

Table 4.21. *T*-test comparisons of ICT proficiency on the basis of education

	n	Mean	SD	SE	Significance
Computer skills					
High school	80	2.07	1.25	.139	.012*
University degree	138	2.48	1.02	.087	
Internet competencies					
High school	80	2.47	.1.10	.124	.075
University degree	138	2.73	.929	.079	

* Mean difference is significant at the .05 level

The results of the *t*-tests showed the difference in *computer skills* was statistically significant at the .05 level (p=.012), meaning the difference in *computer skills* was not due to chance, where participants who had a degree from a university were more confident that they were able to use the computer. On the other hand, there was no statistical significance found

in the *t*-test for *internet competencies*, meaning that participants' confidence in using the Internet was equal.

ICT proficiency by area of employment

As illustrated in Table 4.22 and Figure 4.6, participants who resided in Kota Gorontalo had higher confidence in using both computers (M=2.89, SD=.791) and the Internet (M=3.14, SD=.556). On the other hand, participants who worked in *Boalemo* had the lowest mean value for both *computer skills* (M=1.98, SD=1.05) and *internet competencies* (M=2,28, SD=.935).

Table 4.22. ANOVA comparison of ICT proficiency by area of employment

	Computer skills	Internet competencies
Kota Gorontalo		
Mean	2.89	3.14
N	19	19
SD	.791	.556
Boalemo		
Mean	1.98	2.28
N	38	38
SD	1.05	.935
Bone Bolango		
Mean	2.08	2.63
N	37	37
SD	1.17	.920
Kab Gorontalo		
Mean	2.43	2.78
n	49	49
SD	1.23	1.06
Gorontalo Utara		
Mean	2.42	2.48
n	28	28
SD	1.28	1.20
Pohuwato		
Mean	2.33	2.63
n	50	50
SD	1.01	.991
ANOVA Significance	.058	.043*

* Mean difference is significant at the .05 level.

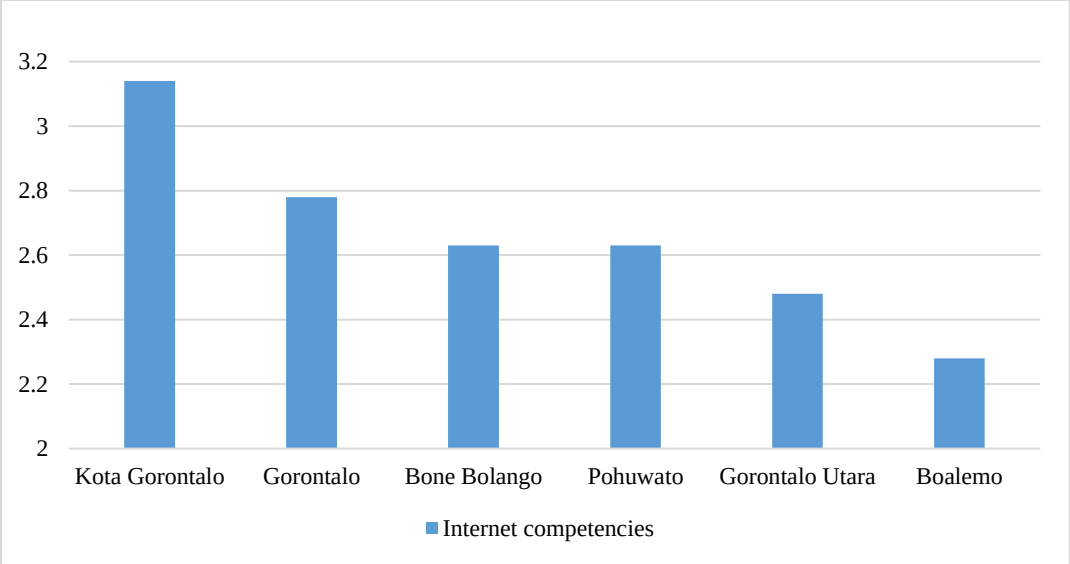


Figure 4.6. Difference between the means of Internet competencies in each area of employment ordered from low to high

An ANOVA test was performed to assess the mean differences among the groups. *Levene*'s test of homogeneity of variances showed that both *computer skills* and *internet competencies* were not significant, meaning that the variance in the data were homogenous. This test showed that there was a difference in the means of *internet competencies* across different areas of employment, significant at the .05 level (.043, F=2.333, p< .05).

Post-hoc analysis with the Tukey HSD test showed a significant difference (*p*=.026) at .05 level between participants who resided in Kota Gorontalo (M=3.14, SD=.556) and Boalemo (M=2.28, SD=.935). The partial eta square (η^2) was calculated at .051 meaning that 5.1% of the variance in *internet competencies* was explained by the different areas of employment.

Prediction of Cyber-Extension Adoption (Objective 8)

The probability of adopting Cyber-Extension was analyzed in this study. A binary logistic regression model was designed by including variables from innovation attributes and ICT proficiency. The total predictive variables were seven, including *relative advantage,*

compatibility, *complexity*, *trialability observability*, *computer skills*, and *internet competencies*. Prior to the test, the variable of stages of adoption that includes six levels was converted into a binary code containing only two levels: *adopt* and *not adopt*. Figure 4.7 shows the distribution of respondents across these two decision areas, either to *adopt* or *not adopt* Cyber-Extension. The non-adoption area (light blue) consists of the phases of *no knowledge*, *knowledge*, *persuasion*, and *decision:no* (reject), while the adoption area (dark blue) comprises *decision:yes, implementation*, and *confirmation* phases.

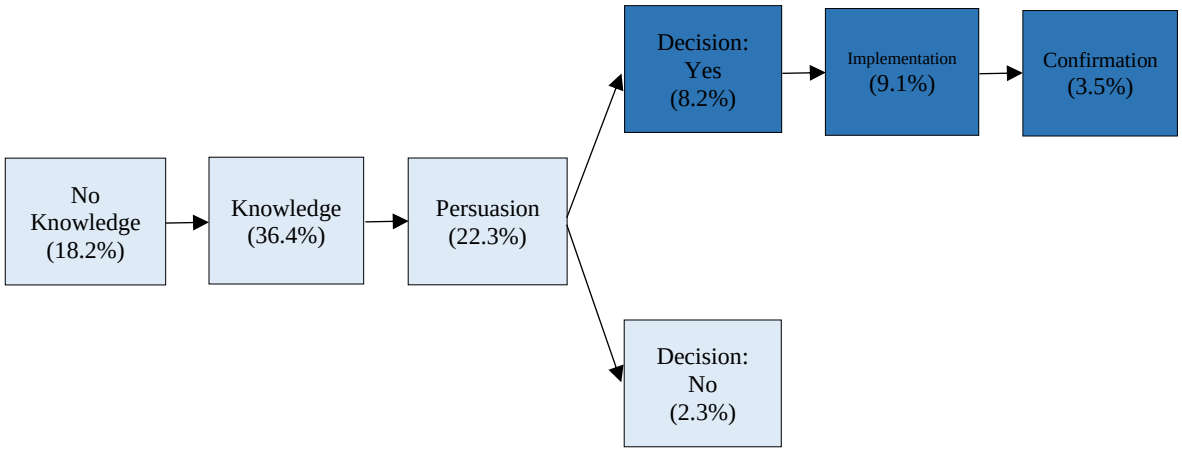


Figure 4.7. Distribution of respondents in each stage of the innovation-decision process

The conversion resulted in two groups in the binary variable as the dependent variable in the test. The non-adoption group consisted of 174 respondents (n=174, 79.1%), and the adoption group consisted of 46 respondents (*n*=46, 20.9%). The regression model was tested for its goodness-of-fit using the Hosmer-Lemeshow test. The test revealed the model is a good fit, as indicated by the *p*-value of .355 which was not significant compared

to the value of .05. The logistic regression model successfully predicted 87.9% of non-adoptions, 66.7% of the adoption group, and 79.3% overall. Table 4.23 summarizes the results of the binary logistic regression test, including the *b* coefficient, standard error, z-scores, and odds ratios.

Table 4.23. Predictive ability of perceived innovation attributes and ICT proficiency in the adoption of Cyber-Extension

	b	SE	z	Exp(B)
Innovation attributes				
Relative advantage	-.66	1.07	.38	.52
Compatibility	1.14	.98	1.35	3.14
Complexity	1.81*	.85	4.53	6.10
Trialability	.60	1.09	.31	1.83
Observability	1.04	.93	1.24	2.82
ICT proficiency				
Computer skills	.56	.45	1.52	1.74
Internet competencies	-.07	.50	.02	.94

* Mean difference is significant at the .05 level.

The seven predictors were simultaneously entered in the logistic regression model. These predictors contributed 42% of the variance in the adoption of Cyber-Extension (R^2=.42). The model showed that the *complexity* variable successfully predicted Cyber-Extension adoption, significant at .05 level. The odds ratio of *complexity* predicted by the model was 6.10, meaning each one-point increase in *complexity* was associated with the odds of adopting Cyber-Extension increasing by 6.10 multiplicative factor.

CHAPTER 5. DISCUSSION

The purpose of this study was to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. The following eightfold objectives were formulated to answer the research purpose.

1. To describe selected demographic data of Indonesian extension agents.
2. To identify extension agents' current positions in the stages of innovation-decision process of Cyber-Extension.
3. To describe extension agents' perceptions of Cyber-Extension's innovation attributes.
4. To compare extension agents' perceptions of Cyber-Extension's innovation attributes across different selected demographic data.
5. To describe extension agents' use of ICT devices and the Internet.
6. To describe extension agents' ICT proficiency based on a self-efficacy test on computer skills and internet competencies.
7. To compare extension agents' ICT proficiency across different selected demographic data.
8. To determine whether extension agents' perceptions on Cyber-Extension's innovation attributes and ICT proficiency predict the adoption of Cyber-Extension.

A total of 221 extension agents agreed to participate in the study. A questionnaire was built to collect the participants' responses. Chapter 4 described the responses according to the research objectives outlined in this study. This Chapter 5 discusses the interpretation of the data explaining the research topic: Adoption of Cyber-Extension in Indonesia. Chapter 5 is

organized with the following outline: respondents' demographic information, Cyber-Extension adoption, perceptions of Cyber-Extension, and ICT proficiency.

Demographics

The average age of respondents in this study was 41.3, where more than 44% of respondents were between 40-49 years old, and about 34% between 30-39 years old. Although there is no specific data showing the national average age of Indonesian extension agents, it was reported by BPPSDMP (2015) that 49% of extension agents would be retiring due to age. This is also comparable to a study conducted by Purnomo and Lee (2010) showing that 51.3% of extension agents in Central Java, Indonesia, were in the age group of 40-50 years old. In another area, a study carried out by Cahyono (2014) in Malang regency, Indonesia, showed that the majority (60.3%) of extension agents were more than 50 years old and 32.5% of the extension agents were between 41-50 years old. The respondents' age in this study was similar to those of the extension agents (educators) in Iowa, the USA, where the majority of extension agents (31.86%) as shown in Taylor's study (2015) were between 43-53. In Lejweleputswa, South Africa, extension agents were younger than the respondents in this study, with 45% of the extension agents under 30 years old (Hadebe, 2010). However, the respondents in this study were younger than extension agents in Eastern Samar and Leyte provinces in the Philippines, where the majority of extension agents (76.3%) were over the age of 50, with an average age of 54 years old (Cidro, 2015). The retirement age of Indonesian extension agents is around 58-60, indicating that extension offices in Gorontalo province will not be having serious problems in 10 years to come regarding the rapid decreased number of extension agents due to retirement, as compared to the extension service in Malang where more than half of extension agents would be retiring soon.

Female extension agents (53.4%) were slightly more numerous than male extension agents (46.6%). According to the initial data gained from the department's website, which is https://bakorluh.gorontaloprov.go.id, about 60% of extension agents in Gorontalo province were male. Generally, the ratio is more balanced compared to some other provinces in Indonesia. For example, there were more male extension agents (79.2%) than female (20.8%) in Central Java, Indonesia (Purnomo & Lee, 2010) and in Bungo, Jambi province in Indonesia, where 72% of the extension agents were male (Putri, Fatchiya, & Amanah, 2016).

In this study, most of the respondents (61.1%) held a Bachelor's degree or Diploma, 36.2% had a high school degree, and 1.4% had a Master's degree or above. This is comparable to studies conducted by Cahyono (2014) that 75.4% of extension agents in Malang, Indonesia had a Bachelor's degree. It is also similar to a study by Purnomo & Lee (2010) which showed that 60% of extension agents in Central Java had a Bachelor's degree. In comparison with other countries, the majority of extension agents (53.3%) in Benue state, Nigeria held a Higher National Diploma (HND) and only 29% had a university degree (Okwoche, Eziehe & Agabi, 2015). A study in nine districts in Sri Lanka showed only 10.9% of extension agents held a degree. Higher education levels of extension agents was found in the USA. For example, Taylor (2015) revealed that the majority of extension agents in Iowa (47.31%) held a Master's degree or above, and Harder (2007) showed that 69.6% of extension agents in Texas had a graduate degree.

The majority of respondents were in Pohuwato (22.6%) and the lowest number was in Kota Gorontalo (8.6%). The small number of extension agents in Kota Gorontalo is due to its geographical status as an urban area. Kota Gorontalo is the capital city of Gorontalo province. Agricultural land in urban zones makes up a very small percentage of the total

agricultural area in the province. For example, out of the total 34,764 hectares of the rice fields in Gorontalo province, only 843 hectares (2.42%) are located in Kota Gorontalo (BPS, 2018).

The study revealed that 50.2% of the respondents served one village, while the other 49.8% handled more than 1 village. The expectation of MoA is that each village in Indonesia have one extension agent to facilitate extension services, a movement called "*one extension agent for one village*" (BPPSDM, 2015). This proportion is needed to optimize learning between and among extension agents and farmers. Most extension agents preferred personal visits and face-to-face meetings with farmers in various settings such as demonstrations, field schools, and group discussions (Purnomo et al., 2015) because of personal contact being most effective. Too many villages being covered makes the visits not efficient. The findings in this study indicated that the ratio between the number of the extension agents and the villages is still far from the ideal ratio of 1:1 as only half of the total number of extension agents in Gorontalo supervise only one village.

Stages of Innovation-Decision Process in Cyber-Extension's Adoption

The data collection in this research study was conducted in 2018, nine years after Cyber-Extension was first officially implemented by the Indonesian Ministry of Agriculture. This part discusses the extent of extension agents adopting Cyber-Extension in regards to the stages of innovation-decision process.

The findings indicated that the majority of the respondents in this study are currently in the first stage of the innovation-decision process: the *knowledge* stage. There were 80 respondents (36.4%) currently at this stage, claiming that they (as mentioned in the questionnaire): had heard about Cyber-Extension but had not used it and had no idea whether

they would use it or not. The smallest number was found in the last stage of the process (*confirmation* stage), where eight respondents claimed that they: had used Cyber-Extension long enough to understand and evaluate whether Cyber-Extension would be part of their extension activities. Cumulatively, about 21% of respondents confirmed that they have adopted Cyber-Extension. This percentage derived from the combination of the numbers of respondents within the three stages: *decision* to adopt (8.2%), *implementation* (9.1%), and *confirmation* (3.6%). Compared to those who were aware of but did not adopt Cyber-Extension, the percentage of those who had adopted Cyber-Extension (21%) was relatively small. There was no explicit information indicated by the MoA regarding the target and expectation about adoption rate of Cyber-Extension. However, Indonesian Cyber-Extension can be compared with the e-extension (eXtension) in the USA's agricultural extension system. Several studies related to eXtension (for example Taylor & Miller, 2016) showed that in 2015 (or seven years after its first launch) more than 25% of extension agents in Iowa had adopted e-extension. Another study conducted by Harder and Lindner (2008) showed that 13.6% of extension agents in Texas had confirmed their use of eXtension one year after its launch. Indonesian Cyber-Extension has been implemented for nine years since 2009, thus the adoption rate (21%) is lower compared to the adoption rate of eXtension in Iowa.

This study adopted Li's stage of *no knowledge* prior to the *knowledge* stage to identify the audience unaware of the innovation (Li, 2004). The findings stated that 18.2% respondents in this study had never heard about Cyber-Extension, meaning that almost 82% of extension agents are aware of Cyber-Extension. The 18.2% rate is lower than eXtension's adoption rate in the same stage (25.59%) as shown in Taylor's study (2015). It seemed that Cyber-Extension is well-socialized among the extension agents in Gorontalo. Unlike other

ICT-based programs in agriculture, such as *TaniHub* which is using local word *Tani* (which means agriculture), Cyber-Extension is the official name of the program which used foreign words that are not familiar to extension agents. This might explain why some extension agents were still not aware of the program.

This study, however, did not capture the communication channel predominantly used by the extension agents in Cyber-Extension's dissemination, especially in the initial stage where it is important to understand the transition from *not aware* (*no knowledge* stage) to *aware* (*knowledge* stage). Further studies on investigating how the extension agent learned about Cyber-Extension might be important to enhance the information in this study.

Identifying the respondents' positions across the innovation-decision stages helps to improve the strategy to increase the adoption and acceptance rate of Cyber-Extension. Rogers (2003) held that different attitudes and behaviors of adopters might be found at each stage. For example, those who are at the *knowledge* stage might show a more passive attitude when encountering an innovation, especially if they become aware of the innovation by accident, rather than through an action they initiate beforehand. Adopters at the *implementation* stage ask questions more actively to clarify consequences (both positive and negative), before deciding to use the innovation for a long period. Also, knowing the stages helps the stakeholders on policy makers to determine which communication channels are appropriate for which clients. For example, mass media works better for those at the *knowledge* stage while interpersonal communication is suitable for those in the *persuasion* stage. Having known about these differences, policy makers in Cyber-Extension may develop more useful and efficient plans and strategies to facilitate learning across adopters and foster the adoption process. This study revealed that 79% of the respondents had not yet

adopted Cyber-Extension, in which the majority of the non-adopters were at the *knowledge* stage (36.4%) followed by the *persuasion* stage (22.3%). Within these just two stages, more than a half (58%) of extension agents were situated. The high percentage of non-adopters (79%) provided evidence that the strategies to convince the extension agents to utilize Cyber-Extension have not yet been effective. To increase the rate of adoption, different approaches to socialize Cyber-Extension should be implemented at each stage to accommodate information flow pertaining to Cyber-Extension.

More attention could be focused on this study at the *decision* stage consisting of *decision to adopt* and *decision to reject*. Although this study revealed that the percentage of respondents in this stage is relatively small (10.5% cumulatively), the process on the *decision* stage could not be overlooked, especially for those who decided to reject Cyber-Extension since this stage is critical in the adoption of innovation. According to Rogers (2003), in the *decision* stage the individual moves toward determining either to adopt or reject the innovation. At this point, adopters should be facilitated in experiencing the innovation to further assess the attributes of the innovation. In this study, the percentage of respondents who decided not to use Cyber-Extension was only 2.3%. Although a small percent number, it is still important to reduce the risks of agents discontinuing Cyber-Extension. Unfortunately, the specific reasons for rejection remain unknown. Further research on Cyber-Extension to investigate rejection or discontinuation might be useful to dig into the underlying reasons for rejection. As the percentage was small, studies using a qualitative approach might be appropriate.

Perceptions of Cyber-Extension

Perceptions of Cyber-Extension measured in this research were indicated by the participants' responses to the five attributes of innovation of Cyber-Extension, including *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*. Out of 221 total respondents, 113 to 114 provided responses. This is due to the questionnaire only accepting participants having direct experiences using Cyber-Extension. This section discusses the attributes that have the highest and lowest scores. In this study, *compatibility* and *relative advantage* attributes were two of the most influential attributes. The findings are similar to the perceptions of extension educators in Iowa toward e-extension as shown in the study conducted by Taylor and Miller (2016), which revealed that *relative advantage* and *compatibility* were the most favorable attributes.

Compatibility was measured with statements such as: "*Cyber-Extension fits well with the way I often do my job*", "*Cyber-Extension supports my work as an extension agent*", or "*Cyber-Extension helps me deliver programs based on the needs of farmers*." In this study, most of the extension agents either agreed or strongly agreed that Cyber-Extension was compatible with their activities related to extension services. Rogers (2003) argued that an innovation must be compatible with the clients' needs and therefore the innovation being offered should be based upon the recognition of those needs through accurate needs assessment. *Compatibility* is one of the strongest determinants of ICT adoption. In a study regarding the adoption of Web 2.0 services (including video sharing, social networking, and social bookmarking) conducted by Corrocher (2010), *compatibility* of Web 2.0 with the clients' needs and behaviors was one of the most significant determinants of frequent use of video sharing and social networking. A more recent research regarding ICT diffusion was

carried out by Shin, Park, and Lee (2018) who studied smart homes adoption in South Korea, indicating that compatibility issues were important in marketing an innovation especially for more highly educated clients.

The variable of *complexity* received the lowest score in this study. Statements such as "*Accessing information in Cyber-Extension is easy for me*", "*I do not need extensive training on how to use Cyber-Extension*", and "*I have no difficulty teaching others how to use Cyber-Extension*" were used to analyze the respondents' perceptions of complexity. This assessment revealed that nearly half of extension agents disagreed or strongly disagreed that training was not needed to utilize Cyber-Extension. It is evident that to integrate Cyber-Extension into the agents' extension activities, assistance plays an important role since many extension agents cannot learn to use Cyber-Extension individually. This finding was confirmed by Rogers (2003) who explained how home computers were adopted in the United States around 1980. The first adopters of home computers were individuals familiar with gadgets, while the majority of adopters got help from friends or by attending a computer users' club dealing with computers' complexity.

Although in this study the *complexity* attribute was found to be the lowest attribute as perceived by extension agents as users, Harder (2007), contrary to this study, found that the *complexity* attribute was the most favorable variable in research regarding extension agents' perceptions of eXtension. Harder's study referred the items of complexity to the extension educator's familiarity with email and the Internet. Overall, the findings in this study were identical to many other studies as summarized by Rogers (2003), which revealed that adopters were more likely to have higher scores on *relative advantage* and *compatibility*, and lower scores on *complexity*.

It was found in this study that the attribute of *complexity* was significantly different across the stages of innovation decision process. The findings revealed that the extension agents in the earlier stages (*knowledge* and *persuasion* stages) perceived Cyber-Extension as more complex than did the extension agents in the later stages of *decision* and *implementation*. The stages of *knowledge* and *persuasion* are in the non-adoption area while the *decision* and *implementation* stages are within the adoption area. Findings indicated that the complexity of Cyber-Extension is associated with the decision made by the extension agents whether to adopt Cyber-Extension. Extension agents on first encountering Cyber-Extension tend to perceive that Cyber-Extension is rather complex compared to previous methods they used. The longer they evaluate Cyber-Extension, the more they are convinced that Cyber-Extension is not so complex. However, at a certain point where the extension agents had decided to use Cyber-Extension and had evaluated and accessed Cyber-Extension long enough (*confirmation* stage), their perceptions of Cyber-Extension's *complexity* tended to follow a negative trend. Although the difference was not statistically significant, the negative trend indicated that for long-time users, there was still a chance that Cyber-Extension was perceived as difficult to use. A future study regarding the different functions and features in Cyber-Extension is warranted to reveal which parts are perceived as complex by users, especially in the *confirmation* stage. In addition, training on Cyber-Extension is highly encouraged when considering that at a certain point there were still a lot of extension agents who perceived that training was needed to deal with complexity. Helmy et al. (2013) argued that institutional support in the form of training is vital to equip extension agents with computer and internet skills to operate Cyber-Extension.

Findings related to the variation in perceived innovation attributes of Cyber-Extension by education level revealed mean differences between extension agents who did not go to college (high school graduates) and those who did (had a university degree). The differences were found in all five attributes of innovation (*relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*) where Cyber-Extension was perceived more positively by the extension agents who had a university degree. This was most likely due to their increased experience of using ICT devices at the college level. In Gorontalo, most universities and colleges had been integrating ICT into their learning systems. University and college students tend to be relatively more familiar with ICT devices as they frequently use ICT in courses. Lapple, Renwick, and Thorne (2015) found similar results, where more highly educated adopters in Ireland tended to have a higher agricultural innovation adoption index. This might be due to adopters spending more hours at school becoming more aware of available innovations, or a higher education might encourage adopters to process new information more effectively. Rogers (2003) argued education levels as being associated with the adopters' innovativeness, where those early adopters in a certain social system generally had more years of formal education than did later adopters. In addition, Leeuwis (2004) revealed that 74% of studies regarding the adoption of innovation showed a positive relationship between adoption index and education.

Access to ICT and the Internet

This study assessed extension agents' use of ICT devices which included smartphones, personal computers, laptops, and tablets. These devices, according to several recent studies, were amongst the most popular ICT devices used by extension agents in

Indonesia (Cahyono, 2014; Fangohoi, Sugiyanto, Sukesi, & Cahyono, 2018; Prayoga, 2018; Purwatiningsih, Fatchiya, & Mulyandari, 2018).

ICT Devices

The findings revealed that laptop and smartphones were the most popular ICT devices used by extension agents. More than 80% of extension agents in Gorontalo stated that they had access to a laptop (80.8%) and a smartphone (80.1%). This was comparable to Cahyono's study (2014) in Malang, which revealed that almost 80% the extension agents in Malang owned computer devices including a laptop. At the wider level, a national survey conducted by Indonesia Internet Service Provider Association (Asosiasi Penyelenggara Jasa Internet Indonesia [APJII], 2017) revealed that approximately half (50%) of Indonesian people owned either a smartphone or tablet, and slightly more than one fourth (26%) had either a laptop or computer. The smartphone is popular due to its user-friendliness as an ICT device and communication tool (cellular phone). Considering that extension agents spend most of their time working with farmers in the field, communication between farmers and extension agents often occurs. An extension agent must always be ready to receive calls from his/her farmers. This study revealed that extension agents use smartphones much more frequently than the other devices by very high percentage (72.8%) of extension agents responding to the "very often" option on the questionnaire. Smartphone use on a daily basis far exceeded the use of other ICT devices such as a laptop (48.6%), tablet (48.5%), and personal computer desktop (45.9%). A smartphone is used more frequently due to its multifunctionality, as respondents not only used smartphones to access the Internet, but also as cellphones.

This study also revealed that the laptop is more popular than the desktop computer (70%) despite similar function. Compared to the desktop computers, the laptop is more popular due to its portability, fitting extension agents' needs. Working with farmers requires high mobility. Almost all farmers live in rural areas, with some having poor transportation connections. Many of extension agents bring their laptops while visiting their farmers. Also, there are fewer computer desks than extension agents so that extension agents cannot rely on using the computers at their offices. In a study in Sumedang, Indonesia, Fatimah (2013) explained that even though MoA and the central government had allocated computer devices to many extension offices, the number was still limited. This situation has resulted in the preference of many extension agents to purchase their own laptops rather than depending on computers at their offices.

Access to the Internet

Internet access includes access using a SIM card, Internet access at home, and Internet access at work. The findings in this study showed that the Internet connection via smartphone was the most popular where nearly three fourths (73%) of the extension agents had access to the Internet through a SIM card, while Internet access at home (10.2%) and at work (15.1%) were much lower. Extension agents mostly access the Internet from using a SIM card inserted into a smartphone, or by using a modem connected to a laptop or personal computer. This explains why the high percentage of smartphone (80.1%) and laptop (80.8) users are identical with the percentage of internet access via SIM card. This percentage, however, is reported to be lower than in another area in Indonesia. A study conducted by Purwatiningsih, Fatchiya, and Mulyandari (2018) showed that Internet access of extension agents in Cianjur, Indonesia was 96%, where 30% of them owned more than four devices to

access the Internet. This can be explained by different internet penetration across different regions. Cianjur is situated in Jawa Island, where, according to APJII (2017) internet penetration is higher (57.7%), while Gorontalo is located in Sulawesi Island where internet penetration is only 46.7%. However, both percentages were much higher compared to extension agents in Sri Lanka, where only 36.6% of extension agents in the tea growing areas had access to the Internet (Samansiri & Wanigasundera, 2014).

Compared to the general public of Internet use, the percentage of extension agents in Gorontalo who had access to the Internet was relatively high. Generally, Internet penetration in Indonesia, based on the general public users, was 54.68% (APJII, 2017), where in the Sulawesi region (the location of Gorontalo province), Internet penetration for the public was 46.7%. This indicates that extension agents are relatively quite familiar with the Internet.

Using the Internet among extension agents is still popular despite problems related to the Internet connection. A qualitative study conducted by Adriana (2015) revealed that in Riau, Indonesia, access to the Internet is still difficult. Slow connection made extension agents reluctant to use the Internet as an information source. A similar finding was also reported by Ardiansyah et al. (2014) in Lampung, and in Gorontalo, Indonesia (Tollinggi & Hadjaratie, 2014), where slow access to the Internet was a major problem even in office at the provincial level. Despite complaints regarding slow Internet connection, the extension agents still show interest in using the Internet. This could be seen as a positive sign for integration of Cyber-Extension into extension services.

Extension Agents' ICT Proficiency

ICT proficiency, including *computer skills* and *internet competencies* was measured by several statements related to the respondents' confidence. The theory of self-efficacy (Bandura, 1977) was used as a framework to lens the statements designed in this study.

Computer Skills

This study showed that the extension agents were confident in their competency in using a computer. Basic computer skills included using software related to their task as extension agents such as typing, creating tables, inserting pictures with using a word processor or spreadsheet software, designing presentations with using presentation software, and dealing with troubles in using printer. The computer skills that the majority of extension agents felt either very confident or extremely confident to use were typing quickly (67.5%) and inserting pictures (59.7%) in a word processor software and creating tables in spreadsheet software (58.4%). Those were the skills the extension agents used mostly in writing reports and designing extension materials. Also, extension agents were obliged to assist farmers and farmer groups administratively for example, in creating a Definitive Plan for Group Needs (Rencana Definitif Kebutuhan Kelompok or RDKK), which is often made in the form of a table used to register the needs of subsidized fertilizer. Experience made the extension agents acquainted with using several types of computer software. Computer skills are higher for extension agents who hold university degrees than those of high school degree. This is due to their familiarity of using the computers in colleges as all local universities have been integrated with computer systems.

Computer skills and internet operating skills for extension, according to Cahyono (2014), were vital skills in the communication of extension agents as perceived by extension

agents in Malang. Praza (2016) suggested that, as extension agents were expected to actively search information not only through conventional media but also from online resources, Cyber-Extension can be optimized by providing trainings related to computer and the Internet. Aligned with that, Fangohoi et al. (2018) suggested that computer-based training systems for extension agents might improve access to needed information.

The findings in this study showed that for both *computer skills* and *internet competencies,* there were significant differences of the mean between the extension agents in the age range above 50 and other age range groups. Aged extension agents tend to have lower confidence in operating a computer and browsing the Internet. Consistent with this result, Purnomo and Lee (2010) found that youth was positively associated with confidence in using ICT. According to their study, young extension agents in Central Java were more prepared to implement ICT than older ones. A more recent study conducted by Adriana (2015) showed that in Riau province, lacking computer skills is the main problem for extension agents above 49. The statistical tests in this study revealed that the *computer skills* and *internet competencies* of the extension agents who were above 50 were significantly different from that of other age groups. Considering that most of the respondents in this study (83.7%) are below 50 years old, the potential of integrating Cyber-Extension into extension services in Gorontalo is relatively high if seen through the aspect of age.

Internet Competencies

This study revealed that *internet competencies* were higher for extension agents who hold a university degree than for those who did not. Extension agents who attended college were more confident in using the Internet. The education system in the universities in Gorontalo had been integrated with the Internet, thus university students had more

experience using the Internet than high school students. These findings aligned with the survey conducted by APJII (2017) that revealed Internet penetration among highly educated Indonesians was higher than penetration among those who were less educated. The survey revealed that almost nine tenths (88%) of those who had a Master's degree or more and eight tenths (79%) of those who held a Bachelor's degree had access to the Internet, while slightly more than seven tenths (70%) who attended high school had access to the Internet. However, Purnomo and Lee (2010) revealed different results; there was no significant different between those who held a Bachelor's degree and those who attended high school. The findings in the current study revealed that the majority of the respondents (62.5%) had at least a university degree. Therefore, it may be concluded that extension agents in Gorontalo were well-prepared to use ICT considering their educational attainment.

Internet competencies across geographical areas of employment were found to be significantly different where extension agents who resided in Kota Gorontalo had more confidence in using the Internet than those in Boalemo. According to APJII (2017), Internet penetration in urban areas reached 72.41%, while in rural areas it was only 48.25%. As Kota Gorontalo was the capital city of the province, Internet infrastructure was much better than in Boalemo wherein most of district was rural. Extension agents in Kota Gorontalo were more familiar with the Internet due to better infrastructure in the urban area. The differences, however, were not significant compared to the other areas (Gorontalo Utara, Bone Bolango, Pohuwato, Kab Gorontalo). Nevertheless, the data showed that the means of ICT proficiency (both for *computer skills* and *internet competencies*) were highest in Kota Gorontalo (M=3.14 and M=2.89, respectively). Considering that the majority (91.4%) of the extension

agents work in rural areas, infrastructure related to ICT should be provided in order to lessen the gaps between urban and rural areas to increase the rate of adoption of Cyber-Extension.

The findings showed that extension agents were more confident in their competencies utilizing the Internet rather than a computer. *Internet competencies* include ability using social media such as Facebook, Instagram, or Twitter. The results showed that 80% of the extension agents were either extremely confident or very confident in their use of social media; especially as social media has been very popular among the extension agents. At the national level, Facebook has been among the most popular social media in Indonesia. In July 2018, Indonesia was the fourth largest Facebook user country with approximately 130 million users (Statistica, 2018), a number likely to increase yearly. Social media is largely for personal interaction as well as for finding information shared by people or institutions. The increased percentage of Internet penetration yearly could be a main cause for the increased social media use among the extension agents, thus affecting their confidence in its use.

Another important finding regarding *internet competencies* was the extension agents' confidence utilizing search engines such as Google and Yahoo. According to the findings, 70% of the respondents were either extremely confident or very confident in being able to use search engines to find needed information. Generally, Internet users search for information utilizing search engines. For extension agents who are Internet users, search engines enable them to quickly find information related to agriculture.

In this era of technology information, extension agents worldwide are expected to possess *internet competencies* for their work with local farmers. A study conducted by Kwaw-Mensah, and Martin (2013) noted that extension agents from the North Central region listed the Internet as the most effective tool used in livestock waste management education.

Various Internet software and applications are being designed to support extension agents. For instance, the implementation of Internet Geographic Information Systems (Internet GIS) might help extension agents to facilitate a community in making informed decisions in land use planning (Watermolen, Andrews, & Wade, 2009). In Indonesia, Cyber-Extension is not the only Internet-based extension as there are many other similar agricultural information exchange systems operated by either Non-Government Organizations (NGOs) or the private sector such as *Petani*, *TaniHub*, or *Pantau Harga*. To align themselves for clients' needs, extension agents must know how to use the Internet. In a study conducted by Cahyono (2014), the majority (81.8%) of extension agents in Malang, Indonesia perceived their Internet operation skills as highly important, despite proficiency being low according to more than half (51.2%) of them. Helmy et al. (2015) noted that there were still many extension agents who were not able to operate computer devices and the Internet. Lubis (2012) added that one of the extension agents' roles was to facilitate farmers to obtain information on Cyber-Extension; therefore, extension agents should be required to be able use Cyber-Extension to teach farmers how to use it as an online resource.

Although the current study revealed high confidence among the extension agents in Gorontalo in utilizing the Internet, contrary to this study, extension agents in Malang reported a lack of internet skills due to unfamiliarity using social media and the Internet (Cahyono, 2014). This might be explained by the different age distribution between research participants in Gorontalo and in Malang, where nearly two-thirds of the extension agents in Malang were more than 50 years old. Despite the present situation, government organizations in Indonesia, both at the local and the national level, have been using social media platforms

to socialize their programs. The popularity of social media has encouraged extension agents to use social media, thus affecting their confidence in utilizing online resource.

Predicting the Adoption of Cyber-Extension

The last objective of this research was to determine whether extension agents' perceptions of the attribute of innovations of Cyber-Extension and ICT proficiency predicted the adoption of Cyber-Extension. A statistical test using logistic regression revealed that the *complexity* attribute significantly predicted the adoption of Cyber-Extension. The less complex the Cyber-Extension as perceived by extension agents, the higher the probability of its adoption. This finding was congruent with the results of a study conducted by Taylor (2015) regarding the adoption of eXtension in Iowa. Taylor revealed that the adoption of eXtension was predicted by the positive perceptions of extension educators in Iowa of the complexity attribute of eXtension.

Complexity, according to Rogers (1995), is: "…*the degree to which an innovation is perceived as relatively difficult to understand and use*" (p. 230). Panigrahi, Srivastava, and Sharma (2018) argued that complexity is one of the factors affecting adoption of online learning. The authors suggested that online learning should be simplified to increase its implementation and use in order to increase the rate of adoption. Complexity of digital technology, according to Yu, Lin, and Liao (2017) was a part of ICT media technostress, a situation wherein users had a negative perception while interacting with computers or ICT devices. ICT technostress is brought about by digital illiteracy and yhe lack of proficiency of ICT users. Pignatti, Carli, and Canavari, (2015) provided an example of how farmers in Europe reacted after interacting with complex ICT devices in which the farmers' anxiety and feelings of incompetence increased the probability of rejection of technology.

Among other attributes, *complexity* was the least favored by the extension agents in this study. Many extension agents believed that Cyber-Extension cannot be learned individually, due to the *complexity* of its features. Therefore, the design of Cyber-Extension must be improved from time to time, making it more user-friendly to increase its simplicity and raise its acceptance rate.

Modelling the Adoption of Cyber-Extension as an ICT-Based Extension

In general, this research study revealed variables related to the adoption of Cyber-Extension as an ICT-based extension. The study addressed the need for better strategies to increase the rate of adoption of Cyber-Extension among Indonesian extension agents. A model elaborating the interconnection and flow among variables in this research is provided in Figure 6.1. The model is comprised of four major parts. First, the adopters' personal characteristics of selected demographic are presented. The second part includes perceived

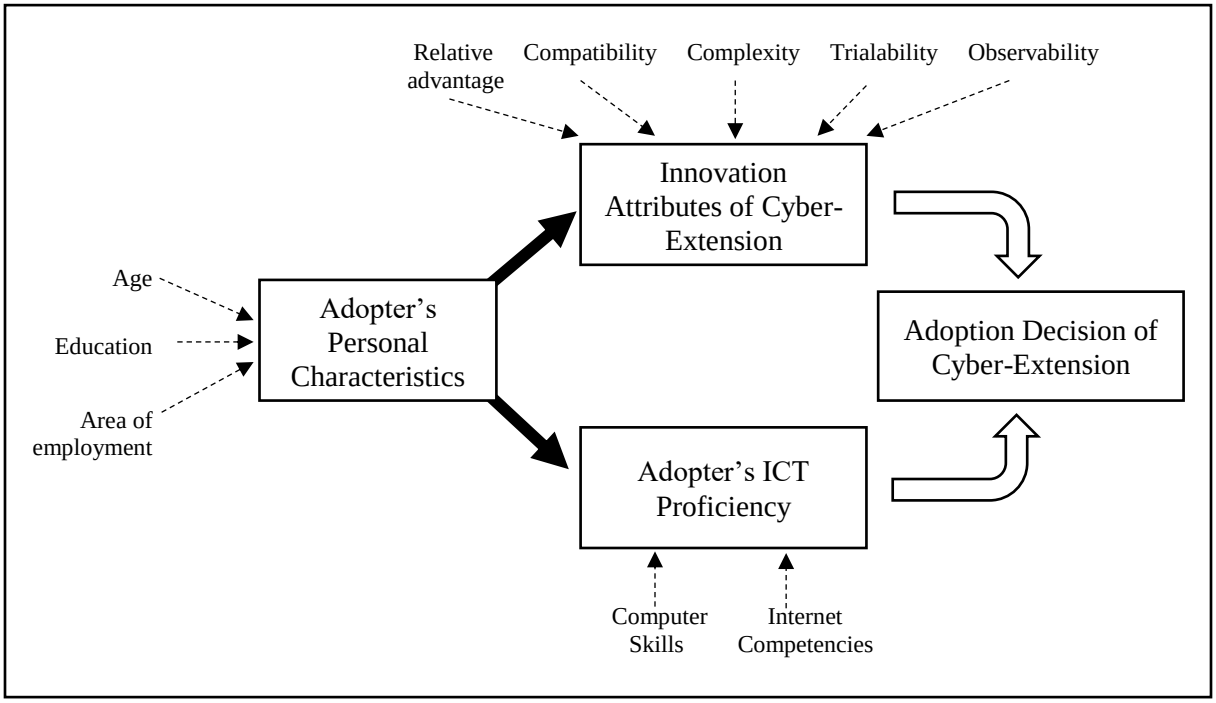


Figure 5.1. A model describing the adoption of Cyber-Extension

attributes of Cyber-Extension that are comprised of five innovation attributes: *relative advantages*, *compatibility*, *complexity*, *trialability*, and *observability*. The third part is the adopters' ICT proficiency which includes *computer skills* and *internet competencies*. The last part of the model is comprised of the adopters' decision for or against Cyber-Extension.

The model introduces two major components that could have direct impact on the decision made by potential adopters in accepting or not accepting Cyber-Extension. The first component is Cyber-Extension's innovation attributes: *relative advantages*, *compatibility*, *complexity*, *trialability*, and *observability*. The components are measured by the perceptions of adopters of Cyber-Extension as an innovation. The theory of diffusion of innovation (Rogers, 2003) supports this assumption. The second component in the model is the adopters' ICT proficiency which includes *computer skills* and *internet competencies*, measured through Bandura's self-efficacy theory (1977). The direction of impact between these two components and the adoption decision appears in the white arrows pointing to the adoption decision of Cyber-Extension box in the model. The arrow's direction indicates the causality between components.

The model also suggests that these two components – innovation and adopter – might affect a person's decision to integrate Cyber-Extension into extension activities. Designs of different strategies to increase the rate of adoption might use the model's concepts as support, as the two components within this model emphasize two different aspects—the *innovation* and the *adopter*. The component of Cyber-Extension's innovation attributes focuses on the innovation itself (Cyber-Extension). The attributes are highly correlated with the nature of the innovation offered to the adopters. For example, low scores on the *relative advantage* attribute might be due to the high cost of using Cyber-Extension as an innovation

(i.e. the price of subscribing to an Internet connection is too much compared to that of conventional media such as brochures), or simply Cyber-Extension may not provide the information demanded by adopters (extension agents). Low scores on the *complexity* attribute, for instance, might be because Cyber-Extension's layout and design are found to be too complex by extension agents as users, making them reluctant to explore the website to search for or to share information. Thus, in this case, strategies to increase the rate of adoption related to the attribute of *relative advantage* might focus on making Cyber-Extension accessible off-line thereby reducing Internet subscription fees, or on aligning information provided by Cyber-Extension with specific needs of extension agents. Strategies to deal with the attribute of complexity may focus on redesigning the layout of the Cyber-Extension's interface. This concept has been confirmed by previous studies related to the adoption of ICT. For example, a study conducted by Moghaddam and Khatoon-Abadi (2013) revealed the *relative advantage*, *complexity*, and *observability* attributes significantly predict the adoption of ICT among rural users in Iran. Nevertheless, the *compatibility* attribute was found significant in determining the adoption of ICT application across the users of Web 2.0 services (Corrocher, 2010). In the USA, studies conducted by Taylor (2015) revealed that the attributes of innovation of eXtension affected decisions made by Iowa's extension educators to adopt eXtension. Taylor's study found that the *complexity* and *trialability* attributes significantly predicted the adoption of eXtension in Iowa. The current study supports Rogers' diffusion of innovation theory (2003) as both revealed the attribute of *complexity* significantly predicted the adoption of Cyber-Extension.

The component of adopter's ICT proficiency is related to the adopter (the subject) rather than the innovation. ICT proficiency which includes *computer skills* and *internet*

competencies deals with the adopter's knowledge in operating ICT devices and programs related to Cyber-Extension. While Cyber-Extension's innovation attributes emphasize the innovation (Cyber-Extension), the component of an adopter's ICT proficiency focuses on the adopter (the extension agent). The variation among scores within *computer skills* and *internet competencies* is more likely to be associated with the adopter's capability rather than the design of Cyber-Extension. For example, low scores on *computer skills* might be due to the adopter's incapacity in using a word processor or spreadsheet software, and low scores on *internet competencies* might be because of the adopter's inability to use internet browsers. In this case, strategies such as training on using the computer and the Internet might be the best strategy that can be used to improve the adopter's ICT proficiency (*computer skills* and *internet competencies*) increasing the rate of adoption of Cyber-Extension.

This model's statement that ICT proficiency is correlated with the intention of adopting ICT concurs with the findings of several studies. For example, Ariff et al. (2012) revealed that computer skills which were measured using a self-efficacy test, predicted *perceived usefulness* and *perceived ease of use* of the Internet Banking Systems in Malaysia. According to Davis (1989), *perceived usefulness* and *perceived ease of use* are the predictors of technology use intentions. In addition, a study conducted by Giotopoulos et al. (2017) regarding ICT implementation across Small and Medium Enterprises (SMEs) in Greece revealed that ICT skills significantly predicted intentions to implement actions to establish ICT. The results indicated that SME's with personnel with high ICT skills are more likely to adopt ICT. In this study of Cyber-Extension's adoption, however, statistical test did not find that ICT proficiency predict the adoption of Cyber-Extension.

The current model also shows the relationship between an adopter's personal characteristics and the innovation attributes of Cyber-Extension, as well as between an adopter's personal characteristics and the adopter's ICT proficiency. This relationship is denoted by two dark arrows pointing at these two components. Different characteristics of adopters might affect the variation of scores within the attributes of innovation of Cyber-Extension (*relative advantages*, *compatibility*, *complexity*, *trialability*, and *observability*) as well as an adopter's ICT proficiency (*computer skills* and *Internet competencies*). This study revealed that different education levels of adopters had an influence on the variability of all attributes of innovation of Cyber-Extension, as well as revealing different age ranges have an effect on the variation of scores in the adopters' ICT proficiency (*computer skills* and *internet competencies*). While education level has a correlation with the variation of scores in *computer skills*, areas of employment has been found to be correlated to variation of scores in *internet competencies*. Other studies confirmed that different demographic characteristics may affect the variation of scores in the innovation attributes. For example, Taylor (2015) found that age and educational attainment correlated with the *trialability* attribute of eXtension as perceived by extension educators in Iowa.

It is widely acknowledged that there is no single model that can be generalized to every situation. The adoption of an innovation is a dynamic process that varies depending on the many facets of the innovation and the variables around it. The model provided in this research study offers an alternative approach, thereby enriching existing approaches related to analyzing ICT adoption in extension services. This model and the components in this model can be used to explore the process of disseminating an innovation, particularly for

evaluating the rate of adoption of an ICT-based extension and for conceptualizing components related to the rate of adoption.

CHAPTER 6. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension. This chapter presents the summary, conclusions drawn from the study, and recommendations for future actions.

Summary

The past decade has witnessed a rapid increase of global interest in Information and Communication Technology (ICT) implementation in agricultural and rural development. Many benefits of ICT for agriculture have been observed globally, including an increase of farm productivity, access to global market information, and effective communication among actors related to agricultural production across different regions (Maumbe, 2012). According to Lubis (2012), ICT implementation in Indonesian rural development was pioneered through several projects such as Microsoft Community Training and Learning Center initiated by Microsoft, Poor Farmers' Income Improvement through Innovation (PFI3) with the Asian Development Bank, and Farmers' Empowerment through Agricultural Technology and Information (FEATI). A recent nationwide program related to ICT implementation was launched by the Ministry of Agriculture in 2009, namely Cyber-Extension (which can be accessed through cybex.pertanian.go.id).

Although various efforts in trainings and socialization have been made to increase the adoption rate of Cyber-Extension in Indonesia, recent studies have shown that nevertheless a small number of extension agents show interest in using the Cyber-Extension system (Adriana 2015; Ardiansyah et al., 2014; Helmy et al., 2013). Therefore, a present exists need to study the challenges in implementing Cyber-Extension especially by examining extension

agent proficiency to practice Cyber-Extension. This will be an important stepping stone in successfully disseminating Cyber-Extension to and among extension agents.

Three hundred and seventy-two (372) extension agents across six regencies in Gorontalo province, Indonesia were invited to participate; 221 respondents agreed to participate in the study. Personal interviews were conducted using a structured questionnaire. To determine the stages of the innovation-decision process, and to describe the perceptions of the extension agents on innovation attributes of Cyber-Extension, the diffusion of innovation theory (Rogers, 1995) was used. The stages of innovation-decision process were modified according to a study conducted by Li (2004) and Taylor (2015) by adding the *no knowledge* stage into the model. The perceptions of Cyber-Extension's innovation attributes (including *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*) was measured with a four-point bipolar Likert scale. The participants' ICT proficiency (consisted of *computer skills* and *Internet competence*) was measured with the self-efficacy theory (Bandura, 1977) designed with a five-point unipolar Likert-type scale. Descriptive analysis was used to present the distribution of participants in the stage of innovation-decision, while, to reveal the association between variables, t-tests and ANOVA were used. Logistic regression analysis was employed to determine whether the perceptions of extension agents of Cyber-Extension's innovation attributes and ICT proficiency predicted Cyber-Extension adoption.

The majority of the respondents were female (n=119, 53.4%), were within the age range of 40-49 years old (n=99, 44.8%), and held a Bachelor's degree (n=135, 61.9%). Most of the respondents worked in *Pohuwato* regency (n=50, 22.6%), belonging to the group of 10-14 years of service (n=99, 45.8%), supervised one village (n=108, 50.2%), and supervised

between eight to sixteen farmer groups (*n*=79, 37.3%). Most of the respondents had access to laptops (n=177, 80.8%) and smartphones (*n*=177, 80.1%), had Internet access on SIM card (*n*=169, 77.5%), but had no cable Internet access at home (*n*=193, 87.7%) and at work (*n*=170, 77.6%).

The majority of the respondents (*n*=80, 36.4%) stated that they had heard about Cyber-Extension but had not used it and had no thoughts about whether they would use it or not (*knowledge* stage). A very small number of respondents (*n*=8, 3.5%) were in the *confirmation* stage of Cyber-Extension adoption, claiming that they had used Cyber-Extension long enough to understand and evaluate conclude thoughts on Cyber-Extension is value for their extension activities.

Respondents in this research study had positive perceptions toward Cyber-Extension, most favorably on the attribute of *compatibility* (M=2.23, SD=.38), followed by *relative advantage* (M=2.17, SD=.37) and *observability* (M=2.09, SD=.40). The lowest value was in the *complexity* attribute with the mean score and standard deviation of M=1.93, SD=.44. In general, respondents held positive opinions about all innovation attributes. On average, respondents had strong confidence in their own *internet competencies* (M=2.63, SD=1.00), followed by *computer skills* (M=2.31, SD=1.13). A logistic regression analysis was conducted with five predictors from perceived innovation attributes, and two predictors (*computer skills* and *Internet competence*) from ICT proficiency were simultaneously entered into the model. These predictors contributed 42% to the variance in the adoption of Cyber-Extension (R^2=.42). The model showed that complexity successfully predicted the Cyber-Extension adoption, significant at .05 level. The odds ratio of the complexity attribute predicted by the model was 6.10, meaning that each one-point increase in computer skills

was associated with the odds of adopting Cyber-Extension increasing by 6.10 multiplicative factor.

Conclusions

This study assessed the adoption of Cyber-Extension in Indonesia by determining the extension agents' perceptions of Cyber-Extension and their proficiency and their impact on the adoption of Cyber-Extension. The following conclusions were drawn from the findings:

1. Although Cyber-Extension has been implemented for nine years, the majority of the extension agents in this study (79.2%) are non-adopters of Cyber-Extension. A large percentage was currently on the first two stages of innovation-decision process (36.4% of respondents in the *knowledge* stage, and 22.3% in the *persuasion* stage), and on the *no knowledge* stage (18.2%). It can be concluded that Cyber-Extension has not yet been successfully adopted.
2. Those who had experience with Cyber-Extension perceived Cyber-Extension to be mostly *compatible*, *relatively advantageous*, and *observable*, but *complex* to use as an ICT-based extension service. Generally, the extension agents who had a university degree perceived Cyber-Extension to be less complex than those who just had a high school degree.
3. Laptops and smartphones were the most popular ICT devices used by the extension agents in this study, with high accessibility to both devices, showing a high potential of disseminating Cyber-Extension across extension agents, generally for smartphone due to its high frequency of use by extension agents.
4. Extension agents were confident that they have appropriate ICT proficiency (both computer skills and internet competences) to operate ICT devices. It indicates the

extension agents' ability to integrate ICT-based extension, such as Cyber-Extension into their work based on their ICT proficiency.

5. Older extension agents (age 50 and above) lacked some ability in operating a computer and using the Internet. *Computer skills* for those who had a university degree were above those of agents with a high school degree. Also, *internet competencies* were better for the extension agents working closer to urban areas than for those in rural areas. It can be concluded that the extension agents' ICT proficiency is relatively higher considering the large percentages of the extension agents who are under 50 (83.7%) and who hold a university degree (63.3%). However, infrastructure gaps between urban and rural areas need to be lessened as a very large percentage of the extension agents (91.4%) work in rural areas.
6. Complexity is the most important aspect to be considered if the rate of adoption of Cyber-Extension is to be increased. The perceptions of extension agents of the complexity of Cyber-Extension predicted their adoption of Cyber-Extension in which each one-point increase in complexity added the probability to adopt Cyber-Extension at the rate of 6.10 times higher.

Recommendations

Several recommendations are made based upon the findings and conclusions of this study:

1. The MoA and local extension offices should cooperate with local universities to design training related to ICT. This study discovered that extension agents who had a degree (who had attended college) had better perceptions of Cyber-Extension's complexity due to their familiarity with ICT devices in colleges. Local universities

have the experiences of training students on using ICT that might be beneficial for the extension services to design training on ICT.

2. It is highly important for the MoA and the agricultural extension services to design and employ diverse strategies for each stage. For example, trainings and workshops might be sufficient for those in the earlier stages, while intense individual tutoring might be more appropriate for those in the later stages. This study identified the extension agents' different positions in the innovation-decision process. These results can be used to design appropriate strategies and approaches to introduce and socialize Cyber-Extension to extension agents. Depending on their positions in the innovation-decision process, extension agents may show different attitudes and reactions toward Cyber-Extension.
3. Cyber-Extension must be improved, especially in its interface and features for the sake of agent user-friendliness, so that the adoption rate can be increased. In this study, the attribute of *complexity* was measured to have the lowest score, reflecting that the extension agents perceived Cyber-Extension as too complex for use. Furthermore, Logistic regression analysis proved that perceptions of Cyber-Extension's complexity predicted the probability of a user adopting Cyber-Extension. Trainings, workshops, or personal assistance specifically designed to operate Cyber-Extension might be a good strategy to reduce the extension agents' difficulties in using Cyber-Extension.

Future Research

The following topics are recommended for future research:

1. This study provides important information regarding the stages of innovation-decision process in Cyber-Extension, including the distribution of extension agents across the stages. This study, however, did not capture the communication channels mainly used during the dissemination of information in socializing Cyber-Extension. Further studies might focus on the communication channels being used, even preferably, to learn about Cyber-Extension or other ICT-based extension with a goal of understanding how information flows, what the impact is for each stage, and especially to understand the transition between stages such as how an extension agent develops his or her interest in using Cyber-Extension and what burdens they encounter during the learning process.
2. Another focus that might be an important topic is on the decision stage. This study revealed that 2.3% of the total respondents rejected using Cyber-Extension after they had tried it. Although this number is relatively small, it is interesting to observe the reasons behind refusal in order to reduce the rejection rate. Studies of similar topics in other areas might be important. Further research on Cyber-Extension to investigate rejection or tendencies to discontinue might be useful to dig into the underlying reasons for rejecting the innovation. As the percentage is small, qualitative studies might be appropriate for further research.
3. This study revealed that the attribute of complexity successfully predicted the adoption of Cyber-Extension. For future study, there might be product evaluation on Cyber-Extension especially regarding its complexity specifically the different

functions and features in Cyber-Extension that were perceived as complex by the extension agents.

4. Replication of this research study in further studies, to be carried out either with extension agents in other provinces as respondents, or with other ICT-based extension systems across Indonesia, is highly recommended. Many ICT-based extension systems were employed either by the government or the private sectors.

Implications and Significance to Agricultural Education and Extension

ICT implementation in agricultural extension has become more popular in the digital age. Agricultural extension deals with the learning process of integrating "new" and "existing" knowledge. ICT plays an important role in improving information flow and knowledge circulation between stakeholders in agriculture and between researchers and farmers. This study addresses Cyber-Extension implementation in Indonesia as an ICT-based extension services, with a specific focus on the adoption of Cyber-Extension as the innovation, and the proficiency of agricultural extension agents to implement Cyber-Extension as an ICT-based extension.

Extension agents are the main users of Cyber-Extension. The extension agents' role in agricultural extension services is to facilitate learning among clients being served. Extension agents are expected to utilize multiple resources, including optimally and efficiently using online resources. In the digital era, utilizing ICT is a must-have skill to bridge information needs in agriculture. Extension agents are expected to have motivation and proficiency in using ICT in extension.

Furthermore, in many countries (including Indonesia), ICT integration in agricultural extension has become a regular government project, where budgeted aid is allocated to

integrate ICT into extension services. The results of this study are important to provide information and ideas for both the government and donors in evaluating their projects, efficiently using their budgets to improve ICT-based extension services and avoiding "white elephant" projects, a term that refers to projects which failed to achieve their objectives despite high budgeted expense.

Finally, a theoretical understanding of this study hopefully can improve understanding of the adoption of innovation, especially regarding that of ICT in agricultural extension. This study might help Agricultural Extension professionals to understand how ICT is being integrated into extension services, as well as how academic professionals in agricultural extension can prepare others in the field and institutions of higher learning to develop curriculum relevant to ICT use in agricultural extension systems.

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APPENDIX A. INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 3/2/2018

To: Dr. Zulham Sirajuddin
59 Schilletter Village, Apt D
Ames, IA 50010

CC: Dr. Robert Martin
201 Curtiss Hall

From: Office for Responsible Research

Title: An assessment of ICT-based extention in Indonesia: Adoption of cyber-extension and the readiness of agricultural extension agents

IRB ID: 17-627

Study Review Date: 3/2/2018

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

APPENDIX B. INFORMED CONSENT

Informed Consent

This is a research study. Please feel free to ask questions at any time. The purpose of this research is to determine the extension agents' perceptions of Cyber-Extension and their proficiency in using ICT and their impact on the adoption of Cyber-Extension.

If you agree to participate in this research, an interviewer will ask you to complete a three-part survey concerning your perception toward cyber-extension and your self-efficacy beliefs on ICT readiness. You are welcome to participate by responding to the questions and statements. There are various types of questions in this questionnaire, simple instructions about how to responds will be provided along each question when necessary. The survey should take less than 20 minutes to complete. If you agree to participate, you will be placed in a draw for Rp 100,000, to take place in March 2018. The winner will receive an email from the main researcher associated with this research.
The is no foreseeable risks of participating this survey study. We highly encourage you to complete all the items in this questionnaire, because every piece of your responds worth a lot to us. Even though, as your participation will be completely voluntary, you are allowed to skip any question that you do not wish to answer, or you may withdraw at any time without any penalty. All responses will be kept secure and confidential.

There will be no direct benefit to you. We expect the information gained in this study will be a great support to the improvement of cyber-extension and the professional skills of extension agents in working with ICT.

If you have any questions about this research, or would like to understand more about this study, please do not hesitate to contact the researcher through this following information: Zulham Sirajuddin, zulham@iastate.edu, +1 515-735-6889, Department of Agricultural Education and Studies, 217 Curtiss Hall, Iowa State University, Ames, Iowa, 50011. If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's Name (printed) _____

_____ _____

Participant's Signature Date

Informed Consent

Kuisioner ini adalah bagian dari penelitian. Mohon bertanya kapan saja anda membutuhkan. Tujuan penelitian ini adalah untuk memahami penerapan cyber-extension di Indonesia serta penggunaan Teknologi Informasi dan Komunikasi di kalangan penyuluh.

Jika anda setuju untuk berpartisipasi dalam penelitian ini, pewawancara akan meminta anda untuk mengisi kuisioner. Anda dipersilahkan untuk menjawab dengan memberi respon sesuai petunjuk yang diberikan. Pengisian kuisioner ini akan berlangsung sekitar 15-20 menit.

Jika anda setuju untuk berpartisipasi, anda akan diikut sertakan dalam undian dengan total Rp.300.000 untuk tiga orang (masing-masing mendapatkan Rp.100.000) dalam bentuk uang kas. Undian ini akan dilakukan setelah pengambilan data selesai. Pemenangnya akan dihubungi oleh pewawancara dan peneliti.

Berpartisipasi dalam penelitian ini sebagai reponden tidak memiliki resiko apa-apa. Kami sangat mendorong anda untuk berpartisipasi dan menyelesaikan kuisioner dalam penelitian ini, sebab setiap respon anda akan sangat bernilai bagi kami. Juga, setiap data yang anda berikan akan dijaga dengan baik. Partisipasi anda bersifat sukarela, anda dapat melewati pertanyaan yang tidak ingin anda jawab atau dapat mengundurkan diri jika menginginkannya.

Informasi dari hasil penelitian ini akan digunakan untuk mendukung upaya peningkatan kualitas penyuluhan pertanian Indonesia untamanya penyuluhan berbasis Teknologi Informasi dan Komunikasi.

Jika anda memiliki pertanyaan lebih lanjut, mohon hubungi peneliti utama melalui informasi berikut: Zulham Sirajuddin, zulham@iastate.edu, (+1) 515-735-6889, Department of Agricultural Education and Studies, 217 Curtiss Hall, Iowa State University, Ames, Iowa, 50011. Jika anda memiliki pertanyaan mengenai hak-hak partisipan, silahkan menghubungi IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Jika anda setuju, mohon untuk mengisi nama dan tanda tangan anda dibawah ini. Tanda tangan anda adalah bukti bahwa anda telah menyetujui untuk berpartisipasi dalam penelitian ini, telah mendapatkan penjelasan dengan cukup jelas, dan telah memahami hak sebagai partisipan. Anda akan menerima copy dari dokumen ini.

Nama Partisipan _____

_____ _____

Tanda Tangan Tanggal

APPENDIX C. PARTICIPANT COMMUNICATION

C1. Letter of Introduction

For: To Whom It May Concern

Re: Letter of Introduction

The purpose of this document is to present a "Letter of Introduction" for your information regarding a research study to be conducted focused on Agricultural Extension Education in Gorontalo Regency, Indonesia. This study will be conducted by Zulham Sirajuddin, a PhD student at Iowa State University.

In an effort to discover and use the best practices to deliver agricultural extension program training, we are preparing to conduct a research study entitled The adoption of Cyber-Extension in Indonesia: Impact of extension agents' perception of Cyber Extension's innovation attributes and Information and Communication Technology (ICT) proficiency. We need your help and cooperation.

The research will be conducted using an interview process and a questionnaire distributed to extension agents.

Participation in this study is strictly voluntary. Furthermore, participants can skip questions they prefer not to answer. Responses to all questions will be held in strict confidence and only used for group analysis. Each interview will take approximately 15 to 20 minutes to complete.

The findings of this study will be used to complete a Doctor of Philosophy (Ph.D.) degree in Agricultural Education at Iowa State University, U.S.A. This study has been reviewed and approved by the Iowa State University Institutional Review Board for use of information from human subjects.

We expect the findings of this study will provide guidelines to identify training practices and ways to enhance agricultural extension programs in Indonesia. Findings from the study will be shared with all interested individuals who may find the results of the study useful.

If you have any further questions regarding the study, please contact Zulham Sirajuddin at zulham@iastate.edu or Robert A. Martin at drmartin@iastate.edu.

Thank you,

Robert A Martin, Ph.D
Major Professor

Zulham Sirajuddin
Graduate Student

C2. Letter of Introduction (Bahasa Indonesia)

Kepada YTH: Calon Partisipan Penelitian

Surat ini merupakan surat perkenalan yang bertujuan untuk memberikan informasi mengenai penelitian tentang penyuluhan pertanian di Kabupaten Gorontalo. Penelitian ini akan dilakukan oleh saudara Zulham Sirajuddin, mahasiswa Doktoral di Iowa State University, Amerika Serikat.

Dalam rangka meningkatkan kualitas penyuluhan pertanian, kami menyusun penelitian dengan tema mengenai asesmen penerapan penyuluhan berbasis TIK di Indonesia dalam hal dopsi Cyber-Extension dan kemampuan penyuluh dalam penyuluhan berbasis TIK. Untuk itu, kami membutuhkan bantuan anda.

Penelitian ini akan dilakukan melalui proses wawancara dalam bentuk pengisian kuisioner oleh penyuluh pertanian. Partisipasi dalam penelitian ini bersifat sukarela. Responden dapat melewati pertanyaan yang tidak ingin dijawabnya. Setiap respon yang diberikan semata-mata hanya digunakan untuk analisis data. Adapun proses pengisian kuisioner ini akan memakan waktu kira-kira 15 hingga 20 menit.

Hasil penelitian ini utamanya digunakan sebagai disertasi untuk penyelesaian studi doktoral saudara Zulham. Disertasi ini telah disetujui oleh lembaga berwenang yakni Institutional Review Board pada Iowa State University.

Jika anda memiliki pertanyaan terkait penelitian ini, dapat menghubungi sdr. Zulham pada alamat e-mail zulham@iastate.edu atau Robert A Martin pada alamat e-mail drmartin@iastate.edu. Terima kasih atas bantuan anda.

Hormat saya,

Zulham Sirajuddin
Kandidat Doktor,
Iowa State University
Amerika Serikat

QUESTIONNAIRE

The purpose of this study is to understand the Indonesian cyber-extension. We respect your ideas and experiences and we thank you for your time.

Directions:

This questionnaire consists of four sections. It should take approximately twenty minutes to complete all sections.

We want to assure you that your responses will be completely confidential. No personally identifiable information will be captured. Your responses will be combined with those of many other respondents summarized in a report to further protect your privacy.

Thank you for your participation in this study.

Section 1. Access to ICT

1. Do you own or have access to smartphone?
   ☐ Yes ☐ No

2. If YES, how often do you use it?
   ☐ Seldom/monthly ☐ Often/weekly ☐ Very often/daily

3. Do you own or have access to computer?
   ☐ Yes ☐ No

4. If YES, how often do you use it?
   ☐ Seldom/monthly ☐ Often/weekly ☐ Very often/daily

5. Do you own or have access to laptop/netbook?
   ☐ Yes ☐ No

6. If YES, how often do you use it?
   ☐ Seldom/monthly ☐ Often/weekly ☐ Very often/daily

7. Do you own or have access to tablet/iPad?
   ☐ Yes ☐ No

8. If YES, how often do you use it?
   ☐ Seldom/monthly ☐ Often/weekly ☐ Very often/daily

9. The table below is about your internet access. Please indicate your best answers by checking (√) the box that reflects your position (select all appropriate).

Devices	Years of use
Internet in the SIM card/cellphone	☐ Do not use ☐ Between 3-5 years ☐ Less than 1 year ☐ More than 5 years ☐ Between 1-3 years

Internet at home	☐ Do not use ☐ Less than 1 year ☐ Between 1-3 years	☐ Between 3-5 years ☐ More than 5 years
Internet at office	☐ Do not use ☐ Less than 1 year ☐ Between 1-3 years	☐ Between 3-5 years ☐ More than 5 years

10. If you don't have any of these ICT devices (Smart phone, laptop, Desktop PC), have you considered having at least one of them?

    ☐ Yes, I have considered
    ☐ No, I have not considered

Section 2. Cyber-Extension

Part 1.
The Indonesian government launched an online information resource called cyber-extension since 2013 to support extension agents. Please indicate your level of involvement with cyber-extension by checking (√) the box that reflects your position

Please select only ONE statement that best reflects your current position	
☐	I have never heard about Cyber-Extension
☐	I have heard about cyber-extension but I have not use it and have no idea that I will use it or not
☐	I have tried cyber-extension but haven't use it in my works because I am still learning about it
☐	I have tried cyber-extension and I have decided that I will not use it
☐	I have tried cyber-extension and I have decided that I will use it
☐	I have used cyber-extension and am still exploring the features to know its benefit
☐	I have used cyber-extension long enough to understand and evaluate whether cyber-extension will be part of my extension activities

Part 2.

Below is a list of statements regarding cyber-extension. You can fill in your responses ONLY if you have ever used cyber-extension.

Use the following scales to indicate your response. Check (√) the best response.

1= Strongly Disagree (SD)
2= Disagree (D)
3= Neither agree or disagree (N)
4= Agree (A)
5= Strongly Agree (SA)

Items	Responses			
Part A	Strongly Disagree	Disagree	Agree	Strongly Agree
Cyber-extension enhances the quality of work I do				
Cyber-extension is a useful tool in delivering educational outreach to farmers				
Cyber-Extension increases the accessibility of extension programming to farmers				
I can find information I need in cyber-extension more quickly				
The quality of information provided by cyber-extension is better than brochures				
Cyber-extension costs me less money than other media				
Part B	Strongly Disagree	Disagree	Agree	Strongly Agree
Cyber-extension supports my work as an extension agent				
Cyber-extension fits into my needs in finding information to prepare extension materials				
My vision for the future of extension includes cyber-extension				
Cyber-extension helps me deliver programs based on the needs of farmers				
Cyber-extension fits well with the way I often do my job				
Part C	Strongly Disagree	Disagree	Agree	Strongly Agree
Accessing information in cyber-extension is easy for me				
I can find the information I am looking for using cyber-extension				
I do not need extensive training on how to use cyber-extension				
I have no difficulty teaching others how to use cyber-extension				
Part D	Strongly Disagree	Disagree	Agree	Strongly Agree
I have tried cyber-extension				
I am able to experiment with cyber-extension				
I can easily select the features of cyber-extension that I want to use				
I can test key features of cyber-extension				
It doesn't require much time to try cyber-extension				
Cyber-extension can be tested without obligation to continue further				

Part E	Strongly Disagree	Disagree	Agree	Strongly Agree
I have heard a lot about Cyber-extension				
I have seen how other extension agents use cyber-extension in their work				
I have seen cyber-extension help extension agents in finding important information to clients				
I have seen cyber-extension help extension disseminate research-based information to farmers				
I am aware of the benefits of cyber-extension for extension agents or farmers				

Section 3. ICT Proficiency

Below is a list of statements to indicate your confidence. The scale indicates your degree of confidence in your ICT skills. Rate your degree of confidence by selecting the appropriate responses. Fill this out whether you have used ICT devices or not.

Items		**Confidence**
Part A		
I am able to quickly type in word processor software (e.g. Microsoft Word).	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to insert pictures using word processor software	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to create a table using spreadsheet software (e.g. Microsoft Excel).	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to plot a graph and chart using spreadsheet software.	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to create presentation with presentation software (e.g. Microsoft PowerPoint)	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident

I am able to edit the size and type of fonts in presentation software.	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to troubleshoot the printer (e.g. jammed paper, failure connection)	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
Part B		
I am able to set a homepage for an internet browser (e.g. Mozilla, Opera, Internet Explorer).	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to search for information on the Internet using a search engine (e.g. Yahoo, Google).	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to use email to communicate.	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to use social media (e.g. Facebook, Twitter, Instagram).	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to download files from the internet.	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident
I am able to upload files to the internet.	☐ ☐ ☐ ☐ ☐	Extremely confident Very confident Moderately confident Slightly confident Not confident

Section 4. Demographic data

Please fill your answer in the box OR check (√) the box that reflects your position.

1. What is your age ☐
2. What is your gender
   - ☐ Male
   - ☐ Female
3. What is the highest education level you have completed?
   - ☐ High school
   - ☐ Bachelor's/Diploma
   - ☐ Master's or above
4. Work area: ……
5. Number of village(s) you cover: ……. village(s)
6. Number of farmer group(s) you supervise: …….. group(s)
7. How long have you been working as an extension agent? …….. years

Thank you for completing this questionnaire. As a token of appreciation, your name will be entered into a drawing to win one of three $7.5 vouchers.

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KUISIONER PENELITIAN

Tujuan dari penelitian ini adalah untuk memahami cyber-extension di Indonesia. Terima kasih atas kesempatan dan waktu yang anda luangkan untuk mengisi kuisioner ini.

Arahan:
Kuisioner ini terdiri dari empat sesi. Dibutuhkan kira-kira 20 menit untuk menyelesaikan seluruh sesi. Kami menjamin bahwa setiap respon yang anda berikan bersifat tertutup (rahasia). Kami tidak akan meminta informasi pribadi anda. Respon yang anda berikan akan dikombinasikan dengan respon seluruh responden lainnya lalu dirangkum dalam bentuk laporan. Terima kasih atas kesediaan anda untuk berpartisipasi dalam penelitian ini.

Sesi 1. Pengalaman menggunakan peralatan Teknologi Informasi

1. Apakah anda memiliki/punya akses terhadap smartphone (telepon pintar)?

   ☐ Ya ☐ Tidak

2. Jika YA, seberapa seringkah anda menggunakannya?

   ☐ Jarang/sebulan sekali ☐ Cukup sering/seminggu sekali ☐ Sering sekali/tiap hari

3. Apakah anda memiliki/punya akses terhadap komputer?

   ☐ Ya ☐ Tidak

4. Jika YA, seberapa seringkah anda menggunakannya?

   ☐ Jarang/sebulan sekali ☐ Cukup sering/seminggu sekali ☐ Sering sekali/tiap hari

5. Apakah anda memiliki/punya akses terhadap laptop atau sejenisnya?

   ☐ Ya ☐ Tidak

6. Jika YA, seberapa seringkah anda menggunakannya?

   ☐ Jarang/sebulan sekali ☐ Cukup sering/seminggu sekali ☐ Sering sekali/tiap hari

7. Apakah anda memiliki/punya akses terhadap tablet/iPad atau sejenisnya?

   ☐ Ya ☐ Tidak

8. Jika YA, seberapa seringkah anda menggunakannya?

   ☐ Jarang/sebulan sekali ☐ Cukup sering/seminggu sekali ☐ Sering sekali/tiap hari

9. Tabel dibawah ini adalah mengenai akses anda terhadap internet. Mohon centang jawaban yang anda anggap sesuai.

Jenis akses	Lama penggunaan
Langganan internet melalui Kartu SIM di handphone/smartphone	☐ Tidak punya ☐ Kurang dari 1 tahun ☐ Antara 1-3 tahun ☐ Antara 3-5 tahun ☐ Lebih dari 5 tahun
Sambungan internet di rumah	☐ Tidak punya ☐ Kurang dari 1 tahun ☐ Antara 1-3 tahun ☐ Antara 3-5 tahun ☐ Lebih dari 5 tahun
Sambungan internet di kantor	☐ Tidak punya ☐ Kurang dari 1 tahun ☐ Antara 1-3 tahun ☐ Antara 3-5 tahun ☐ Lebih dari 5 tahun

10. Jika anda **TIDAK** memiliki satupun peralatan untuk mengakses internet saat ini (yakni smartphone, laptop, komputer), apakah anda sedang mempertimbangkan untuk membelinya dalam satu tahun kedepan?
(*Mohon untuk **tidak** menjawab bagian ini jika anda **sudah** memiliki salah satu peralatan untuk mengakses internet seperti smartphone, laptop, atau komputer*)

☐ Ya
☐ Tidak

Sesi 2. Cyber-Extension

Bagian 1.
Pemerintah Indonesia melaui Kementerian Pertanian meluncurkan program bernama cyber-extension pada tahun 2013 sebagai upaya untuk mendukung penyuluh pertanian. Mohon berikan respon mengenai sejauh mana anda mengenal cyber-extension. Mohon memberi tanda centang (√) pada kotak yang tersedia.

Mohon hanya mencentang **SATU** kotak saja. Pilihlah yang menurut anda **PALING TEPAT** menggambarkan pandangan anda mengenai cyber-extension	
☐	Ini pertama kalinya saya mendengar tentang cyber-extension
☐	Saya pernah mendengar tentang cyber-extension, namun saya belum pernah menggunakannya dan belum berniat mencobanya
☐	Saya pernah mencoba cyber-extension, namun saya belum menggunakannya dalam pekerjaan saya sebab saya masih sedang mempelajarinya lebih jauh
☐	Saya telah mencoba dan mempelajari cyber-extension dan memutuskan bahwa saya TIDAK akan menggunakannya
☐	Saya telah mencoba dan mempelajari cyber-extension dan memutuskan bahwa saya akan menggunakan cyber-extension
☐	Saya telah beberapa kali menggunakan cyber-extension, namun saya masih tetap mempelajari lebih jauh lagi fungsi-fungsinya untuk memantapkan keputusan saya untuk tetap menggunakannya
☐	Saya telah menggunakan cyber-extension cukup lama sehingga saya benar-benar telah memahami seluruh fitur-fiturnya dan memutuskan untuk menggunakannya terus dalam pekerjaan saya

Bagian 2.

Daftar dibawah ini adalah beberapa pernyataan mengenai cyber-extension. Mohon diperhatikan bahwa anda dapat menjawab bagian 2 ini **HANYA** jika anda **PERNAH** mencoba/menggunakan langsung cyber-extension. Jika anda sama sekali **TIDAK PERNAH** mencoba/menggunakan cyber-extension, silahkan untuk melangkahi bagian ini dan langsung menuju **Sesi 3**.
Gunakan skala sebelah kanan tabel untuk menentukan respon anda.

Beri hanya **SATU** centang (√) pada kotak (□) yang disediakan untuk jawaban terbaik anda.

Item	**Respon**			
Sub-bagian 1	Sangat Tidak Setuju	Tidak Setuju	Setuju	Sangat Setuju
Cyber-extension meningkatkan kualitas pekerjaan saya	□	□	□	□
Cyber-extension berguna dalam menyampaikan informasi kepada petani	□	□	□	□
Saya dapat menemukan informasi yang saya butuhkan melalui Cyber-Extension dengan lebih cepat dibanding cara lain	□	□	□	□
Kualitas informasi pada Cyber-Extension jauh lebih baik dibandingkan brosur	□	□	□	□
Penggunaan Cyber-Extension lebih murah dibanding media lainnya	□	□	□	□
Sub-bagian 2	Sangat Tidak Setuju	Tidak Setuju	Setuju	Sangat Setuju
Cyber-extension mendukung pekerjaan yang saya lakukan sebagai penyuluh	□	□	□	□
Cyber-extension cocok dengan kebutuhan saya sebagai penyuluh untuk mencari informasi dalam mempersiapkan materi penyuluhan	□	□	□	□
Cyber-extension termasuk dalam visi saya kedepan tentang program penyuluhan	□	□	□	□
Cyber-extension membantu saya dalam penyuluhan yang berdasarkan kebutuhan informasi petani	□	□	□	□
Cyber-extension sangat cocok dengan cara penyuluhan yang selama ini saya lakukan	□	□	□	□
Sub-bagian 3	Sangat Tidak Setuju	Tidak Setuju	Setuju	Sangat Setuju
Sangat mudah untuk memahami cara menggunakan cyber-extension	□	□	□	□
Saya dapat menemukan informasi yang saya cari dengan menggunakan cyber-extension	□	□	□	□
Saya tidak perlu dilatih khusus hanya untuk tahu cara menggunakan cyber-extension	□	□	□	□
Saya tidak kesulitan dalam mengajarkan orang lain mengenai bagaimana cara menggunakan cyber-extension	□	□	□	□

Sub-bagian 4	Sangat Tidak Setuju	Tidak Setuju	Setuju	Sangat Setuju
Saya sudah pernah mencoba cyber-extension	☐	☐	☐	☐
Saya dapat mencoba cyber-extension dengan mudah	☐	☐	☐	☐
Saya dapat dengan mudah memilih bagian mana dari cyber-extension yang ingin saya gunakan	☐	☐	☐	☐
Saya dapat mencoba beberapa bagian kunci Cyber-Extension	☐	☐	☐	☐
Mencoba cyber-extension tidak membutuhkan banyak waktu	☐	☐	☐	☐
Cyber-extension dapat dicoba tanpa ada kewajiban untuk melanjutkan menggunakannya	☐	☐	☐	☐
Sub-bagian 5	Sangat Tidak Setuju	Tidak Setuju	Setuju	Sangat Setuju
Saya sudah mendengar cukup banyak mengenai Cyber-Extension	☐	☐	☐	☐
Saya telah melihat bagaimana penyuluh lain menggunakan Cyber-Extension dalam melakukan pekerjaannya	☐	☐	☐	☐
Saya telah melihat bagaimana cyber-extension membantu penyuluh untuk *memperoleh* informasi yang dibutuhkan petani	☐	☐	☐	☐
Saya sudah melihat bagaimana cyber-extension membantu penyuluh dalam *menyebarkan* informasi berbasis ilmu pengetahuan kepada petani	☐	☐	☐	☐
Saya mengetahui apa keuntungan menggunakan cyber-extension baik untuk penyuluh maupun petani	☐	☐	☐	☐

Sesi 3. Tingkat Keyakinan

Skala pada tabel berikut ini menunjukkan tingkat keyakinan anda dalam menerapkan penyuluhan berbasis Teknologi Informasi dan Komunikasi (TIK). **Mohon untuk mengisi bagian ini meskipun anda tidak memiliki** peralatan TIK seperti smartphone, komputer, atau laptop. Beri satu centang pada kotak yang anda anggap paling sesuai.

Item	**Keyakinan**
Sub-bagian A	
Saya dapat mengetik dengat cukup baik pada aplikasi pengolah kata seperti Microsoft Word	☐ Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya dapat memasukkan gambar pada aplikasi Microsoft Word	☐ Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya dapat membuat tabel pada aplikasi Microsoft Excel.	☐ Sangat yakin ☐

		Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya dapat menyusun materi presentasi dengan menggunakan Microsoft PowerPoint	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya dapat mengatur ukuran dan jenis font pada Microsoft PowerPoint.	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya dapat mengatasi persoalan secara mandiri apabila saya menemui kendala dalam menggunakan printer (misalnya ketika kertas macet atau printer tidak terhubung dengan baik)	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Sub-bagian B		
Saya tahu cara membuka halaman website dengan menggunakan aplikasi internet misalnya Mozilla, Opera, dll.	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya tahu cara mencari informasi di internet dengan menggunakan mesin pencari seperti Google, Yahoo, dll.	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya tahu cara menggunakan email untuk berkomunikasi	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya tahu cara menggunakan sosial media misalnya Facebook, dll.	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya tahu cara mengunduh (mendownload) file di internet	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin
Saya tahu cara mengunggah (mengupload) file di internet	☐	Sangat yakin ☐ Yakin ☐ Cukup yakin ☐ Agak yakin ☐ Tidak yakin

Sesi 4. Data demografi

Mohon tuliskan jawaban anda didalam kotak yang disediakan ATAU memberi tanda centang (√) pada kotak kecil yang anda rasa merefleksikan jawaban anda.

1. Umur anda: …….. tahun

2. Jenis kelamin
   - ☐ Laki-laki
   - ☐ Perempuan

3. Tingkat Pendidikan tertinggi yang anda selesaikan?
   - ☐ SMA/SMK atau sederajat
   - ☐ S1 (Sarjana) / D3 / D4
   - ☐ S2 (Master) atau lebih tinggi

4. Area tugas: Kecamatan ……., Kabupaten ……..……

5. Jumlah desa yang dibina: ……. desa

6. Jumlah kelompok tani binaan: ……... kelompok tani

7. Sudah berapa lama anda bekerja sebagai penyuluh? …….. tahun

Terima kasih sudah menyelesaikan kuisioner ini. Sebagai ucapan terima kasih kami, nama anda akan kami masukkan dalam undian untuk mendapatkan voucher pulsa untuk senilai Rp.100.000 (seratus ribu rupiah) yang akan kami berikan kepada tiga responden.

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Training Syllabus for Interviewers

Prepared by: Zulham Sirajuddin (Principal Investigator – PI)

Overview

This training syllabus is specially prepared to provide information on conducting data collection in a dissertation entitled: The adoption of Cyber-Extension in Indonesia: Impact of extension agents' perception of Cyber Extension's innovation attributes and Information and Communication Technology (ICT) proficiency. Topics include research ethics, research procedures pertaining to the dissertation, introduction to IRB

Objectives

After this training, interviewers will be able to:

1. Explain research ethics
2. Describe the IRB process
3. Describe data collection procedures as approved by the IRB committee

Topics and Sources of Materials

Topic 1: Ethical and Legal Aspects in Research
Subtopic:

- Obligation to research subjects and the profession
- Obtaining informed consent
- Confidentiality of data

Materials:

- Materials taken from Introduction to Research in Education (Book, 8th ed.) written by Donald Ary et al., Chapter 20, sub-chapter "Ethic and legal considerations" on page 590-592
- Materials taken from Educational Research (Book, 5th ed.) written by John Creswell, Chapter 1, sub-chapter "Important ethical issues in conducting research" on page 22-24
- Materials taken from Res Ev 580: Intro to Qualitative Research Methodology (Week 5) about confidentiality of data

Topic 2: The Institutional Review Board (IRB) Process
Subtopic:

- An overview of the Institutional Review Board (IRB)
- Participant information
- Frequently Asked Questions (FAQ) about IRB

Materials:

- Materials taken from https://www.compliance.iastate.edu/committees/irb
- Materials taken from Introduction to Research in Education (Book, 8th ed.) written by Donald Ary et al., Chapter 20, sub-chapter "Protection of human subjects" on page 580-581

Topic 3: Data collection procedures as approved by the IRB
Subtopic:

- An overview of the dissertation chapter 1-3
- An in-depth overview of data collection procedures as approved by the IRB
- FAQ about data collection process, including unanticipated events

Materials:

- Materials taken from the dissertation summary chapter 1 to 3
- Data collection procedures in the IRB approved form

Settings
This training will be conducted in two sessions.

1. Session one will be conducted by reading materials. Interviewers will have to allocate approximately 3-4 hours to read all the materials provided by PI
2. Session two will be conducted through an online discussion between PI and interviewers. Our first priority would be a video call through Skype or Whatsapp. If video call is disrupted, for instance, poor internet connection, online chat via Skype, Whatsapp, of Facebook will be conducted. The discussion will be scheduled after session one has been completed.

The training is critical to your success in data collection process. Please complete all sessions and confirm that you have been completed all sessions.

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MATERI PELATIHAN

TOPIK 1. ETIKA DAN ASPEK LEGAL DALAM PENELITIAN

Penelitian memiliki aspek etika, yakni sejauh mana peneliti tidak melanggar norma-norma selama melakukan pengambilan data seperti wawancara. Misalnya, peneliti wajib memberitahukan apa tujuan dari penelitian terhadap responden. Ketaatan yang ketat terhadap standar etika dalam perencanaan dan pelaksanaan penelitian sangatlah penting. Periset memiliki kewajiban baik terhadap subjek penelitian (respoden) maupun profesi mereka. Misalkan, peneliti harus menyatakan bagaimana caranya surat persetujuan (*informed consent*) oleh responden, kerahasiaan data responden, dan isu etika lainnya akan ditangani.

Kewajiban terhadap Subjek Penelitian (Responden)

Ketika sebuah penelitian melibatkan manusia, peneliti wajib menghormati hak, privasi, maupun hal-hal yang bersifat sensitif berkaitan dengan responden, Setidaknya adasebelas aspek yang mesti diperhatikan, yakni;

1. Responden, dalam studi penelitian berhak informasi tentang kemungkinan risiko yang terjadi atau mereka hadapi atas keterlibatan mereka dalam penelitian. Dalam meminta persetujuan responden melalui informed consent, peneliti wajib memberitahukan responden mengenai tujuan penelitian dengan sejelas mungkin.
2. Responden memiliki hak kerahasiaan, yakni bahwa informasi yang diberikan responden saat wawancara tidak akan diungkapkan kepada siapapun tanpa izin responden. Peneliti wajib melindungi segala informasi mengenai responden.
3. Kejujuran mesti menjadi fondasi hubungan antara peneliti dan responden. Tidak dianjurkan untuk mengelabui responden.
4. Peneliti mesti sensitif dan patuh terhadap aturan pemerintah lokal dimana responden berada. Hal ini mesti dipertimbangkan dalam menyusun rencana penelitian.
5. Responden berhak untuk menarik diri/membatalkan keikutsertaannya kapanpun ia inginkan.
6. Peneliti tidak boleh memanfaatkan posisinya dalam memaksa responden untuk ikut serta. Misalnya jika peneliti merupakan atasan dari responden, peneliti tidak bisa memanfaatkan posisi tersebut untuk memaksa responden untuk terlibat dalam wawancara.
7. Dalam menyusun rencana penelitian, peneliti tidak boleh mengabaikan persoalan budaya lokal, aturan, gender, maupun hal lain yang bisa saja berkaitan dengan reponden.
8. Peneliti mesti meminimalisir penggunaan metode/teknik pengambilan data yang dapat merugikan responden.
9. Peneliti mesti sensitif terhadap dampak penelitiannya terhadap aktifitas disekitar responden. Peneliti tidak boleh mengganggu aktifitas yang sedang terlaksana.
10. Peneliti mesti memberitahukan dengan jelas kepada responden mengenai temuan penelitiannya.
11. Responden memiliki hak anonimius, yakni bahwa informasi pribadi responden tetap terjaga dan tidak dibeberkan kepada siapapun.

Kewajiban terhadap Profesi sebagai Peneliti

Peneliti memiliki tanggung jawab terhadap hasil penelitiannya. Informasi yang diberikan mesti benar-benar asli, jujur dan apa adanya. Peneliti tidak boleh memberikan informasi yang bohong, memanipulasi data, ataupun memanipulasi temuan penelitiannya. Jika misalnya, hasil uji temuan dalam penelitian menunjukkan fakta A, maka peneliti wajib memaparkan A, bukan B. Hal ini sangat ketat diatur bahwa peneliti tidak dibolehkan berbohong. Selain itu, peneliti juga tidak boleh plagiat (menjiplak) hasil karya orang lain dalam penelitiannya. Jika ada kondisi dimana peneliti merasa perlu untuk mencantumkan hasil karya orang lain, peneliti wajib mengutip dengan menyebutkan nama penulis dan karyanya.

Kewajiban Hukum

Perlindungan terhadap responden sebagai subjek penelitian bukan hanya diatur sebagai etika, tapi juga hukum. Peneliti misalnya, tidak boleh melakukan eksperimen yang membahayakan responden, baik fisik maupun mentalnya. Hal ini sangat tegas diatur dalam hukum. Selain itu, memperoleh persetujuan (informed consent) responden sangat penting. Dalam hal ini, peneliti wajib memaparkan apa tujuan penelitian dan bagaimana informasi yang diberikan responden akan berpengaruh terhadap penelitian tersebut.

TOPIK 2. MENGENAL PROSES DALAM INSTITUTIONAL REVIEW BOARD (IRB)

Sekilas mengenai Institutional Review Board (IRB)

Institutional Review Board (disingkat IRB) adalah komite yang dibentuk untuk mengawasi etika penelitian yang dilakukan oleh peneliti. Universitas-universitas di Amerika mewajibkan setiap dosen maupun mahasiswa untuk memperoleh persetujuan dari IRB sebelum melakukan penelitian yang melibatkan manusia sebagai subjeknya (misalnya sebagai responden). Umumnya, peneliti mengisi form aplikasi IRB untuk menjelaskan prosedur-prosedur yang akan dijalankan secara detail dalam penelitiannya, lalu komite IRB akan melakukan rapat untuk membahas mengenai prosedur penelitian tersebut. IRB akan menelaah apakah penelitian yang diajukan tersebut layak untuk disetujui sebagai penelitian yang memperlakukan manusia sebagai subjek sudah sesuai dengan etika penelitian maupun kaidah hukum yang berlaku. Setelah itu, IRB akan mengeluarkan surat persetujuan, dan barulah peneliti dapat melanjutkan penelitiannya. Apabila IRB tidak disetujui, peneliti wajib mengoreksi dan merevisi prosedur penelitiannya lalu mengajukannya kembali kepada komite IRB. Revisi dilakukan hingga IRB menetapkan bahwa prosedur penelitan tersebut telah memenuhi standar.

Informasi Partisipan

Responden harus diberi informasi tentang tujuan penelitian dan apa yang akan mereka lakukan. Mereka juga harus diberi tahu tentang risiko dalam berpartisipasi (jika ada). Responden diberi waktu yang cukup untuk memutuskan apakah mereka ingin berpartisipasi

dan tidak boleh dipaksakan. Selain itu, informasi yang disajikan kepada peserta harus dalam bahasa yang dapat dimengerti oleh mereka.

Kesediaan dan persetujuan responden untuk mengambil bagian dalam penelitian mesti didokumentasikan dalam bentuk tanda tangan responden pada dokumen yang disebut *informed consent* (semacam surat persetujuan), dilengkapi dengan waktu, tanggal dan tempat dimana mereka setuju untuk berpartisipasi dalam penelitian. Semua responden akan menerima salinan dokumen *informed consent* yang mereka tanda tangani.

Apabila *informed consent* itu tidak ada, baik lisan maupun tulisan, maka responden berhak untuk menolak keikutsertaan mereka dalam penelitian. Oleh karena itu, *informed consent* lebih dari sekedar dokumen yang ditandatangani; Ini adalah proses komunikasi yang membantu responden mengetahui tujuan penelitian dan memungkinkan mereka untuk membuat keputusan apakah akan berpartisipasi atau tidak. Dan ini adalah proses berkelanjutan yang dimulai bukan hanya sebelum keikutsertaan mereka sebagai responden, tetapi juga selama diwawancara dan bahkan setelah selesai pengambilan data.

Pertanyaan-pertanyaan yang sering diajukan terkait IRB

Tanya (T): Siapa saja yang wajib mengajukan izin dari IRB?

Jawab (J): Anggota Fakultas (dosen), mahasiswa, dan staf kampus harus mendapatkan persetujuan dari Komite IRB sebelum penelitian yang melibatkan manusia sebagai partisipan/responden dimulai. Contoh spesifik kegiatan yang memerlukan tinjauan IRB adalah survei ataupun wawancara.

T: Bagaimana jika saya bukan dosen, mahasiswa, atau staf kampus dan ingin melakukan penelitian di kampus?

J: Peneliti yang tidak terafiliasi, yang ingin melakukan penelitian yang berlangsung di kampus atau yang melibatkan anggota fakultas, mahasiswa, atau staf, harus menyerahkan salinan permohonan dan surat persetujuan dari IRB institusi mereka.

T: Pelatihan apa yang mesti diikuti oleh peneliti yang dibutuhkan dalam aplikasi IRB sebelum persetujuan dikeluarkan oleh komite IRB?

J: Siapapun yang terdaftar sebagai personil kunci dalam protokol IRB harus mengikuti pelatihan Human Subject Training (HST). Informasi tentang siapa yang mesti mengikuti training dan bagaimana teknis pelatihan yang akan diikuti dapat ditemukan di halaman Pelatihan IRB.

T: Bagaimana jika penelitian saya melibatkan individu yang bukan penutur asli bahasa Inggris?

J: Apabila informed consent didokumentasikan, dokumen persetujuan tertulis harus disertakan dalam terjemahan bahasa yang dapat dimengerti responden, serta juga semua

dokumen yang diperlukan untuk informed consent. Responden yang tidak berbahasa Inggris harus diberi dokumen persetujuan tertulis dalam bahasa yang bisa dimengerti oleh mereka.

TOPIK 3. PROSEDUR PENGAMBILAN DATA SEBAGAIMANA YANG DISETUJUI IRB

Topik 3 pada pelatihan ini akan menggunakan materi yang diambil dari disertasi peneliti. Terlampir adalah ringkasan penelitian/disertasi (lampiran 1) serta prosedur pengambilan data (lampiran 2) yang akan dibaca dengan cermat oleh pewawancara sebagai peserta pelatihan ini.

Selain itu, juga penting untuk mengetahui langkah-langkah apa yang harus diambil apabila ada kasus di lapangan yang tidak diantisipasi. Adapun kasus-kasus yang dimaksud adalah sebagai berikut;

Kasus	Yang harus dilakukan
Ditengah-tengah wawancara, responden meminta untuk membatalkan keikutsertaannya	Pewawancara mesti mengijinkan dan tidak boleh melarang hal tersebut
Ditengah-tengah wawancara, responden meminta untuk menunda wawancara karena sesuatu hal (misalkan ada keperluan mendesak)	Pewawancara menyetujui dan menjadwalkan ulang untuk wawancara lanjutan dengan responden
Setelah wawancara, responden menelepon pewawancara untuk membatalkan keikutsertaannya	Pewawancara mesti mengijinkan dan tidak boleh melarang hal tersebut

Lampiran 1. Ringkasan Penelitian

Judul Penelitian: Adopsi Cyber-Extension di Indonesia: Dampak persepsi penyuluh pertanian terhadap atribut inovasi Cyber-Extension dan kecakapan Teknologi Informasi dan Komunikasi (TIK) (*The adoption of Cyber-Extension in Indonesia: Impact of extension agents' perception of Cyber Extension's innovation attributes and Information and Communication Technology (ICT) proficiency*).

Pendahuluan

Penyuluhan pertanian saat ini merupakan salah satu faktor utama dalam meningkatkan produksi pertanian di Indonesia. Melalui pendekatan alih teknologi, berbagai model dan program telah diterapkan dengan tujuan meningkatkan hasil panen dalam negeri. Penyuluh pertanian memiliki peran yang sangat penting sebagai pendidik, fasilitator, dan motivator, menyampaikan informasi yang berkaitan dengan teknologi pertanian dari Balai Pengkajian Teknologi Pertanian (BPTP) di tingkat provinsi, dan menyebarluaskan paket teknologi yang sesuai dengan kebutuhan spesifik petani setempat. Dalam beberapa tahun terakhir, integrasi Teknologi Informasi dan Komunikasi (TIK) kedalam sistem penyuluhan pertanian di Indonesia telah menjadi tambahan yang berpotensi vital untuk memperkuat sistem penyuluhan. Pada tahun 2013, pemerintah Indonesia meluncurkan program sistem penyuluhan berbasis TIK bernama cyber-extension.

Peralihan dari metode konvensional dalam berbagi informasi pertanian ke penyuluhan berbasis TIK ternyata tidak berlangsung mulus. Studi terbaru menunjukkan bahwa meski cyber-extension telah diterapkan selama tiga tahun, penyuluh yang menunjukkan ketertarikannya untuk menggunakan cyber-extension masih sedikit jumlahnya. Oleh karena itu, perlu untuk menelusuri tantangan dalam mengimplementasikan cyber-extension. Perlu diadakan penelitian yang mencakup evaluasi terhadap adopsi cyber-extension serta bagaimanakesiapan penyuluh dalam menerapkan cyber-extension.

Tujuan dari penelitian ini adalah untuk mengetahui persepsi penyuluh pertanian Indonesia tentang cyber-extension, dan untuk menilai kesiapan penyuluh untuk mengadopsi penyuluhan berbasis ICT. Hal ini akan akan menjadi batu loncatan penting untuk menyebarluaskan penggunaan cyber-extension dan sistem penyuluhan berbasis TIK lainnya di Indonesia. Lebih jauh, hasil penelitian ini akan berkontribusi terhadap kebijakan yang relevan dengan integrasi TIK ke dalam sistem penyuluhan pertanian. Selain itu, penelitian ini akan mendukung pemangku kepentingan terkait dalam merancang strategi untuk memperbaiki sistem penyuluhan berbasis TIK di Indonesia.

Penelitian ini menggunakan teori difusi inovasi yang ditemukan oleh Rogers (1995) dan teori self-efficacy oleh Bandura (1977). Difusi teori inovasi membingkai adopsi cyber-extension sebagai inovasi dalam layanan penyuluhan pertanian di Indonesia. Teori ini akan mengungkap tahap adopsi dengan memanfaatkan lima tahapan proses keputusan inovasi, dan menganalisa hambatan adopsi dengan memperhatikan karakteristik karakteristik adopsi inovasi yang berbeda. Sementara itu, keyakinan self-efficacy akan digunakan untuk menilai

kesiapan agen penyuluhan pertanian untuk mengadopsi dan menanamkan ICT ke dalam pekerjaan mereka.

Metodologi Penelitian

Penelitian ini menggunakan desain penelitian deskriptif. Statistik deskriptif digunakan untuk menggambarkan, mengatur, dan merangkum informasi kuantitatif. Penelitian ini bertujuan untuk mendeskripsikan populasi tanpa melakukan intervensi ataupun manipulasi pada variabel penelitian. Studi ini akan menjelaskan latar belakang dan karakteristik penyuluh, persepsi penyuluh terhadap Cyber-Extension, dan kecakapan TIK yang dibutuhkan untuk menggunakan Cyber-Extension. Populasi penelitian ini adalah 372 penyuluh pertanian yang bekerja di Provinsi Gorontalo di Indonesia. Penelitian ini akan menggunakan model sensus dimana semua populasi akan diminta untuk berpartisipasi dalam sebagai responden dalam penelitian ini.

Peneliti utama telah menyelesaikan pelatihan berbasis Web yakni National Institutes of Health (NIH) tentang "Perlindungan terhadap manusia sebagai peserta penelitian ". Karena keterbatasan anggaran perjalanan dalam penelitian ini, empat orang pewawancara akan direkrut untuk melakukan pengumpulan data. Pewawancara adalah mereka yang sudah mendapatkan gelar sarjana. Pewawancara setidaknya telah mengambil kelas mengenai metode penelitian, dan telah menyelesaikan skripsnya. Selanjutnya, pelatihan dasar mengenai pengumpulan data akan dilakukan untuk pewawancara dalam bentuk bacaan dan diskusi online dengan penyidik utama.

Daftar yang berisi nama-nama penyuluh pertanian beserta informasi kontak mereka akan diambil dari situs https://bakorluh.gorontaloprov.go.id/simbangluh, sebuah situs web yang dimiliki dan dikelola oleh Badan Koordinasi Penyuluhan (Bakorluh), biro yang bekerja di bawah Kementerian Pertanian di tingkat provinsi (Provinsi Gorontalo). Pewawancara dapat menghubungi calon peserta melalui telepon, ataupun secara informal mengunjungi kantor mereka. Kuisioner akan didistribusikan oleh pewawancara. Terlampir adalah surat yang meminta partisipasi, surat pengantar yang menjelaskan rincian penelitian, salinan *informed consent*, dan kuisioner. Seluruh materi intuk keperluan interview akan diterjemahkan kedalam Bahasa Indonesia sebelum pengumpulan data. Terjemahan akan dilakukan oleh peneliti utama. Peneliti utama adalah orang asli Indonesia yang mampu dan kapabel menerjemahkan bahasa Inggris ke Bahasa Indonesia. Dalam penerjemahan, beberapa hal yang akan diperhatikan adalah penggunaan kata-kata yang dapat dimengerti oleh responden, format penulisan yang sesuai (jarak, huruf, jenis huruf dan ukuran), penguraian istilah, meminimalisir penggunaan istilah yang rumit, dan memilih kalimat dan paragraf pendek yang mudah dipahami. Hal ini akan memudahkan responden dalam memahami isi pertanyaan maupun pernyataan dalam kuisioner.

Rincian penelitian ini akan dilampirkan bersama kuesioner. Wawancara akan dimulai hanya jika peserta telah menyatakan kesediaan mereka dan menandatangani form *informed consent* untuk menegaskan kesediannya. Kuesioner terdiri dari beberapa bagian yang masing-masing bagian terdapat pertanyaan maupun pernyataan tertutup. Wawancara akan berlangsung sekitar 15 sampai 20 menit. Wawancara akan diadakan di tempat yang dipilih sendiri oleh

peserta dimana peserta akan memilih tempat dimana dia merasa nyaman untuk diwawancarai. Setelah wawancara, untuk menjaga kerahasiaan data, pewawancara akan menyimpan dokumen yang berkaitan dengan hasil wawancara di tempat yang aman dimana hanya pewawancara yang dapat mengaksesnya. Setelah selesai wawancara, pewawancara akan menginput data ke file Microsoft Excel dan mengirimkannya ke penyidik utama. Untuk menjaga kerahasiaan data, semua data akan disimpan dalam folder di aplikasi *cybox* yang hanya dapat diakses oleh penyidik utama. Semua file hardcopy yang tersisa akan dihancurkan oleh pewawancara.

Program Statistic Package for Social Sciences versi 23 (SPSS ver.23) akan digunakan untuk analisa statistik dalam penelitian ini. Statistik deskriptif seperti frekuensi, persentase, dan nilai rata-rata akan digunakan untuk menampilkan data deskriptif. Selain itu, tabel dan grafik akan digunakan untuk menyajikan hasilnya. Beberapa uji statistik akan diterapkan untuk menjawab pertanyaan penelitian. Misalnya, uji-t sampel independen digunakan untuk mengukur perbedaan antara dua kelompok yang tidak berkorelasi contohnya adalah beda persepsi antar gender. Contoh lain, uji statistik ANOVA akan digunakan untuk menganalisis perbedaan antara beberapa kelompok, misalnya jenis pekerjaan. Tes korelasi akan digunakan untuk mengukur korelasi antar variabel. Regresi logit dilakukan untuk prediksi adopsi Cyber-Extension. Adapun tingkat signifikansi akan diukur pada angka 0,05.

Lampiran 2. Prosedur Penelitian/Pengambilan data (Data Collection)

Adapun langkah-langkah pengambilan data adalah sebagai berikut:

1. Nama-nama calon partisipan (responden) yakni para penyuluh pertanian akan diambil dari website resmi Bakorluh yaitu https://bakorluh.gorontaloprov.go.id/simbangluh. Nama-nama tersebut akan divalidasi melalui kantor penyuluhan di tingkat Kabupaten Gorontalo yakni Badan Pelaksana Penyuluhan (BPP) Kabupaten Gorontalo.
2. Pewawancara menghubungi responden baik melalui telepon/sms maupun dengan berkunjung langsung untuk menemui responden untuk menjadwalkan wawancara. Pewawancara akan memperkenalkan diri kepada calon responden, meminta kesediaan wawancara, dan memberitahukan bahwa jika responden bersedia, namanya akan diikutkan dalam undian voucher pulsa sebesar Rp.100.000 untuk tiga orang.
3. Setelah ada kepastian jadwal, pewawancara akan mengunjungi responden. Responden diminta untuk menetukan sendiri lokasi wawancara yang ia anggap nyaman.
4. Pewawancara membawa berkas-berkas sebagai berikut: (1) Surat perkenalan/pengantar yang berisi detail ringkas penelitian, (2) surat izin penelitian dari Kesbangpol Provinsi Gorontalo, (3) informed consent, dan (4) kuisioner.
5. Sebelum memulai wawancara/pengisian kuisioner, pewawancara akan menanyakan kesediaan calon responden. Apabila bersedia, responden akan menandatangani informed consent.
6. Wawancara dilakukan sesuai dengan kenyamanan. Responden bisa mengisi langsung kuisioner, ataupun pewawancara membacakan isi kuisioner dan membantu mengisikan jawaban.
7. Jika ada pertanyaan yang membingungkan, pewawancara akan memberi penjelasan hingga dapat dimengerti oleh responden.
8. Setelah selesai wawancara, pewawancara melakukan finalisasi dengan memeriksa kembali kuisioner (crosscheck) untuk memastikan bahwa semua jawaban telah terisi dan tidak ada yang terlewatkan.
9. Setelah itu, pewawancara mengucapkan terima kasih kepada responden, lalu memberitahukan bahwa undian voucher akan diumumkan setelah seluruh proses pengambilan data selesai.

Lampiran 3. Surat Pernyataan Konfirmasi telah mengikuti Pelatihan

Dengan hormat,

Saya yang bertanda tangan dibawah ini:

Nama : …….
Posisi : Interviewer
No. KTP : …….

Menyatakan/mengkonfirmasikan bahwa saya TELAH mengikuti seluruh sesi pelatihan.

Demikian surat konfirmasi ini saya buat dengan sebenar-benarnya.

Gorontalo, …… 2018

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