THE DEVELOPMENT OF AWARENESS ON GREEN ICT THROUGH THE IMPLICATIONS OF SELF-DIRECTED LEARNING

Kultida Malison

A Dissertation Submitted in Partial
Fulfillment of the Requirements for the Degree of
Doctor of Philosophy (Computer Science and Information Systems)
School of Applied Statistics
National Institute of Development Administration
2020

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ABSTRACT

Title of Dissertation	THE DEVELOPMENT OF AWARENESS ON GREEN ICTTHROUGH THE IMPLICATIONS OFSELF-DIRECTED LEARNING
Author	Kultida Malison
Degree	Doctor of Philosophy (Computer Science and Information Systems)
Year	2020

This mix-method study aims at investigating dimensions of awareness on Green ICT and self-directed learning among employees working in the listed companies in The Securities Exchange of Thailand (SET). The influences of self-directed learning on awareness of Green ICT were also examined. The dimensions of awareness on Green ICT were collected through 37-item Green ICT questionnaire, and the results revealed that there were primarily three dimensions of awareness on Green ICT among Thai employees: 1) Saving energy and Avoiding using wasteful paper; 2) Using reusable and recyclable equipment and Upgrading devices; 3) Using saving energy function. For achieving the purposes of this study, dimensions of self-directed learning were collected via 52-item self-directed learning questionnaires, and the results showed that five dimensions including 1) Learning with intention; 2) Open-mindedness; 3) Characteristics of self-discipline; 4) Characteristics of self-management; and 5) Desire to learn were classified. The influence of self-directed learning on awareness of Green ICT revealed that among three dimensions of awareness on Green ICT, Dimension 1 (Saving energy and Avoiding using wasteful paper) and Dimension 3 (Using saving energy function) were affected by four out of five dimensions of self-directed learning. This study has the implications for organizations since the guideline for improving awareness of Green ICT was provided.

ACKNOWLEDGEMENTS

My work would not have been completed without the most important help from my advisor, Associate Professor Dr. Nithinant Thamakornnonta. She has shaped my ideas about dissertation topic and always assist during data collection, interview, and thesis writing process. Next, I am grateful to Associate Professor Dr. Waraporn Jirachiefpattana, who is not only Ph.D. committee, but also my supporter and encourager throughout my study. I am also thankful to Associate Professor Dr. Ohm Sornil for his guidance and counsel. Furthermore, I very appreciate for the kindness of Associate Professor Dr. Yaowadee Temtanapat who devotes her time to give valuable suggestions for my study.

I would like to take this opportunity to thank all officers at Graduate School of Applied Statistics, National Institute of Development Administration (NIDA) for their supports and encouragements they gave for me. I am always received moral support from them.

I am also grateful to Rajamangala University of Technology Tawan-Ok for granting me the permission to study Ph.D. Moreover, I am also indebted to all participants who devote themselves to complete questionnaire, attend the interview, and improve guidelines. Without their sacrifice, my work does not become visible.

Importantly, I would like to express my deep appreciation to my mother, my aunt, my family and my friends for their love and support everything I have done.

Kultida Malison

March 2021

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CHAPTER 1

INTRODUCTION

Nature holds the key to our aesthetic, intellectual,
cognitive and even spiritual satisfaction.

Wilson (n.d.)

From quote above, it is undeniable that nature or environment has worth for humankinds. Nature or environment is important for people since it gives beautiful view, helps to relax and protects people from any natural disasters. Therefore, we, as people living in the world, should take part to preserve nature or environment sustainable. There are several thoughts when it comes to find out how to save our environment. According to the strategic plan for Thailand's Ministry of Natural Resources and Environment (2016- 2021), the environmental problem is an urgent issue and an ongoing problem to solve in Thailand. The government attempts to find the way to achieve environmental sustainability or improve long-term environmental quality. However, the situation of disruptive technology which innovation significantly alters the way that consumers, industries, or businesses operate causes the use of Information and Communication Technology (ICT) in Thailand continuously increased. As mentioned by Berkhout and Hertin (2001), a major cause of environmental problem is human behavior, especially when using information and communication technology (ICT). ICT has profound environmental impacts, both positive and negative. In positive way, ICT can help environment by reducing of gas emission and carbon footprint. For instance, teleconferencing and online learning technologies can reduce travel needs, leading to reduce carbon emissions for the environment. Because of ICT, information can be stored and retrieved through the digital medium instead of paper, and it can lead us to the term paperless environment. On the other hand, ICT can affect negatively on environment such as the use of

energy in producing and running ICT equipment. The process of ICT equipment producing is associated with production of Carbon Dioxide. If Carbon Dioxide increases, it will continue to be accompanied by changing warming climate. In the same way, ICT has introduced the convergence of e-services with broadband network infrastructure, wireless technologies and mobile devices. The revolution of ICT has also resulted in the increase of carbon footprint (Andreopoulou, 2016). Thailand now also faces with environmental problems caused by ICT as we have seen from the case of rapid development cycle of ICT equipment that is computers, laptops, tablets, projectors, visualizers, and so on. This means that if ICT equipment is developed, the old ones will become obsolete. People who do not want to use the old ones, they will possess the improved equipment suddenly although it is not necessary for them. Because of this, the waste of old ICT equipment or electronic waste effect environment if there is not a good disposal. The effects of ICT towards environment is also supported by the study of (Buchalcevova, 2015) who mentioned that the environment is affected by ICT in two different perspectives. First, ICT itself causes environmental problems at each state of their lifecycle from manufacturing to usage and disposal. The other perspective is that ICT can be used as a tool to address the environmental problems in other areas, for example carbon footprint calculation, deployment of computerized models for increasing energy efficiency and reduction of greenhouse gas emissions (Buchalcevova, 2015). This implies that ICT can be used for supporting environmental protection activities, while using ICT themselves damage environment significantly. Most people use ICT as 'ICT for green', but very few people concern about 'Green ICT'. Then, ICT should be considered to be one of important ways to solve environmental problems since ICT was viewed as a cause of the problems, and it is also one of the best tools to reduce the effects from those problems (Lagos & Nwosu, 2013). Therefore, if we would like to reduce the level of deterioration of environments, people should concern about how to use ICT in appropriate ways in order to make environment sustainable.

The importance of ICT should be emphasized as it has proven to be one of the most effective ways of solving environmental problems (Babalola, Babalola, Okhale, 2010). The researcher hereby initially conducted Green Information and Communication Technology (Green ICT) research in Thailand. In order to support the

implementation of ICT for reducing environmental problems, this study attempts to find out the way to raise the awareness of green ICT among employees who play important role in business industries.

1.1 Problem Statement

Information and Communication Technology or ICT is clearly useful for utilizing human's daily activities. Yet, it cannot be denied that ICT is one of main factor causing many environmental problems (Andreopoulou, 2016). In Thailand, for example, Fujixerox (2017) and Sermsuk (2017) are big companies who concern with this environmental issue. For instance, they trained their employees about consciousness of using ICT together with awareness of environmental problems (Fujixerox, 2017; Sermsuk, 2017). Canon also provided an environment protection receiving used ink cartridges back from customers (Canon, n.d.). However, many policies and campaigns may not be practical completely if there is no collaboration from people. In other words, the policies and campaigns might not be successful, if employees or people using technology are not aware of the effects of ICT on environments. To improve environmental problem, this study is conducted to explore the dimensions and the status of awareness on Green ICT among employees. Since the awareness of adults can be increased by encouraging them to acquire knowledge (Masiuliene, Looney, Aertgeerts, & de Greef, 2015), this study also focuses on the dimensions of self-directed learning. Self-directed learning is also an essential personal characteristic of an employee to improve individual performance which leads to organizational goal achieving (Long & Morris, 1996). In addition, this study investigates the influence of self-directed learning on awareness of Green ICT in order to suggest learning environment to increase awareness for employees. In order to provide concrete ways of increasing awareness on Green ICT, this study also provides guideline which can be used to encourage people to realize how to use ICT to reach the company's targets for maintaining sustainable environment.

1.2 Purpose Statements

The purposes of this study are to:

1) Explore the dimensions of awareness on Green ICT among employees.

2) Explore the dimensions of self-directed learning among employees

3) Investigate the influence of self-directed learning on awareness of Green ICT

4) Propose guidelines in order to increase awareness on Green ICT which are appropriate for employees and organizations.

1.3 Research Questions

To encounter the purposes of this research, four research questions that need to find out the answers are as follows:

Research question 1: What are the dimensions of awareness on Green ICT among employees?

Research question 2: What are the dimensions of self-directed learning among employees?

Research question 3: Does self-directed learning have a significant influence on awareness of Green ICT among employees?

Research question 4: What is appropriate guideline to increase awareness on green ICT for employees?

These four research questions possibly gave the clues or the suggestions how we can educate or promote employees to have more awareness on environment and know how to use ICT appropriately. The hypotheses were shown in section 1.4. The hypotheses of this study were based on assumption of research question 3 which attempted to find out whether self-directed learning has influence on awareness of Green ICT or not.

1.4 Hypotheses

The Hypotheses of this study are:

Ha1: There is a significant influence of self-directed learning on awareness of Green ICT.

$H_0$1: There is no significant influence of self-directed learning on awareness of Green ICT.

1.5 Significance of the Study

Phase 1*:* Exploring the dimensions of awareness on Green ICT among employees.

The results of this phase showed the different dimension of awareness on Green ICT among employees. The results were analyzed by Principal Component Analysis *(*PCA*)* which is generally an exploratory or descriptive method that requires many subjective judgments by the user. It is a useful method to factorize observed variables.

Phase 2*:* Exploring the dimensions of self-directed learning among employees.

The results of this phase showed the way of self-directed learning among employees. The results were analyzed by Principal Component Analysis *(*PCA*)* which is a useful method to reduce dimensions of self-directed learning in a smaller unit. The results of this phase also showed how well people learn by themselves. Self-directed learning is essential for people. For instance, undergraduate students need to develop skills in self-directed learning for being successful in their university learning (Field, Duffy, & Huggins, 2015; Morrison & Premkumar, 2014). There is convincing evidence that people who take the initiative in self-directedness learn more things and learn better than people who passively wait to be taught *(*Ramnarayan & Hande, 2005*)*. This means that self-directed learning enhances self-improvement of people.

Phase 3*:* Investigating the influence of self-directed learning on awareness of Green ICT.

Finding the influencing of self-directed learning on awareness of Green ICT would be helpful for conducting Phase 4. This means that if the dimensions of self-

directed learning have a significant influence on the dimensions of awareness on Green ICT, employees may be stimulated in order to increase their awareness via process of self-directed learning.

Phase 4*:* Proposing guidelines in order to increase awareness of Green ICT which are appropriate for Thai employees.

One of the tasks for adult education is to make adults aware of historical background of their individual existence and environment (Brookfield, 1985). Therefore, an important part of this study is to propose some useful guidelines and activities that make Thai employees become more aware of Green ICT and help environment sustainable. The guideline was built from the combination of the literature review, the results of awareness on Green ICT, the results self-directed learning, the relations of these two variables, and the perspectives of organizations from interview.

1.6 Definition of Key Terms

1.6.1 Awareness

Awareness can be defined as the state or ability to perceive, to feel, or to be conscious of events, objects, or sensory patterns (Gafoor, 2012). Awareness is the quality or state of being aware, that is knowledge and understanding that something is happening or exists (Merriam-Webster dictionary). Awareness refers to a consciousness of internal or external events or experiences. For this study, awareness is specifically defined as a state of being knowledgeable about Green ICT and being aware of "Green of ICT" and "Green by ICT" (which are defined in 1.6.2).

1.6.2 Green ICT

Generally speaking, Green ICT was defined as the prevention of pollution at the end of a product's use together with product maintenance to minimize the environmental problem during use (United Nations Environment Programme, 2018). In addition, it refers to utilization of technologies to reduce the pollution and development of environmentally friendly competencies (Hart, 1997, as cited in Anthony & Mazlina, 2016). Green ICT is about considering all impacts of ICT on the

environment and reducing the impact of ICT on the environment. Green ICT is divided into two dimensions: “Green of ICT and Green by ICT” (Buchalcevova, 2015). For this study, Green ICT is the combination of Green of ICT and Green by ICT. Green of ICT is defined as the way of reducing direct impacts of ICT caused by manufacturing, usage and disposal on the environment while Green by ICT refers to the way of using ICT as an instrument to reduce the impacts of other sections on the environment.

1.6.3 Self-directed Learning

Self-directed learning (SDL) is “the art and science of helping adults to learn” (Knowles, 1980, p. 43, as cited in Merriam, 2001). SDL can be viewed as a part of adult education. The self-directed learning for this case means a skill that engaged by individuals (Carson, 2012). In addition, SDL is a characteristic of personality which makes individual high in self-efficacy and intrinsically motivated. Self-directed learners can also check their learning needs, set individual goals, choose appropriate method to achieve those goals, evaluate themselves, and are not afraid of facing new challenges. Self-directed learning for this study referred to the way of employees to learn by themselves. It is believed that self-directed leaning affect awareness on Green ICT.

This chapter introduced background, rationale and details which is related to the study. The following chapters describe Green ICT management (Chapter 2), Self-directed learning (Chapter 3), The Influence of Self-directed learning on awareness of Green ICT (Chapter4), Guideline to increase the awareness on green ICT (Chapter 5), and Conclusion, Implications, Limitations, and Recommendations for this study (Chapter 6).

CHAPTER 2

GREEN ICT MANAGEMENT

This chapter provided the details of Green ICT management including the rationale, review of literature about Green ICT, research methodology for this chapter, the results of dimensions of awareness on Green ICT among employees, and discussion of the study.

2.1 Rationale of Green ICT Study and Expected Results

Information and communication technology (ICT) is clearly useful for utilizing human's daily activities and increasingly important for our society (Arushanyan, 2016). When the topics of society problems are being discussed, rather high expectations of making society sustainable are being placed on ICT in relation to sustainable development. Some studies claim that ICT could play a crucial role in supporting various sustainability strategies and may enable transition to a less waste (Carrera-Rivera & Kurnia, 2015; Souter, Maclean, Akoh, Creech, 2010; Twinomurinzi, 2012). Therefore, Green ICT become a key idea which can reduce the problems caused by ICT or other factors. In addition, the concept of Green ICT may be concerned about using ICT devices to reduce environmental problems. In order to develop Green ICT awareness for employees, dimensions of Green ICT awareness were investigated and needed to study.

The results of this section which attempted to investigate dimensions of Green ICT awareness were expected to reveal the dimensions or styles of awareness on Green ICT among employees such as reducing paper, recycling, and saving energy because these dimensions seemed to be activities which employees were familiar with and there were campaigns about these activities in their organizations. Importantly, the results of this section were expected to be valuable data for designing Green ICT policy in Thailand.

2.2 Review of the Literature

2.2.1 Concepts of Green ICT

Information and communication technology (ICT) is pervasive all sectors in the economy and everywhere in the world (Wabwoba, Wanyembi, & Mutua, 2013). ICT normally refers to a wide range of computerized technologies. It includes products and services for communication and the electronic capturing, processing and transmission of information (Ashrafi & Murtaza, 2008). ICT has evolved into an inherent part of current society and led to enhance living conditions and provided opportunities around the world (Buchalcevova, 2015). Considering ICT utilization, the concept of Green ICT was created in order to support behaviors when bringing ICT to use (Din, Harron, & Ahmad, 2013).

Green ICT refers to pollution prevention at the end of a product's use together with product maintenance to minimize the environmental crisis during use (United Nations Environment Programme, 2018). In addition, it also refers to utilization of technologies to reduce the pollution and development of environmentally friendly competencies (Hart, 1997, as cited in Anthony & Mazlina, 2016). For most people, Green ICT is possibly about reducing the impacts of ICT on the environment. By definition, Green ICT is the study and practices of how to use computing technologies in an efficient, effective and economic way (OECD, 2009). From the perspective of an organization, Green ICT is a combination of activities that minimize the negative impact of ICT on the environment and optimize the positive impact of ICT (Hankel, Heimerike, & Lago, 2017). This means Green ICT is about considering all impacts of ICT on the environment, direct or indirect, positive or negative. For eco-sustainability perspectives, Green ICT is viewed as the systematic application of environmental considerations such as pollution prevention and use of clean technology (Molla, 2009, as cited in Patel, 2017). This can be implied that Green ICT has an aspect of innovation in managing ICT related to the environment (Suryawanshi & Narkhede, 2015). The examples of Green ICT activities are the disposal of electronic waste, regulatory compliance, and telecommuting. Telecommuting is helpful for workers because they are not necessary to commute or travel. It is the way to make them easily communicate or work while reduce pollution which released during travelling.

Currently, the concern of Green ICT has become a priority, especially for the government in many countries which needs to achieve considerable reductions of carbon dioxide or CO_2 which releasing into the atmosphere, which called carbon emissions (Widjaja, Mariani, & Imam, 2011). In other words, Green ICT has many benefits which include reduce the usage of hardware, less carbon emission, and reduce resource consumption (Din et al., 2013). Green ICT is continuously interesting to people and organizations all over the world. Recent changes in the environment, economy and technology importantly drive an adoption of Green ICT practices across the world. From the perspective of Buchalcevova (2015), Green ICT is divided into two groups: "Green of ICT and Green by ICT". Green of ICT is defined as "practices that aim to reduce direct impacts of ICTs on the environment, that is the impacts caused by manufacturing, usage and disposal of ICTs". And Green by ICT refers to "practices where ICT serves as an instrument to mitigate the impacts of other sectors on the environment". Similar to Buchalcevova (2015), Chaudhri (2011, as cited in Patel, 2017) stated that Green ICT can reduce environmental impact in two ways: direct and indirect. The direct way is about improving materials technologies in the manufacturing of ICT components, making ICT equipment and infrastructure more efficient to reduce direct impact on the environment, while the indirect way is about developing more efficient information systems and technology solutions to support business initiatives to reduce indirect and negative impacts on environment.

2.2.2 The Role of Green ICT on Environmental Problem

There are several ways suggested that Green ICT helps to improve environmental problem. While technological advances have resulted development of a lot of electronic products for continuously increasing number of customers, the customer tastes and features of these products change rapidly. Then, the life cycles have come down tremendously. Therefore, a large volume of electronic wastes (e-wastes) is now emanated every year (Shumon & Ahmed, 2013). Therefore, e-wastes are becoming environmental hazards and affecting the ecological imbalance, and these wastes are remaining still economically valuable. For instance, reuse and recycle of waste electrical and electronic equipment is currently a global concern. In recent years, there has been a growing concern about waste electrical and electronic

equipment (WEEE). Waste electrical and electronic equipment (WEEE) is a designation for hardware and other electrical appliances covered by European Community law. This legislation helps to maintain better control systems for the disposal and reuse of electrical or electronic appliances, parts or systems, which can have a severe effect on the environment if they are disposed of improperly (Kuehr, 2012). E-waste management is reflected in many academic case studies that explain how management is or could be in different countries, such as the United States, China, Japan, Switzerland, or Spain (Araceli & Dios, 2015). One of the possibilities for managing electrical and electronic equipment at the end of their lifecycle is reuse. The European WEEE Directive 2002/96/EC presented a hierarchy of actions for the management of WEEE that reuse should assume priority over recycling. There is still debate about the benefits of reuse. Some authors argue that even intensive product reuse of electrical and electronic equipment reduces total resource consumption of a highly developed industrial economy by less than 1% (Walther, Steinborn, Spengler, Luger, & Herrmann, 2010, as cited in Araceli & Dios, 2015). Some authors argue that recycling is not always profitable (Geyer & Blass, 2010). But for many others, reuse may involve several environmental and socioeconomic benefits (Papaoikonomou, Kipouros, Kungolos, Somakos, & Aravossis, 2009, as cited in Araceli & Dios, 2015) such as extending the useful life of equipment, protecting the environment, or facilitating access of the unemployed to jobs, and also facilitating the acquisition of equipment by people with few resources. In terms of recycling, Ramayah and Rahbar (2013) who studied the recycling behavior of university students suggested that recycling is influenced by awareness and perceived value. For understanding the reuse and recycling behavior, the link between knowledge (eco-literacy) and attitudes may need to be concerned. Eco-literacy is defined as the ability of understanding the natural systems that make life on earth possible. Studies of prior scholars have illustrated that the environment quality depends essentially on the level of peoples' knowledge, attitude, values and their practices. For example, in some empirical studies (Ajzen, 1991; Ramayah & Rahbar, 2013) confirmed that the eco-literacy has strong correlations with attitudes towards purchasing the environmentally friendly products. Babaei, Alavi, Goudarzi, Tymouri, Ahmadi Angali, and Rafiec (2015) conducted a survey among the Abadan residents seeking to evaluate their knowledge

linked to solid waste reduction, source separation and recycling of solid waste. The findings of study confirmed that awareness is an important factor driving intention on waste separation and recycling.

In addition to reusing and recycling, saving energy at work might be a considered topic. The employees who try to reduce their energy use might depend on a number of motivations including if they see it as a key aim of their job (Rioux & Penner, 2001) or if they are motivated by behavior among their colleagues (Nisiforou, Poullis, & Charalambides, 2012; Schelly, Cross, Franzen, Hall, & Reeve, 2011). Existing research on environmental behavior in the workplace shows that employees can be encouraged to adopt energy saving behaviors (Lo, Peters, Kok, 2012). In general, employees intended to turn off their computers when they left their desk for one hour or more, and particularly if they think switching things off is a good thing (notably for the environment), and if the social norms of the workplace fit this behavior. Goal setting has also proven an effective intervention (McCalley & Midden, 2002), as well as the use of rewards, (Handgraaf, van Lidth, de Jeude, & Appett, 2011), individual feedback (Murtagh, Natti, Headley, Getersleben, Gluhak, Imran, Uzzell, 2013), group discussions (Werner, Cook, Colby, Lim, 2012) and group feedback and peer education (Carrico & Riemer, 2011).

In addition, using saving energy function is interesting topic for promoting Green ICT (Mattern, Staake, & Weiss, 2010). For example, the selection of computers with energy star-labeled office equipment is widely available. It can provide dramatic energy savings. In addition, sleep mode and power management features are one of saving energy functions which easy to use. Many computers contain a sleep mode or power management feature.

However, there might be some barriers for making sustainable e-waste management. For instance, recycling, reuse, and remanufacturing technological devices may obtain inappropriate value (Shumon & Ahmed, 2013). The people tended to think that those devices were disabled to use, and they preferred a new one instead. Therefore, it was suggested by Shumon and Ahmed (2013) that the harmful effects from e-waste processing can be minimized by using latest technology.

2.2.3 Awareness on Green ICT

Awareness in general means the state or ability to perceive, to feel, or to be conscious of events, objects, or sensory patterns (Gafoor, 2012). Awareness is the quality or state of being aware, that is knowledge and understanding that something is happening or exists (Merriam-Webster dictionary). When people become aware, it means they know, realize, interested in knowing about something, or know what is important. The previous studies of awareness on Green ICT were scarcely found in Thailand, yet it was found in some countries. For instance, Din et al. (2013) saw the importance of increasing awareness of Malaysian citizen for taking care the environment, so they conducted the study of awareness on Green ICT concept among Malaysian adult learners. The results showed that the level of awareness on Green ICT among adult learners was at the average level. In addition, it was showed that the highest-rated item was "Switch off the computer after use", followed by "Aware that the reduction of paper will save trees" and "The use of ICT to minimize travelling" which received mean score of 4.20, 4.14, and 3.97 respectively. The lowest-rated item was "My PC having energy saving feature" which receive mean score of 2.95. This means that Malaysian learners were aware the most on switching off the computer after use and paper reduction. On the other hand, they were aware the least on using saving energy function. In addition to Din et al., (2013)'s study, the importance of awareness Green ICT was currently seen in the study of Patel (2017). This study proposed that Green ICT is an important strategic technology which has various benefits, so the researcher aimed to 1) determined the awareness and attitude carried out by the IT or Computer engineering students towards the Green ICT; 2) examined the acceptance of younger people concerning Green ICT practices and 3) identify the reasons, barriers and attitudes towards IT. Patel (2017) proposed that ICT affect environment and the way to take care environment was investigating level of awareness on Green ICT among IT/Computer engineering students. The results showed that the most of students (70%) were aware on Green ICT, while the rest of them (30%) were not aware on Green ICT. The students had awareness on Green ICT in to five ways: 1) Switch off PC when not in use; 2) Reduce energy consumption by powering down of ICT devices; 3) Use of e-books and e-learning tools; 4) Improve telecommuting capabilities to reduce travelling or CO_2 emissions; and 5) Use of

recycled paper and reduce paper consumption. In addition, the students revealed that they considered energy star logo when they purchased a new electronic device. The students also indicated that lack of knowledge, ignorance to use, lack of motivation, and lack of government strict policies are the reasons for not adopting Green ICT.

The awareness of Green ICT was still continuously conducted among various countries and the results showed different aspects. Since the results of awareness on Green ICT in Thailand seemed to be rarely found, this study attempts to investigate dimensions of Green ICT and then applies the results to increase awareness on Green ICT.

2.3 Research Methodology and Sampling

The data of this section were collected quantitatively by questionnaires. The details of questionnaires, population and samples, and the process of data collection were described in 2.3.1, 2.3.2, and 2.3.3 respectively.

2.3.1 Instrumentation (Questionnaire)

The questionnaires of this part included items asking about the awareness on Green ICT among employees which the researcher adapted framework of Din et al. (2013) from their study "The Level of Awareness on the Green ICT Concept and Self-Directed Learning among Malaysian Facebook Users". The questionnaire from Din, Haron, and Ahmad (2013) was adapted since it is suitable in this context because of two reasons: 1) the population of Din et al., (2013)'s study were adults which their ages likely to be in the same generation of the population of this study and 2) Din et al. (2013) were interested in the relationship between self-directed learning and Green ICT which rather match with the purposes of this study. The original questionnaire includes question items to explore the awareness of both Green of ICT and Green by ICT, while some question items which related to investigating basic knowledge or concept of Green ICT such as "Read Green ICT Concept" seemed not to be appropriate for this study because this study did not focus on concept knowledge of Green ICT among population. Therefore, these unrelated items were deleted. All question items were translated into Thai language by an expert to ensure that English

and Thai language in the questionnaire were equal. The resume of translator was available in Appendix A.

Before collecting data, these survey questions were tested validity and reliability. In terms of validity, the items were sent to five experts in the field of information system, information technology, and language in order to evaluate content and face validity by using Item-Objective Congruency Index (IOC) (Rovinelli & Hambleton, 1977, as cited in Turner & Carlson, 2003). IOC is a procedure used in test development for evaluating content validity at the item development stage. The items which gained more than 0.6 score of IOC values were accepted, while any items gaining less than 0.6 score were revised. The items which received IOC value of 0 were deleted. For Green ICT questionnaire, it was found that all 37 items were evaluated higher than 0.6 Therefore, 37 items were appropriate to employ in the study. The results of IOC were available in Appendix B.

In order to test reliability, the questionnaire was piloted in order to find the reliability using Cronbach's alpha. In piloting process, the questionnaire was sent to 30 employees who were selected by the invitation from the researcher's colleagues. The employees were all working in SET companies and the researcher was comfortably to send the questionnaire. The employees in piloting process were excluded in the study. After receiving responses, the data were measured in order to assess the reliability by using Cronbach's alpha. The questionnaire should have reliability of .70 or better (Nunnally, 1978). The Cronbach's alpha value of this questionnaire was 0.934 which was accepted to use (see Appendix C). The final version of questionnaire was available in Appendix D.

2.3.2 Population and Samples

The target population of this study were the employees working in 574 listed companies in The Securities Exchange of Thailand (SET). SET strongly achieves for sustainable economic growth and social well-being. By focusing on both sustainable economic development and on all stakeholders' sustainability, SET attempts to provide more opportunities and knowledge for investors, partners, alliances, or communities and whole society. Importantly, in order to develop business growth, SET has continued to develop expertise and skills among capital market professionals

(SET, 2015). Since companies in SET play important role in economic growth of Thailand, the investigation among employees working in those companies may give interesting results, and the results from them can show the wide picture of awareness on Green ICT. In addition, companies in SET were large and high-performing companies which were assumed to launch campaign about Green ICT for their employees. Therefore, the employees may gain some knowledge about Green ICT and understand what the questionnaires were about. This may help to reduce misunderstanding during study process.

As we have seen form Table 2.1, there were eight industry groups of SET. The number of companies are totally 574 companies.

Table 2.1 Total Numbers of Listed Companies in Set Divided by Industry Group

No.	**SET Industry Group**	**Total**
1	Agro and Food Industry	50
2	Resources	43
3	Technology	40
4	Financials	58
5	Services	102
6	Consumer Products	40
7	Property and Construction	154
8	Industrials	87
	Total	**547**

For collecting data from questionnaire, this study applied multi-stage sampling method to select respondents from 574 listed companies of SET. The multi-stage sampling techniques were employed to find out good representatives. There were two stages of methods: stratified sampling and quota sampling. (see Figure 2.1).

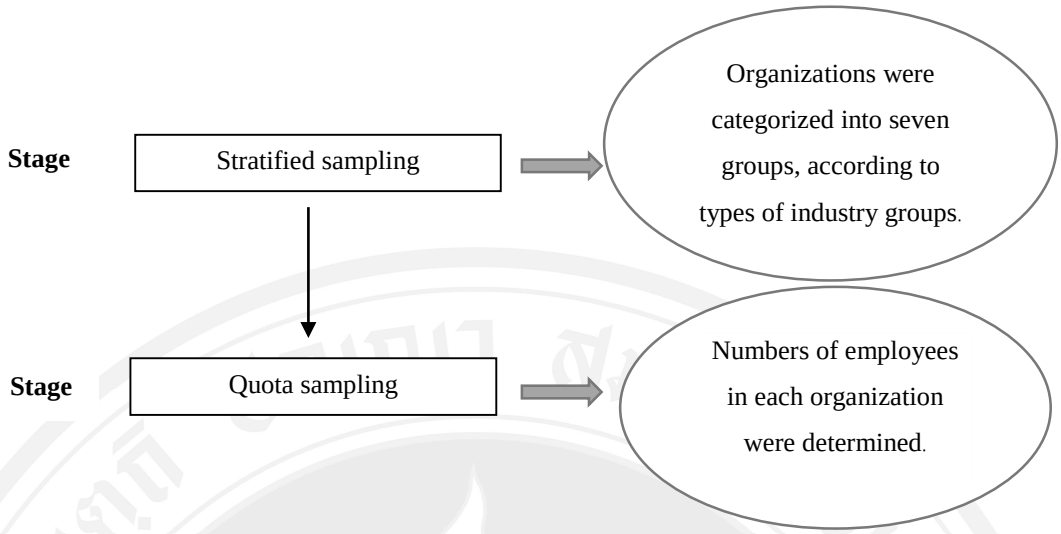

Figure 2.1 Multi-stage Sampling Method Employed in this Study

In the first step, stratified sampling method was used to divide the listed companies into eight groups according to types of industry: Agro and Food Industry, Resources, Technology, Financials, Services, Consumer Products, Property and Construction, and Industrial. The stratified sampling is a process of selecting subjects which represents a high degree of representativeness of all the strata or layers in the population. When the organizations were stratified, the data were collected from various angles of employees from different types of industry group. So, the data would be good representatives.

Quota sampling was also employed in order to calculate the numbers of respondents of questionnaire. Quota sampling is also a non-probability sampling technique that the researcher assigns quota of survey respondents. Quota sampling can save budget and time for researcher and it is not dependent on the presence of the sampling frames (Saunders et al., 2019). Therefore, quota sampling method would help to set numbers of each companies identically.

To gather data by using quota sampling, the respondents were arranged to three employees of each company in SET. The three respondents were selected by human resources managers. Therefore, the questionnaires were assigned to 1,722 employees (see Table 2.2).

Table 2.2 Total Numbers of Expected Respondents

Industry Group	Number of companies	Respondents
Agro and Food Industry	50	150
Resources	43	129
Technology	40	120
Financials	58	174
Services	102	306
Consumer Products	40	120
Property and Construction	154	462
Industrials	87	261
Total		**1,722**

The expected respondents for this study were 1,722 employees.

2.3.3 The Process of Data Collection

The data of awareness on Green ICT were collected via mail, hand- delivered, or online (google docs) questionnaires based on the selection of each organization which was selected as samples. These three collecting methods were selected to use depending on comfortableness of the organizations. The questionnaires were sent to human resources managers of each organization and asked them to assign three employees to complete all questions. The questionnaire also included consent form which explained the purposes and details of the study and the participants were informed that their responses would be kept strictly confidential (see Appendix E). The first mailed questionnaire was administered within one month. After the first step of data collecting, the second step was following up by phone in order to improve response rates of returned questionnaire and waiting for about one month. At this step, the researcher made a phone call to human resources managers and asked them for help. After making a phone call, the researcher waited about one month for additional returned questionnaires. Then, the third step was assigned. For the third step, the researcher sent email messages to human resources in all organizations which included thank you sentences for their answering and asked them to complete the

questionnaire if they have not completed the questionnaire yet. The overall process of survey procedure finally completed within about three months.

The numbers of returned questionnaire were shown in Table 2.3. The numbers of questionnaires returned by sample organizations was between 1-3 questionnaires. The total number of returned questionnaires was 289 from 1,722 questionnaires which accounted for 16.78%. The numbers of returned questionnaire were reported according to industry groups in Table 2.3.

Table 2.3 The Numbers of Returned Questionnaire from each Industry Group.

Industry Group	**Number of companies**	**Expected Respondents**	**Returned Questionnaire**
Agro and Food Industry	50	150	14
Resources	43	129	28
Technology	40	120	42
Financials	58	174	69
Services	102	306	49
Consumer Products	40	120	14
Property and Construction	154	462	48
Industrials	87	261	25
Total		**1,722**	**289**

According to the literatures, there were possible two factors that particularly influence the expected rate of return: the type of case or subject being investigated, and the method of data collection (Hager, Wilson, Pollak, & Roony, 2003). The two most common subjects in survey research are individuals, that is, people and organizations. Surveys of this study were answered by individuals and some questions related to workplaces, factors such as the limited conditions of work, confidentiality of information, or workplace rules and policies which may cause low rate of returned surveys (Greer, Chuchinprakarn, & Scshadri, 2000). Therefore, 15% return rates may reach a level of acceptability (Hager et al., 2003; Moncrief et al., 1999). The second factor influencing return rates is the way data are collected. Collecting data through

mailing questionnaire was the least expensive method in terms of time and money, but it typically yielded the lowest return rates. Even though it yielded the lowest return rate, the researcher decided to assign mailed questionnaires because it allowed the researcher to obtain a large amount of information from a large sample, give respondents time to consider their answers, potentially allow respondents to remain anonymous, and help reduce interviewer bias. The return rate of this study was 16.78% which was acceptable as those samples could be representative of population (Greer et al., 2000, as cited in Hager et al., 2003).

2.3.4 Questionnaire Response Rates

The returned questionnaires were totally 289 employees and the biographical data were described in Table 2.4.

Table 2.4 Socioeconomic Background of Respondents

Background of Respondents	Frequency	Percent
Sex		
Male	84	30.1
Female	195	69.9
Age		
<= 25	70	25.1
26-35	171	61.3
36-45	28	10.0
>45	10	3.6
Education		
Secondary Education	9	3.2
Diploma	6	2.2
Bachelor's degree	179	64.2
Master's degree	82	29.4
Doctor's degree	3	1.1

Background of Respondents	Frequency	Percent
Major		
IT	125	44.8
Non-IT	154	55.2
Experience		
<=5	191	68.5
6-10	*65*	*23.3*
11-15	13	4.7
16-20	2	.7
>20	8	2.9
Income		
<=15,000	43	15.4
15,001-30,000	122	43.7
30,001-45,000	47	16.8
>45,000	67	24.0

As shown in Table 2.4, the final respondents of this study were 289 employees which their genders were male 84 employees which accounted for 30.1 % and female 195 employees, accounted for 69.9%. The majority of age was 26-35 years old which accounted for 61.3%. Most of employees obtained bachelor's degree, accounted for 64.2%. In addition, the numbers of respondents working in IT field (44.8%) were rather close to non-IT field (55.2%). Most of employees worked in the listed companies less than five years (68.5%) and got income between 15,001-30,000 baht (43.7%).

2.4 Dimensions of Awareness on Green ICT and Status of Green ICT in Thailand

Research question 1: What are the dimensions of awareness on Green ICT among employees?

In order to investigate the dimensions of awareness on green ICT, the questionnaire items were analyzed by using Principal Component Analysis (PCA).

PCA is probably the most popular multivariate statistical technique which can reduce dimensions from a large set of variables to a small set that still contains most of the information in the large set (Abdi & Williams, 2010) (Abdi & Williams, 2010). Before conducting PCA, it was needed to check ratio of cases for analysis. KMO & Bartlett's test of sphericity is a measure of how suited the data is for conducting PCA because it is a method to indicate sampling adequacy. The KMO is a statistical technique that indicates the proportion of variance in variables that might be caused by underlying factors. High values (close to 1.0) generally indicate that PCA may be useful with the data. If the value is less than 0.6, the results of PCA probably were not useful (Hair et al., 2010, as cited in Chan & Idris, 2017). In addition, Bartlett's test of sphericity proved whether correlation matrix is an identity matrix which would indicate that the variables are unrelated and unsuitable for structure detection or not. Small values (less than 0.05) of the significance level indicate that PCA may be useful with the data (Field, 2017). Therefore, KMO & Bartlett's Test of Sphericity was reported in Table 2.5.

Table 2.5 KMO & Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.931
Bartlett's Test of Sphericity	Approx. Chi-Square	7551.281
	df	666
	Sig.	.000

As shown in Table 2.5, the KMO & Bartlett's Test value is .931 which is greater than 0.6. Therefore, the data set is appropriate, which means the sampling numbers of this study are adequate for conducting PCA.

In order to determine the numbers of dimensions of awareness on Green ICT, three criteria were used: scree plot, eigenvalues and interpretability of dimensions. The solution that seems best according to all these criteria should be subjected to a further investigation into the meaningfulness of the dimensions (Schönrock-Adema, Heiji-Penninga, van Dell, & Cohen-Schotanus, 2009). A scree plot shows the

eigenvalues on the y-axis and the number of factors or dimensions on the x-axis. It always displays a downward curve. The point where the slope of the curve is clearly leveling off indicates the number of dimensions that should be generated by the analysis (Ledesma et al., 2015). The researcher can inspect the shape of the resulting curve in order to detect the point at which the curve changes drastically. This point on the curve indicates the maximum number of components to retain (Ledesma et al., 2015). After determining numbers of dimensions from a scree plot, eigenvalues were also considered. Eigenvalues refer to the variances explained or accounted for. An eigenvalue reflected the proportion of variance explained by the component. According to determination based on eigenvalues, only dimensions with eigenvalue greater than 1.0 were retained (Field, 2017; Rietveld & van Hout, 2011). This is because a dimension with an eigenvalue of 1 accounts for as much variance as a single variable, and the logic is that only dimensions that explain at least the same amount of variance as a single variable is worth keeping. The third criterion for determining dimensions was interpretability which required two steps: 1) A given component contains at least three variables with significant loadings and a loading of 0.40 being suggested as the cut-off point (Schönrock-Adema et al., 2009); 2) Variables loading on the same component share the same conceptual meaning based on theoretical framework of Green ICT.

After running data in a statistical program, a scree plot (Figure 2.2) shows that it was gradually flattens from the third dimension. This drop occurs after the third dimensions and consequently, three dimensions should be retained.

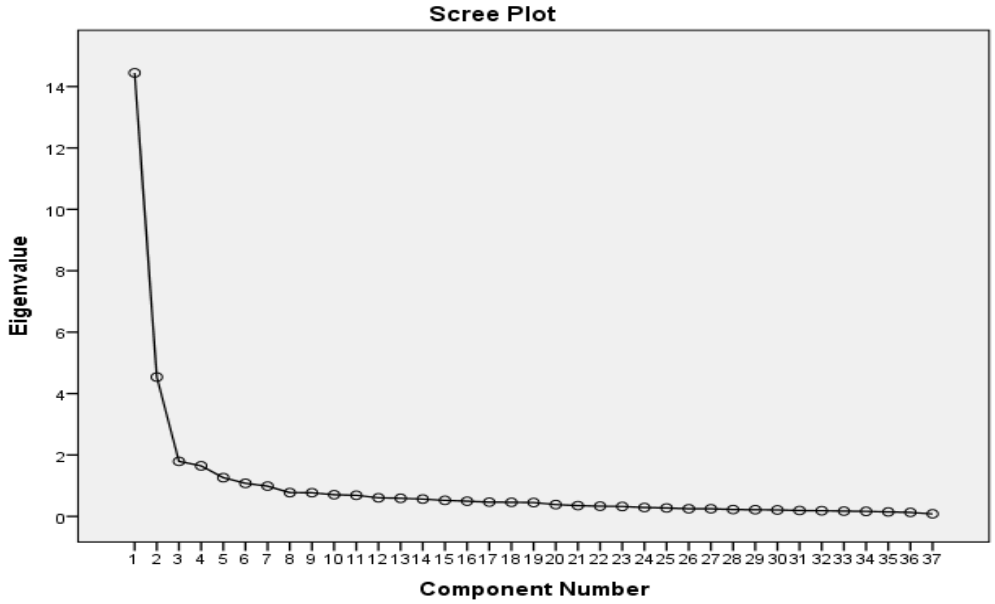

Figure 2.2 Scree Plot of Eigenvalues

Figure 2.2 shows that awareness on Green ICT should be extracted to three dimensions. Then, in order to gain more comprehensive interpretation of the scree plot and promote better decision making by considering other important aspects in the results, the scree plot was considered together with another statistical criterion: eigenvalues (Table 2.6).

Table 2.6 First 6 Eigenvalues of Unrotated Factor Analysis

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	14.444	39.039	39.039	14.444	39.039	39.039
2	4.538	12.265	51.303	4.538	12.265	51.303
3	1.792	4.842	56.145	1.792	4.842	56.145
4	1.646	4.449	60.594	1.646	4.449	60.594
5	1.261	3.407	64.001	1.261	3.407	64.001
6	1.077	2.911	66.913	1.077	2.911	66.913

Note: Extraction Method: Principal Component Analysis.

Table 2.6 shows that the initial model contains six dimensions which obtaining more than 1.0 eigenvalues. The six dimensions accounted for 66.91% of the whole variance, which means that the variance of variables which explained by all six dimensions was accounted for 66.91%. However, it is important to keep in mind that one of the reasons for running PCA is to reduce the large number of variables that describe a complex concept to a few interpretable latent factors or dimensions. In other words, it is important to find a smaller number of interpretable dimensions that explain the maximum amount variability in the data.

Since the initial factor analysis step has unclear numbers of factors or dimensions, that is the numbers of dimensions were ambiguous between three or six dimensions and the first dimension accounted for the most part of the whole variance, varimax rotation was used as the second step which involves adjusting the coordinates of data that result from a principal component analysis. Varimax rotation was used to ensure that most variables have high loadings on the most important dimensions and small loadings on all other dimensions (Field, 2017). Factor rotation, including varimax rotation, transforms the initial factors into new ones that are easier to interpret (Allen, 2017). The varimax rotation is a popular orthogonal rotation method for social sciences research that minimizes the numbers of variables that have high loadings on each factor (Brown, 2009). This method simplifies the interpretation of the dimensions. In varimax rotation process, the numbers of dimensions were fixed to three and six dimensions to see whether three-dimension solution or six-dimension solution would be the best solution to interpret. The results of varimax rotation showed that three-dimension solution would be appropriate to interpret. The six-dimension solution was not considered because there were only one or two items in some dimensions which contains loading of 0.40. The dimension structure or cumulative percentage of three dimensions as reported in eigenvalues accounted for 56.15% which is appropriate for interpreting dimensions since in the humanities research, the explained variance is commonly as 50-60% (Pett, Lackey, & Sullivan, 2003, as cited in Williams, Onsman, & Brown, 2012).

Therefore, there were three dimensions to be interpreted. The dimension structure accounted for 56.15% of the whole variance (See Table 2.6). Table 2.7 reports the rotated dimension pattern for the three-dimension solution.

Table 2.7 Rotated Dimension Pattern for the Three-factor Solution (Varimax Rotation)

	Rotated Component Matrix[a]		
	Component		
	1	2	3
Green19	.799		
Green21	.783		
Green12	.779		
Green16	.769		
Green14	.768		
Green10	.765		
Green13	.750		
Green23	.740		
Green11	.707		
Green35	.671		
Green4	.661		
Green9	.659		
Green15	.646		
Green27	.643		
Green17	.617		
Green8	.611		
Green6			
Green20			
Green18			
Green34			
Green36			
Green29		.822	
Green32		.815	
Green37		.799	
Green25		.782	
Green24		.768	
Green26		.723	

	Rotated Component Matrix[a]		
	Component		
	1	2	3
Green33		.689	
Green22		.653	
Green30		.627	
Green31			
Green7			
Green28			
Green1			.727
Green2			.721
Green3			.681
Green5			

Note: Extraction Method: Principal Componet Analyasis.

Rotation Method: Varimax with Kaiser Nomalization[a] a Rotation covergedin 6 itrations.

The rotated pattern for the three dimensions shown in Table 2.7 shows that there are 38 items contains factor loadings higher than 0.4. Hence, 9 items with lower factors loadings than 0.4 were deleted. The factor structure is reported in Table 2.8.

Table 2.8 Dimensions of the Awareness on Green ICT

No	**Items**	**D1**	**D2**	**D3**
Dimension 1: Saving energy and Avoiding using wasteful paper				
19	Reuse printed papers for testing printers	0.799		
21	Use rewritable storage media	0.783		
12	Save documents on disk rather than printing on paper	0.779		
16	Circulate soft copies rather than printing out	0.769		
14	Try to reduce the number of pages when creating document	0.768		
10	Print on paper only when necessary	0.765		

No	Items	D1	D2	D3
13	Send documents via email rather than by post/hardcopy	0.750		
23	Recycle unwanted paper printouts	0.740		
11	Print on both sides of the paper if possible	0.707		
35	Use GPS to calculate distance	0.671		
4	Turn on computer only when the need arises	0.661		
9	Turn off entire computer system when out for a long break	0.659		
15	Use multi-page printing	0.646		
27	Buy computer device only when needed	0.643		
17	Use energy efficient computer equipment	0.617		
8	Turn on peripherals only when I need to use it	0.611		
Dimension 2: Using reusable and recyclable equipment and Upgrading devices				
29	Buy recyclable computer equipment where possible		0.822	
32	Use refurbished mobile phone		0.815	
37	Use seconded-hand mobile phone		0.799	
25	Recycle unwanted computer equipment		0.782	
24	Recycle unwanted lithium (laptop) batteries		0.768	
26	Buy computer device whenever a new model available		0.723	
33	Buy mobile phone whenever a new model available		0.689	
22	Recycle ink and toner cartridges		0.653	
30	Donate unwanted computer and ICT devices which are still in good condition to others		0.627	
Dimension 3: Using saving energy function				
1	Use the screen saver function			0.727
2	Use the monitor sleep function			0.721
3	Use the system sleep function			0.681

As shown in Table 2.8, it is found that there are primarily three dimensions of awareness on Green ICT among Thai employees which are 1) Saving energy and Avoiding using wasteful paper; 2) Using reusable and recyclable equipment and Upgrading devices; 3) Using saving energy function.

2.4.1 Dimension 1 Saving Energy and Avoiding Using Wasteful Paper

There were sixteen important loading features in this dimension. They were all positive loadings. This factor contained item 19 (Reuse printed papers for testing printers), 21 (Use rewritable storage media), 12 (Save documents on disk rather than printing on paper), 16 (Circulate soft-copies rather than printing out), 14 (Try to reduce the number of pages when creating document), 10 (Print on paper only when necessary), 13 (Send documents via email rather than by post/hardcopy), 23 (Recycle unwanted paper printouts), 11 (Print on both sides of the paper if possible), 35 (Use GPS to calculate distance), 4 (Turn on computer only when the need arise), 9 (Turn off entire computer system when out for a long break), 15 (Use multi-page printing), 27 (Buy computer device only when needed), 17 (Use energy efficient computer equipment), and 8 (Turn on peripherals only when I need to use it). Item 19 contained the highest loading in this dimension (.799). It was found that items 4, 8, 9, 17, and 35 relates to using other tools or functions to save energy, while item 10, 11, 12, 13, 14, 15, 16, 19, 21, 23, and 27 relates to saving paper in terms of doing other ways instead of printing wasteful paper. Therefore, this dimension is labelled as “Saving energy and Avoiding using wasteful paper”.

2.4.2 Dimension 2 Using Reusable and Recyclable Equipment and Upgrading Devices

There were nine important loading features in this dimension. They were all positive loadings. This factor contained item from question 29 (Buy recyclable computer equipment where possible), 32 (Use refurbished mobile phone), 37 (Use seconded-hand mobile phone), 25 (Recycle unwanted computer equipment), 24 (Recycle unwanted lithium (laptop) batteries), 26 (Buy computer device whenever a new model available), 33 (Buy mobile phone whenever a new model available), 22 (Recycle ink and toner cartridges), and 30 (Donate unwanted computer and ICT

devices which are still in good condition to others), Question item 29 contained the highest loading in this factor (.822). It was found that items 22, 24, 25, 29, 30, 32, 37 relates to using recycling, refurbished, and second-handed devices, while item 26 and 33 relates to upgrading devices. Therefore, this dimension is labelled as "Using reusable and recyclable equipment and Upgrading devices".

2.4.3 Dimension 3 Using Saving Energy Function on Computers

There were three important loading features in this dimension. They were all positive loadings. This factor contained item from question 1 (Use the screen saver function), 2 (Use the monitor sleep function), and 3 (Use the system sleep function). Question item 1 contained the highest loading in this factor (.727). All important loading features relates to using function to save computer's energy such as monitor sleep function, system sleep function, and screen saver function. Therefore, this dimension is labelled as "Using saving energy function on computers".

2.5 The Discussion of Awareness on Green ICT

According to the results, it can be implied that Thai employees working in listed companies of SET have attitudes and behaviors towards awareness on Green ICT in three different dimensions including 1) Saving energy and Avoiding using wasteful paper; 2) Using reusable and recyclable equipment and Upgrading devices and 3) Using saving energy function on computers.

It can be assumed that Thai employees use ICT devices and equipment for Green in different ways. Based on PCA results, the first dimension accounted for 29.04% which is the most valuable of whole variance, so this dimension was most emphasized by Thai employees. It means that employees are familiar with saving energy and avoiding using wasteful paper. As Lo et al. (2012) stated, environmental behavior in the workplace shows that employees can be encouraged to adopt energy saving behaviors. Similar to previous studies, the dimensions of awareness on Green ICT for this study were overlapped with Din, Haron, and Ahmad (2013) who conducted about awareness on Green ICT concept among Malaysian adult learners. The highest-rated item was "Switch off the computer after use" which can be implied

that Malaysian people tended to be aware on saving energy because they switched off computer after they completed their work. It was consistent with the first dimension of this study since the first dimension of this study included “Saving energy”. In addition, it was found that Malaysian student adult learners become “Aware that the reduction of paper will save trees” which quite similar to this study since the results of this study included “Avoiding using wasteful paper”. This may be an easy way to do if people become aware on ICT and environment. Likewise, Patel (2017) also proposed that switching off PC when not in use and reducing energy consumption by powering down of ICT devices were awareness on Green ICT which found among IT or Computer engineering students. In terms of saving energy, Thai people tended to be foster to save energy such as electricity and water supply. When we talk about Green, Thai employees may recognize about saving energy. In addition, using wasteful paper is a campaign which has been frequently launched for a long time. Thai people were educated to reuse printed papers for testing printers, use rewritable storage media, save documents on disk rather than printing on paper, circulate soft-copies rather than printing out, try to reduce the number of pages when creating document), print on paper only when necessary), send documents via email rather than by post/hardcopy), recycle unwanted paper printouts), and print on both sides of the paper. Therefore, saving wasteful paper seemed to be easier as a routine work for employees.

For dimension 2, it can be implied that Thai employees widely use reusable, recyclable equipment and upgrade devices. The employees have more awareness on reusing and recycling such as recycling computer and second-handed mobile phone because they possibly learned that reusing and recycling are comfortable, concrete, and cheap ways to make environment sustainable. Yet, the upgrading devices including buying new mobile phone and computer when the new model is available seemed to be inappropriate behaviors. This means that Thai employees tend to spend money extravagantly on mobile phone and computer (Suwannee, 2013). In other words, they seemed to be materialism since they prefer using new model although their old ones were still usable (Jarurat Boonwaedlorm, 2003). Materialism is now concerned as a big problem for people. The reason why Thai people prefer having new model of these belongings is probably because they want to fit in the group of

peers, follow current trend, addict to brand-new things, and so on (Naruetharadhol, Kerdpech, Kaoplod, & Kannarat, 2015). Otherwise, an important reason which employees intended to upgrade technology devices might be because the businesses and individuals nowadays are using way less paper. So, the employees may prefer using new model of computers and smartphones to make them convenient. The upgraded devices may have new function which help them to take notes, manage their schedules, and present their woks efficiently. Although the behavior of buying new mobile phone and computer when the new model is available seemed to be inappropriate since it indicated a waste of resources, it cannot be denied that upgraded devices become greater tools for environmental activities. For instance, cell phones can turn anyone into an eco-warrior with apps, a camera, accessories and the ability to quickly communicate with people anywhere. It is possible that new mobile phones and computers may be able to report air quality and embedded sensors may automatically record and send real-time air quality measurements and lead to highly accurate, crowd-sourced air pollution data. So, using new devices may relates to environmental sustainability in some ways.

For the last dimension of Green ICT, it was found that using saving energy function on computers such as screen saver function, monitor sleep function, and system sleep function seemed to be the least-employed dimension among Thai employees. The study of Din et al., (2013) showed that the lowest-rated item was “My PC having energy saving feature”, which means Malaysian adult learners were aware on saving energy function the least. The results seemed not to be consistent with this study since “Using saving energy function” was found as the third dimension of awareness on Green ICT among Thai employees. The item was found differently may be because it was the dimension which people need to be educated for using those saving energy functions. As suggested by Lo et al., (2012), employees can be encouraged to adopt energy saving functions in the workplace. This may be because these functions are not widely known among general employees. In other words, these functions are considered to be knowledge among IT and IT-related employees. The employees in other fields (non-IT) may hardly know about these functions until they are educated. Besides, the employees should be trained and gain more knowledge in

order to reduce inappropriate behaviors as well as using ICT by saving energy and maintaining sustainable environment.

In conclusion, the status of awareness on Green ICT among employees in Thailand were divided into three dimensions: Dimension 1 (Saving energy and Avoiding using wasteful paper), Dimension 2 (Using reusable and recyclable equipment and Upgrading devices), and Dimension 3 (Using saving energy function). Dimension 1 (Saving energy and Avoiding using wasteful paper) was most emphasized by Thai employees since it seemed to be promoted among Thai people for a long time. Dimension 2 (Using reusable and recyclable equipment and Upgrading devices) was found as one dimension of Green ICT among employees because it seemed to be convenient, easy, cheap, and concrete way to save environmental resources. The last dimension (Using saving energy function) was found because the employees who were educated to learn these functions would perceive that these functions were easiest way to save energy.

Compared the results of this study to Patel (2017) who found five dimensions of awareness on Green ICT among students. It was found that dimensions of (Patel, 2017) were consistent with this study, except “Use of e-books and e-learning tools”. The use of e-books and e-learning tools were not found among Thai employees because they were responsible with their works and tended to be aware on dimensions with related to working. They may not frequently learn by e-books and e-learning tools; otherwise the organizations did not encourage e-learning tools for them. However, it was found that lack of knowledge and motivation were the reasons for not adopting Green ICT (Patel, 2017). This means that gaining knowledge is related to awareness of Green ICT. Therefore, promoting self-directed learning for employees is important, that is why this study attempted to study about awareness of Green ICT and self-directed learning which was presented in the next Chapter.

CHAPTER 3

SELF-DIRECTED LEARNING

This chapter provided the details of self-directed learning including the rationale of the study of self-directed learning, review of literature, research methodology for this chapter, the results of dimensions of self-directed learning among employees, and discussion of the study.

3.1 Rationale of Self-Directed Learning

While our world is changing and jumping into the world of technology, people can adopt self-directed learning easily. Self-directed learning takes an important role nowadays since people can learn lots of things by themselves from websites and applications that are designed to allow people to share content quickly, efficiently, and in real-time (Blaschke, 2014). It is clearly to say that people have accessed the content for learning or getting their knowledge from Information Technology. Learning from those websites and applications can also influence the ways of life and decision making (Siriwongs, 2015). Since people learn something more from their own experiences independently, investigating the dimensions of self-directed learning can shed light of the preferable ways and styles of their self-directed learning. The results can help organization to provide the suitable training facilities and environment for their employees. In order to gain more benefits for organizations, the difference of self-directed learning between IT and Non-IT employees was examined.

3.2 Review of the Literature

3.2.1 The Concept of Self-Directed Learning

The concept of Self-Directed Learning (SDL) was initially viewed as a part of adult education. It was first discussed in educational literature as early as 1926. As Lindemann and Knowles stated, self-directed learning is “the art and science of helping adults learn” (Knowles, 1980, p. 43 as cited in Merriam, 2001). The motivation source of adults to learn was stemmed from their experiences and the opportunity to choose the own way to learn (Carson, 2012). Later, there were many scholars attempted to define what SDL is. The perspectives of SDL have been emerged in various ways depending on the frame of concepts of scholars. Oddi (1987) mentioned that the most of researchers view self-directed learning as a process of learning, while a smaller group of researchers views self-directed learning from a psychological point of view (Carson, 2012). Ones who view SDL as a process possibly defined SDL as the part of adult education. The self-directed learning for this case means a skill that engaged by individuals (Carson, 2012). It could be improved by experience or training by instructors. Many researchers agreed that learners should be guided to increase their levels of self-directed learning and levels of responsibility for their own learning (Merriam, 2001). On the other point of views, scholars, viewing SDL in dimension of psychology, defined SDL as a characteristic of personality. For instance, the self-directed learning has allowed individual high in self-efficacy and intrinsically motivated. Self-directed learners can also check their learning needs, set individual goals, choose appropriate method to achieve those goals, evaluate themselves, and are not afraid of facing new challenges. In addition to these two concepts, some researchers stated that SDL is an important component which should be encouraged for workplace learning, especially for adults who want to be higher in socio-economic ladder, to increase political awareness, and to promote social action (Ellinger, 2004). Thus, SDL is an important function of human resource development process.

For this study, self-directed learning is viewed as the combination of two perspectives. SDL for this study means a process of learning which can be improved from experience or training. SDL is also viewed as learner's desire or preference for

learning. There may be psychological variables such as motivation and self-efficacy related to SDL. In addition, SDL is an important component which should be supported in workplace. So, this research attempted to investigate SDL in adult education, that is employees.

Although there are many concepts or definitions of SDL, the most commonly used definition is (Knowles, 1989). For Knowles, SDL is viewed as a process of study which "the students take initiate with or without the help of others, assess their learning needs, formulate goals with implementation of appropriate strategies and evaluate learning outcome". It also requires students to improve themselves (Knowles, 1989). According to learning theory of (Merriam et al., 2012), learning can be categorized into five approaches: behaviorist, cognitivist, humanist, constructivist, and social learning. Among five approaches, there are two approaches related to self-directed learning: cognitivist and constructivist (Merriam et al., 2012). Based on cognitivist approach, there are four essential abilities of learners including self-awareness, self-monitoring, critical and creative thinking, and improving learning styles. In aspect of constructivism approach, learning is described as a social-interactive, self-regulated and reflective process. This approach focuses on three kinds of learning functions (preparatory, executive and closing) as building blocks that can be used in self-directed learning. In addition, self-directed learning was viewed as an action learning in working places. Based on some previous scientific researches, the major characteristics which is appropriate to self-directed learners are independent person, ability to apply knowledge in their real life, being responsible for their learning quality and experience (Vaivada, 2012). The people who performed themselves as self-directed learners can be lifelong learners (Wu, 2004). Lifelong learners are ones who never lose their enthusiasm for learning and able to investigate the necessary knowledge and skills for better living and overcoming the facing problems (Bidokht & Assareh, 2011). They love to try any learning opportunities and to be able to employ learning strategies and skills, to be able to make future plan, and to have ability and skills for solving problem. It is clear that self-directed learning can lead to lifelong learning which is one of important characteristics required by every country (Chiang, 1998).

Since self-directed learners are able to use various learning method and strategies, Information and Communication Technology or ICT is viewed as a tool for their learning (Department of Economic and Social Affairs, 2003). Self-directed learning and ICT is related in many ways, especially in education. ICT is widely used in learning contexts (Prestridge, 2012). Teachers are gaining access to ICT and digital curriculum resources are accessible and are continually being developed. For instance, teachers can teach the fundamentals of computer system by motivating children that they can retrieve any information they need to because of the internet. In the same way, students can practice collaboration skills by getting involved in different online activities. It can be said that almost every part of our culture including educational context was interrelated with technology (Mareco, 2017). The adoption of ICT in learning was beneficial since technology has enabled learners to be self-directed learners and this has caused the increase of their motivations to learn (Hamidi et al., 2011). This can be implied that the use of technology can increase the motivation of students to learn, and can support lifelong, self-directed learning beyond the regular classes (Saxena, 2013).

In this century, the use of technology in education becomes an important factor to achieve in effective learning. The students were initially taught in class, and then provided activity via on-line learning and remote training. The students were given freedom to learn by themselves and brought out their intelligence (Asfar & Zainuddin, 2015). This helps students to learn more knowledge and experience a sense of independence while learning. Apart from that, most students have started doing collaborative learning using various technology devices to promote self-directed learning ability. When the students learned from learning applications such as YouTube, Twitter or Facebook, they may have collaboration among learners in the same channels. Video conferencing is a preferable tools help turning classrooms into global communication centers for free. Students can connect with anyone around the world and discuss topics they are interested in with other experts and scholars (Saxena, 2013). During the last three decades, self-directed learning has become a major research area (Hiemstra, 1994). However, there are only a few research topics about self-directed learning and ICT. For example, Dawson, Macfadyen, Risko, Foulsham, and Kingston (2012) investigated the relationship between using

technology and self-directed learning and found that adoption of technology can promote and foster SDL skills: motivation, self-management and self-monitoring. In addition, using technology encouraged learning analytics for learners to evaluate their progress, and allow instructors to monitor the development of SDL skills. This can also be supported by the study of Rashid and Asghar (2016) which aimed to inspect a path model with technology use and self-directed learning among university students (Rashid & Asghar, 2016). The results showed that use of technology has a direct positive relationship with students' self-directed learning. In addition, the findings of path analysis demonstrated that technology use can predict self-directed learning and help to improve students' learning. The relationship between technology usage and academic performance can be supported by the study of (Eyyam & Yaratan, 2014). The study revealed that the mathematics posttest scores of the students who were instructed using technology were significantly higher than the posttest scores of those who were instructed without technology (Eyyam & Yaratan, 2014). The results also showed that learning through technology seemed to be a preferable choice for the students.

As shown in previous studies, the relationship between self-directed learning and ICT was investigated among children or students. The study of self-directed learning and ICT among adult learners was rarely found although the adults can also be autonomous to learn when they need to be free to learn by themselves (Abdullah, Binkoren, Muniapan, Parsuraman, & Rathakrishman, 2008). Self-directed learning is somewhat related with adult learning theory on both theoretical and practical grounds. Therefore, this study intended to provide an important concept of adult learning because the population in this study, employees, are in adult age. Since adult learner are more responsible for their life, they are freely choosing the way they learn by themselves. In addition, adults have been taught from their schools or university courses, and this can lead them to know how they can learn by themselves. Presently, adults are ready to learn those things they need to know in order to manage their life effectively. So, for productive learning, adults know proper time to learn and what value to them (Mallows & Litster, 2016). The adult learner is one who returns to study, on a full-time or part-time basis, after a period of time spent in other activities (Manning, 2007). Likewise, the adult learner is one who tends to be motivated to take

further education at the end of a working day or required to attend a program for obtaining certificate (Freedman, 1985). Modern adult learning theory has found on assumptions that adults needs to be self-directed learners. They are motivated to learn because they found from their experiences and interests that learning is interesting and important for them. In addition, it is assumed that adults' learning orientation is self-centered (Manning, 2007). Hence, adult learning, based on this concept, is mainly related to self-directed learning. It is also clear that learning should be largely based on individuals' experiences and focused on life situations and life goals. According to Knowles's theory of adult education (1989), adult learners are more successful when they are highly motivated, when they can participate in learning process, and when learning content had practical implications. (Knowles, 1989) also asserted that adults prefer informal settings as conduciveness to learn. In addition, they need opportunities to practice their new skills and immediate feedback on their learning process. Therefore, the education of adult learners is a process which people can direct and manage their own learning. In addition to Knowles (1989), (Tough, 1971) who was a scholar doing adults' learning project found that adults seemed to highly achieve in their learning when the amounts of assistance decrease. Thus, providing only a little help will be one of effective way for improving adults' learning (Tough, 1971).

In section 3.2.1 perspectives of SDL were described. In addition, the studies of self-directed learning were shown. According to previous studies, it was seen that SDL is related to ICT and SDL is important in adult educational context. Since, SDL is a process which learners can study by themselves, online learning is a way for self-directed learners to study. So, the importance of online learning was also described, in section 3.2.2.

3.2.2 Online Learning

In this era, online learning has come to be a popular way for working people (Norman, 2016). Since there are several problems for traditional learning, online learning has become popular among people who want to learn by themselves. One problem of traditional learning is the cost. If online learning has not grown in our society, learners would pay much money for the courses they want to attend. Paying for courses would make learners more difficult to learn because they possibly had

problem with tuition fee. In addition, learners cannot choose their available time to learn in traditional learning. Learning process would depend on instructors, places, and number of attendants. Yet, online learning can help learners to save budget and choose their preferable time by themselves. Online learning seems to be the greatest revolution in contemporary education (Norman, 2016). It made a considerable change and opened valuable opportunities for everyone who wants to learn something new. Only have the Internet, people can learn everything that they want. It is clear to say that online learning is a sign showing that technology is possibly important for learning. Since technology was widely accessed, online learning has increased from a limited option available for a few adults; it becomes an active and growing commercial industry available to anyone with a good online connection (Carson, 2012). Since the rapid growth of technology enhanced online learning, new tools for learning have emerged (Tlili et al., 2016). One of these tools is computer-based learning. Computer-based learning or CBL is the term used for any kind of learning with the help of computers. CBL is the use of computers for learning activities which has many benefits, including the advantage of users learning at their own way and also learning without the need for an instructor to be physically present. Computers can be used to solve the problem of the insufficiency of traditional learning for educating individuals or helping learners gain the required learning skills (Tareef, 2014). In CBL, the learners can get interactive, motivating or immersive teaching methods. CBL also helps learners to have more decision-making, problem solving, data-processing and communication capabilities skills (Bakaç, Tasagiu, & Akbay, 2011). While the adoption of CBL tended to increase, several weaknesses should be concerned. Technical difficulties such as slow Internet connection or older computers can affect the learning process negatively (Tlili, Essalmi, Jemni, Kinshuk, & Chen, 2016). In addition, the learning content for learners in CBL is provided in different forms such as drawings, graphics, animation, music and video. Learners who are not familiar with computers may found themselves in a dilemma. It is noted that characteristics of IT and non-IT employees seemed to be different in some aspect. For instance, software engineers displayed very high growth needs and were concerned about learning new technology (Beecham, Baddoo, Hall, Robinson, & Sharp, 2007).

3.2.3 Self-Directed Learning in Thailand

In Thailand, the studies of self-directed learning were found in nursing education (Arpanantikul et al., 2006; Klunklin, Viseskul, Sripusanapan, & Trale, 2010; Preeyavongsakul, 2004; Tuanma, 1996) and college or undergraduate students teaching (Prabjandee & Inthachot, 2013; Siriwongs, 2015; Thanpong Sombat, Wareesiri Singhasiri, Atipat Boonmoh, 2014; Sriarunrasmee et al., 2015; Suknaisith, 2014). For nursing education, self-directed learning is viewed as a method of teaching and learning which increasingly used in nursing education. For instance, the readiness of nursing students in Chiang Mai University was investigated and revealed that the overall self-directed learning readiness of nursing students was at a high level in the dimensions of openness to learning opportunities, self-concept as an effective learner, initiative and independence in learning, informed acceptance of responsibility for one's own learning, creativity, and the ability to use basic study and problem-solving skills (Klunklin et al., 2010a). In addition to readiness of nursing students, there were considerable studies focusing on self-directed learning in teaching process for university students. It was found that learners were satisfied with the instruction using the self-directed learning technique at a high level (Suknaisith, 2014) and they seemed to have positive attitudes towards integration of self-directed learning into the class (Sombat et al., 2014). The results from previous studies provide encouragement to teaching and learning area. It can be used to further apply self-directed learning into courses, to improve teaching and learning methods, and promote life-long learning for Thai students within Thailand. The studies of self-directed learning in business area have been scarce although employees who work in business sector and have position to do the job completely and effectively tended to do their jobs with computer, this means, they were familiar with technology. They tended to use technology to improve the processes of work with effectiveness and become tech-savvy. Thus, they are provided to learn directly by themselves. Thus, this study needs to investigate the dimensions of self-directed learning of Thai employees. In order to gain insight knowledge, this study also aims to explore the difference of self-directed learning between IT and non-IT employees.

3.3 Instrumentation

3.3.1 Instrumentation (Questionnaire)

This part investigated dimensions of self-directed learning, so the self-directed learning readiness scale questions was adapted from Fisher, King, and Tague (2001) which the researcher asked for the permission to use the questionnaire in this study (see Appendix F). This questionnaire was originally developed to investigate the level of self-directed learning for nursing education. The questionnaire included the items about styles of self-directed learning among nursing students. The questionnaire did not only match with nurse education, but also appropriately used for adult education. Because the population of this study were employees, this questionnaire for adult education seemed to be suitable to gather data from them. In addition, this is a well-designed, precise questionnaire with useful item and seems to match the purpose of the study. Some items which were not suitable for employees were adjusted. This means that some items used to evaluate self-directed learning scale in nursing classroom; for example, the item "I often review the way nursing practices are conducted" were changed to "I often review the way working practices are conducted" since this study was conducted among employees, not nursing students. All question items were translated into Thai language by the same expert of Green ICT questionnaire in order to ensure that English and Thai language in the questionnaire were equal. The resume of translator was available in Appendix A.

Before collecting data, these survey questions were tested validity and reliability. In terms of validity, the items were sent to five experts in the field of information system, information technology, and language in order to evaluate content and face validity by using Item-Objective Congruency Index (IOC) (Rovinelli & Hambleton, 1977, as cited in Turner & Carlson, 2003). IOC is a procedure used in test development for evaluating content validity at the item development stage. The items which gained more than 0.6 score of IOC values were accepted, while any items gaining less than 0.6 score were revised. The items which received IOC value of 0 were deleted. From 52 items of self-directed learning questionnaire, three items received less than 0.6 score and they were adjusted. The three items were

recommended to edit some unclear words. The final version of self-directed questionnaire contained 52 items. The results of IOC were available in Appendix G.

In order to test reliability, the questionnaire was piloted in order to find the reliability using Cronbach's alpha. In piloting process, the questionnaire was sent to 30 employees who were selected by the invitation from the researcher's colleagues. The employees were all working in SET companies and the researcher was comfortably to send the questionnaire. The employees in piloting process were excluded in the study. After receiving responses, the data were measured in order to assess the reliability by using Cronbach's alpha. The questionnaire should have reliability of .70 or better (Nunnally, 1978, p. 245). The Cronbach's alpha value of questionnaire was 0.966 which was accepted to use (see Appendix H). The final version of questionnaire was available in Appendix D.

3.3.2 Population and Samples

The target population of this study were the employees working in 574 listed companies in The Securities Exchange of Thailand (SET). SET strongly achieves for sustainable economic growth and social well-being. By focusing on both sustainable economic development and on all stakeholders' sustainability, SET attempts to provide more opportunities and knowledge for investors, partners, alliances, or communities and whole society. Importantly, in order to develop business growth, SET has continued to develop expertise and skills among capital market professionals (SET, 2015). Since companies in SET play important role in economic growth of Thailand, the investigation among employees working in those companies may give interesting results, and the results from them can show the wide picture of self-directed learning. In addition, companies in SET were large and high-performing companies which their employees were assumed to be familiar with self-directed learning.

As we have seen form Table 3.1, there were eight industry groups of SET. The number of companies are totally 574 companies.

Table 3.1 Total Numbers of Listed Companies in SET Divided by Industry Group

No.	SET Industry Group	Total
1	Agro and Food Industry	50
2	Resources	43
3	Technology	40
4	Financials	58
5	Services	102
6	Consumer Products	40
7	Property and Construction	154
8	Industrials	87
	Total	**574**

For collecting data from questionnaire, this study applied multi-stage sampling method to select respondents from 574 listed companies of SET. The multi-stage sampling techniques were employed to find out good representatives. There are two stages of methods: stratified sampling and quota sampling. (see Figure 3.1).

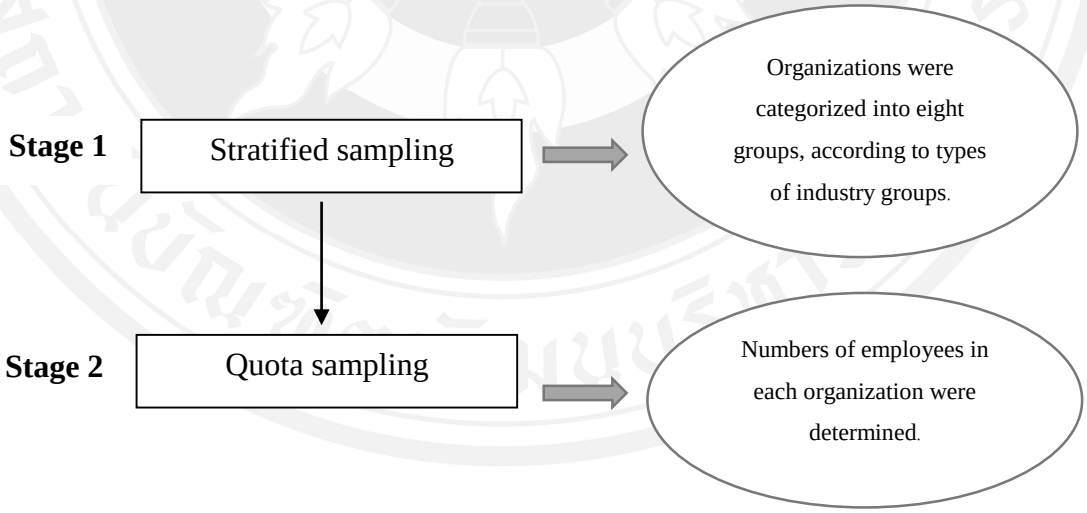

Figure 3.1 Multi-stage Sampling Method Employed in this Study

In the first step, stratified sampling method was used to divide the listed companies into eight groups according to types of industry: Agro and Food Industry,

Resources, Technology, Financials, Services, Consumer Products, Property and Construction, and Industrial. The stratified sampling is a process of selecting subjects which represents a high degree of representativeness of all the strata or layers in the population. When the organizations were stratified, the data were collected from various angles of employees from different types of industry group. So, the data would be good representatives.

Quota sampling was also employed in order to calculate the numbers of respondents of questionnaire. Quota sampling is also a non-probability sampling technique that the researcher assigns quota of survey respondents. Quota sampling can save budget and time for researcher and it is not dependent on the presence of the sampling frames (Saunders, 2012). Since, this study was conducted to compare the dimensions of self-directed learning between IT and non-IT employees, the numbers of employees would be equal according to their educational and working backgrounds.

To gather data by using quota sampling, the respondents were arranged to three employees of each company in SET. The three respondents were selected by human resources managers. Therefore, the questionnaires were assigned to 1,722 employees (see Table3.2).

Table 3.2 Total Numbers of Expected Respondents

Industry Group	**Number of companies**	**Respondents**
Agro and Food Industry	50	150
Resources	43	129
Technology	40	120
Financials	58	174
Services	102	306
Consumer Products	40	120
Property and Construction	154	462
Industrials	87	261
Total		**1,722**

The expected respondents for this study were 1,722 employees.

3.3.3 The Process of Data Collection

The data of self-directed learning were collected via mail, hand-delivered, or online (google docs) questionnaires based on the selection of each organization which was selected as samples. These three collecting methods were selected to use depending on comfortableness of the organizations. The questionnaires were sent to human resources managers of each organization and asked them to assign three employees to complete all questions. The questionnaire also included consent form which explained the purposes and details of the study and the participants were informed that their responses would be kept strictly confidential (see Appendix E). The first mailed questionnaire was administered within one month. After the first step of data collecting, the second step was following up by phone in order to improve response rates of returned questionnaire and waiting for about one month. At this step, the researcher made a phone call to human resources managers and asked them for help. After making a phone call, the researcher waited about one month for additional returned questionnaires. Then, the third step was assigned. For the third step, the researcher sent email messages to human resources in all organizations which included thank you sentences for their answering and asked them to complete the questionnaire if they have not completed the questionnaire yet. The overall process of survey procedure finally completed within about three months.

The questionnaire was redistributed to participants if the number of returned questionnaires was insufficient or could not reflect population characteristics. Due to this administration procedure, the number of respondents was observed and gathered equally in terms of IT and non-IT educational and working backgrounds.

The numbers of returned questionnaire were shown in Table 3.3. The numbers of questionnaires returned by sample organizations was between 1-3 questionnaires. The total number of returned questionnaires was 289 from 1,722 questionnaires which accounted for 16.78%. The numbers of returned questionnaire were reported according to industry groups in Table 3.3.

Table 3.3 The Numbers of Returned Questionnaire from each Industry Group

Industry Group	Number of companies	Expected Respondents	Returned Questionnaire
Agro and Food Industry	50	150	14
Resources	43	129	28
Technology	40	120	42
Financials	58	174	69
Services	102	306	49
Consumer Products	40	120	14
Property and Construction	154	462	48
Industrials	87	261	25
	Total	**1,722**	**289**

According to the literatures, there were possible two factors that particularly influence the expected rate of return: the type of case or subject being investigated, and the method of data collection (Hager et al., 2003). The two most common subjects in survey research are individuals, that is, people and organizations. Surveys of this study were answered by individuals and some questions related to workplaces, factors such as the limited conditions of work, confidentiality of information, or workplace rules and policies which may cause low rate of returned surveys (Greer et al., 2000). Therefore, 15% return rates may reach a level of acceptability (Hager et al., 2003; Moncrief et al., 1999). The second factor influencing return rates is the way data are collected. Collecting data through mailing questionnaire was the least expensive method in terms of time and money, but it typically yielded the lowest return rates. Even though it yielded the lowest return rate, the researcher decided to assign mailed questionnaires because it allowed the researcher to obtain a large amount of information from a large sample, give respondents time to consider their answers, potentially allow respondents to remain anonymous, and help reduce interviewer bias. The return rate of this study was 16.78% which was acceptable as those samples could be representative of population (Greer et al., 2000, as cited in Hager et al., 2003).

3.3.4 Questionnaire Response Rates

The returned questionnaires were totally 289 employees and the biographical data were described in Table 3.4.

Table 3.4 Socioeconomic Background of Respondents

Background of Respondents	Frequency	Percent
Sex		
Male	84	30.1
Female	195	69.9
Age		
<= 25	70	25.1
26-35	171	61.3
36-45	28	10.0
>45	10	3.6
Education		
Secondary Education	9	3.2
Diploma	6	2.2
Bachelor's degree	179	64.2
Master's degree	82	29.4
Doctor's degree	3	1.1
Major		
IT	125	44.8
Non-IT	154	55.2
Experience		
<=5	191	68.5
6-10	65	23.3
11-15	13	4.7
16-20	2	.7
>20	8	2.9

Background of Respondents	Frequency	Percent
Income		
<=15,000	43	15.4
15,001-30,000	122	43.7
30,001-45,000	47	16.8
>45,000	67	24.0

As shown in Table 3.4, the final respondents of this study were 289 employees which their genders were male 84 employees which accounted for 30.1 % and female 195 employees, accounted for 69.9%. The majority of age was 26-35 years old which accounted for 61.3%. Most of employees obtained bachelor's degree, accounted for 64.2%. In addition, the numbers of respondents working in IT field (44.8%) were rather close to non-IT field (55.2%). Most of employees worked in the listed companies less than five years (68.5%) and got income between 15,001-30,000 baht (43.7%).

3.4 Exploratory of Self-directed Learning

Research question 2: What are the dimensions of self-directed learning among employees?

In order to investigate the dimensions of self-directed learning, the 52 questionnaire items were analyzed by using Principal Component Analysis (PCA). PCA is probably the most popular multivariate statistical technique which can reduce dimensions from a large set of variables to a small set that still contains most of the information in the large set (Abdi & Williams, 2010). Before conducting PCA, it was needed to check ratio of cases for analysis. KMO & Bartlett's test of sphericity is a measure of how suited the data is for conducting PCA because it is a method to indicate sampling adequacy. The KMO is a statistical technique that indicates the proportion of variance in variables that might be caused by underlying factors. High values (close to 1.0) generally indicate that a PCA may be useful with the data. If the value is less than 0.6, the results of the PCA probably were not useful (Hair et al., 2010, as cited Chan & Idris, 2017). In addition, Bartlett's test of sphericity proved

whether correlation matrix is an identity matrix which would indicate that the variables are unrelated and unsuitable for structure detection or not. Small values (less than 0.05) of the significance level indicate that PCA may be useful with the data (Field, 2017). Therefore, KMO & Bartlett's Test of Sphericity was reported in Table 3.5.

Table 3.5 KMO & Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.943
Bartlett's Test of Sphericity	Approx. Chi-Square	9397.464
	df	1326
	Sig.	.000

Table 3.5 shows that the KMO & Bartlett's Test value is .943 which is greater than 0.6. Therefore, the data set is appropriate, which means the sampling numbers of this study are adequate for conducting PCA.

In order to determine the numbers of dimensions of self-directed learning, three criteria were used: scree plot, eigenvalues and interpretability of dimensions. The solution that seems best according to all these criteria should be subjected to a further investigation into the meaningfulness of the dimensions (Schönrock-Adema et al., 2009). A scree plot shows the eigenvalues on the y-axis and the number of factors or dimensions on the x-axis. It always displays a downward curve. The point where the slope of the curve is clearly leveling off indicates the numbers of dimensions that should be generated by the analysis (Ledesma et al., 2015). The researcher can inspect the shape of the resulting curve in order to detect the point at which the curve changes drastically. This point on the curve indicates the maximum number of components to retain (Ledesma et al., 2015). After determining numbers of dimensions from a scree plot, eigenvalues were also considered. Eigenvalues refer to the variances explained or accounted for. An eigenvalue reflected the proportion of variance explained by the component. According to determination based on eigenvalues, only dimensions with eigenvalue greater than 1.0 were retained (Field, 2017; Rietveld & van Hout, 2011).

This is because a dimension with an eigenvalue of 1 accounts for as much variance as a single variable, and the logic is that only dimensions that explain at least the same amount of variance as a single variable is worth keeping. The third criterion for determining dimensions was interpretability which required two steps: 1) A given component contains at least three variables with significant loadings and a loading of 0.40 being suggested as the cut-off point (Schönrock-Adema et al., 2009). Variables loading on the same component share the same conceptual meaning based on theoretical framework of self-directed learning.

After running data in a statistical program, a scree plot (Figure 3.2) shows that it was gradually flattens from the second dimension. This drop occurs after the second dimensions and consequently, two dimensions should be retained.

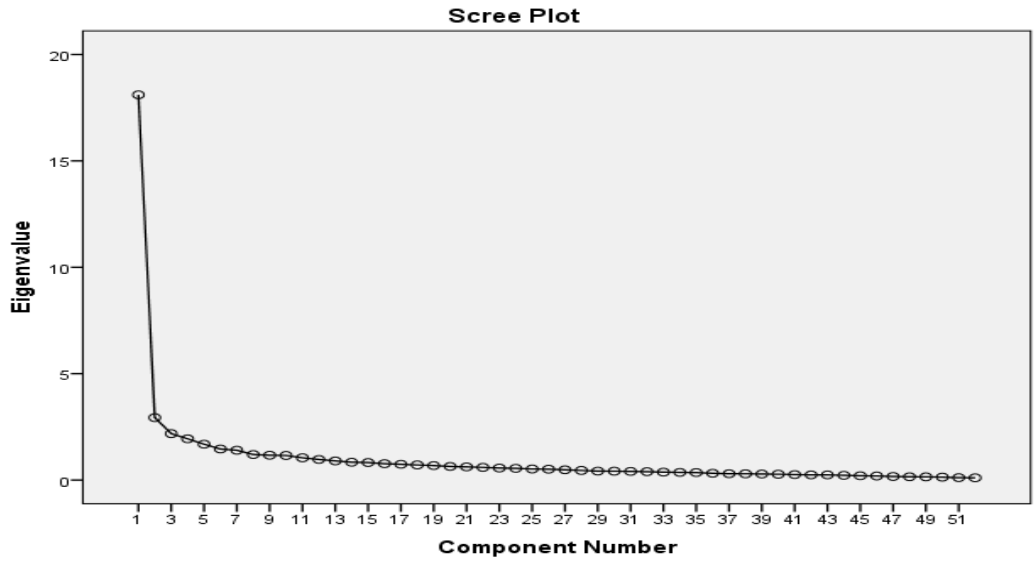

Figure 3.2 Scree Plot of Eigenvalues

Figure 3.2 shows that dimensions of self-directed learning should be extracted to two dimensions. Then, in order to gain more comprehensive interpretation of the scree plot and promote better decision making by considering other important aspects in the results, the scree plot was considered together with another statistical criterion: eigenvalues (Table 3.6).

Table 3.6 First 11 Eigenvalues of Unrotated Factor Analysis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.105	34.818	34.818	18.105	34.818	34.818
2	2.933	5.640	40.458	2.933	5.640	40.458
3	2.181	4.194	44.652	2.181	4.194	44.652
4	1.938	3.727	48.379	1.938	3.727	48.379
5	1.684	3.238	51.617	1.684	3.238	51.617
6	1.458	2.804	54.421	1.458	2.804	54.421
7	1.401	2.694	57.115	1.401	2.694	57.115
8	1.199	2.305	59.420	1.199	2.305	59.420
9	1.167	2.245	61.665	1.167	2.245	61.665
10	1.156	2.223	63.889	1.156	2.223	63.889
11	1.045	2.010	65.898	1.045	2.010	65.898

Note: Extraction Method: Principal Component Analysis.

Table 3.6 shows that the initial model contains 11 dimensions which obtaining more than 1.0 eigenvalues. The 11 dimensions accounted for 65.90% of the whole variance. which means that the variance of variables which explained by all eleven dimensions was accounted for 65.90%. However, it is important to keep in mind that one of the reasons for running PCA is to reduce the large number of variables that describe a complex concept to a few interpretable latent factors or dimensions. In other words, it is important to find a smaller number of interpretable dimensions that explain the maximum amount variability in the data.

Since the scree plot shows that self-directed learning should be extracted to two dimensions, yet the cumulative of two dimensions as reported in eigenvalues accounted for only 40.46%, which seemed to be inappropriate for conducting factor analysis. In the humanities research, the explained variance is commonly as 50-60%

(Pett, Lackey, & Sullivan, 2003, as cited in Williams et al., 2012). Therefore, the appropriate numbers of dimensions were according to cumulative percent of variance more than 50%, which was five-dimension solution. It was found that the initial factor analysis step has unclear numbers of factors or dimensions, that is the numbers of dimensions were ambiguous between two and eleven dimensions Then, varimax rotation was used as the second step which involves adjusting the coordinates of data that result from a principal component analysis. Varimax rotation was used to ensure that most variables have high loadings on the most important dimensions and small loadings on all other dimensions (Field, 2017). Factor rotation, including varimax rotation, transforms the initial factors into new ones that are easier to interpret (Allen, 2017) The varimax rotation is a popular orthogonal rotation method for social sciences research that minimizes the number of variables that have high loadings on each factor (Brown, 2009). This method simplifies the interpretation of the dimensions.

In varimax rotation process, the numbers of dimensions were fixed from five to eleven dimensions to see whether five, six, seven, eight, nine, ten, and eleven-dimension solution would be the best solution to interpret. The numbers of dimensions were fixed from five to eleven because the appropriate numbers of dimensions were according to cumulative percent of variance more than 50%. Therefore, five-dimension solution were chosen to be extracted first because of the dimension structure (cumulative percentage) accounted for 51.62% (See Table 3.6). The results of varimax rotation showed that five-dimension solution would be appropriate to interpret. Other solutions were not considered because the components contain less than three variables with a loading of 0.40 The five-dimension solution would be appropriate to interpret because cumulative percent of variance is more than 50%.; components contain more than three variables with a loading of 0.40; and variables loading on the same component share the same conceptual meaning based on theoretical framework of self-directed learning.

Table 3.7 reports the rotated dimension pattern for the five-dimension solution.

Table 3.7 Rotated Dimension Pattern for the 5-factor Solution (Varimax Rotation)

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
SDL49	.716				
SDL48	.668				
SDL52	.631				
SDL50	.593				
SDL27	.586			.325	
SDL44	.576		.391		
SDL31	.550				
SDL45	.530			.303	
SDL51	.512				
SDL26	.493				
SDL47	.493				.373
SDL37	.470		.452		
SDL30	.461				
SDL29	.443			.418	
SDL43	.438		.344		.413
SDL22		.772			.306
SDL21		.736			.335
SDL18		.733			
SDL19		.722			
SDL20		.677			
SDL23		.627			
SDL17	.301	.563			
SDL13		.385	.385	.308	
SDL7			.732		
SDL15			.679		
SDL10			.630		
SDL8			.607		

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
SDL14			.591	.346	
SDL12		.335	.523		
SDL25	.461		.497		
SDL3			.494		
SDL11			.447	.377	
SDL6			.439	.402	
SDL16		.409	.418		
SDL9				.280	.252
SDL4			.406	.649	
SDL5			.435	.607	
SDL42	.334			.599	
SDL40	.396			.584	
SDL38	.380			.518	
SDL2		.367		.511	
SDL24		.477		.497	
SDL28	.334			.491	.388
SDL41	.300			.489	.337
SDL1			.325	.443	
SDL39				.434	.375
SDL46	.334			.388	.355
SDL36			.301		.747
SDL35		.306			.730
SDL32					.710
SDL34					.693
SDL33		.326			.688

Note: Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 9 iterations.

The rotated pattern for the five dimensions shown in Table 3.7 shows that there are 49 items contains factor loadings higher than 0.4. Hence, 3 items with lower factors loadings than 0.4 were deleted. The factor structure is reported in Table 3.8.

Table 3.8 Factor Analysis of the Self-directed Learning Dimension

No	Items	D1	D2	D3	D4	D5
Dimension 1: Learning with intention						
49	I like to make decisions by myself	.716				
48	I need minimal help to find information	.668				
52	I need to be in control of what I learn	.631				
50	I prefer to set my own goals	.593				
27	I have high personal standards	.586				
44	I prefer to set my own criteria on which to evaluate my performance	.576				
31	I am confident in my ability to search out information	.550				
45	I am responsible for my own decisions/actions	.530				
51	I am in control of my life	.512				
26	I have high personal expectations	.493				
47	I can find out information by myself	.493				
37	I set specific times for my study	.470				
30	I am assertive	.461				
29	I am aware of my own limitations	.443				
43	I evaluate my own performance	.438				
Dimension 2: Open-mindedness						
22	I am open to new ideas		.772			
21	I am open to new learning opportunities		.736			
18	I am willing to accept advice from others		.733			
19	I learn from my mistakes		.722			

No	Items	D1	D2	D3	D4	D5
20	I will alter my practices when presented with the facts		.677			
23	When facing with a problem, I cannot solve, I will ask for assistance		.627			
17	I will ask for help in my learning when necessary		.563			
Dimension 3: Characteristics of self-discipline						
7	I prefer to plan my own learning			.732		
15	I prefer to set my own learning goals			.679		
10	I learn by myself systematically			.630		
8	I prefer to direct my own learning			.607		
14	I critically evaluate new ideas			.591		
12	I often review the way working practices are conducted			.523		
25	I like to evaluate what I do			.497		
3	I like to solve (answer) puzzles/questions			.494		
11	I am able to focus on a problem			.447		
6	I set strict time frames			.439		
16	I am willing to change my ideas			.418		
Dimension 4: Characteristics of self-management						
4	I manage my time well				.649	
5	I have good management skills				.607	
42	I am methodical				.599	
40	I am organized				.584	
38	I am self-disciplined				.518	
2	I prioritize my work				.511	
24	I am a responsible person				.497	
28	I have high beliefs in my abilities				.491	
41	I am logical				.489	
1	I plan when solving problems				.443	

No	Items	D1	D2	D3	D4	D5
39	I like to gather the facts before I make a decision				.434	
Dimension 5: Desire to learn						
36	I enjoy learning about new information					.747
35	I want to learn about new information					.730
32	I enjoy studying					.710
34	I enjoy a challenge					.693
33	I have a need to learn					.688

As shown in Table 3.8, there are five salient dimensions of self-directed learning among Thai employees. They include 1) Learning with intention; 2) Open-mindedness; 3) Characteristics of self-discipline; 4) Characteristics of self-management; and 5) Desire to learn.

3.4.1 Dimension 1 Learning with Intention

There are 15 important loading features in this dimension. They are all positive loadings. This dimension contains item 49 (I like to make decisions by myself), 48 (I need minimal help to find information), 52 (I need to be in control of what I learn), 50 (I prefer to set my own goals), 27 (I have high personal standards), 44 (I prefer to set my own criteria on which to evaluate my performance), 31 (I am confident in my ability to search out information), 45 (I am responsible for my own decisions/actions), 51 (I am in control of my life), 26 (I have high personal expectations), 47 (I can find out information by myself), 37 (I set specific times for my study), 30 (I am assertive), 29 (I am aware of my own limitations), and 43 (I evaluate my own performance). Item 49 obtains the highest loading in this factor (.716). All of these important loading variables relate to learning by setting their own goal and trying to reach that goal. They can control themselves and are comfortable to search information they want. Therefore, this dimension is labelled as “Learning with Intention”.

3.4.2 Dimension 2 Open-mindedness

There are 7 important loading features in this dimension. They are all positive loadings. This dimension contains item 22 (I am open to new ideas), 21 (I am open to new learning opportunities), 18 (I am willing to accept advice from others), 19 (I learn from my mistakes), 20 (I will alter my practices when presented with the facts), 23 (When facing with a problem, I cannot solve, I will ask for assistance), and 17 (I will ask for help in my learning when necessary). Item 21 obtains the highest loading in this factor (.772). All important loading variables relate to openness to new ideas, new things, mistakes, advice and assistance from others; so, this dimension is named as "Open-mindedness".

3.4.3 Dimension 3 Characteristics of Self-discipline

There are 11 important loading features in this dimension. They are all positive loadings. This dimension contains item 7 (I prefer to plan my own learning), 15 (I prefer to set my own learning goals), 10 (I learn by myself systematically), 8 (I prefer to direct my own learning), 14 (I critically evaluate new ideas), 12 (I often review the way working practices are conducted), 25 (I like to evaluate what I do), 3 (I like to solve (answer) puzzles/questions), 11 (I am able to focus on a problem), 6 (I set strict time frames), and 16 (I am willing to change my ideas). Item 7 obtains the highest loading in this factor (.732). The majority of these important loading variables relate to learning responsibly and orderly. Therefore, this dimension is defined as "Characteristics of self-discipline".

3.4.4 Dimension 4 Characteristics of Self-management

There are 11 important loading features in this dimension. They are all positive loadings. This dimension contains item 4 (I manage my time well), 5 (I have good management skills), 42 (I am methodical), 40 (I am organized), 38 (I am self-disciplined), 2 (I prioritize my work), 24 (I am a responsible person), 28 (I have high beliefs in my abilities), 41 (I am logical), 1 (I plan when solving problems), and 39 (I like to gather the facts before I make a decision). Item 4 obtains the highest loading in this factor (.649). All important loading features related to problem-solving skill and

good management skills, so this dimension is labelled as “Characteristics of self-management”.

3.4.5 Dimension 5 Desire to Learn

There were five important loading features in this dimension. They are all positive loadings. This dimension contains item 36 (I enjoy learning about new information), 35 (I want to learn about new information), 32 (I enjoy studying), 34 (I enjoy a challenge), and 33 (I have a need to learn). Item 36 contained the highest loading in this factor (.747). The majority of these important loading variables shows that employees love and enjoy learning. In addition, they are eager and happy to learn. Therefore, this dimension is named as “Desire to learn”.

3.5 The Discussion of Self-Directed Learning

According to the results, Thai employees working in the listed companies of SET prefer to learn directly by themselves in five different dimensions. The five dimensions included 1) Learning with intention; 2) Open-mindedness; 3) Characteristics of self-discipline; 4) Characteristics of self-management; and 5) Desire to learn. It can be implied that Thai employees have positive attitude towards self-directed learning since they intend to learn, and they are broad-minded to learn from new things and other people. In addition, Thai employees are characterized as good self-discipline and management to learn by themselves. As Freedman (1985) stated, the adult learners are motivated enough to want further education at the end of working day (Manning, 2007). Thai employees nowadays tend to learn directly by themselves because of some reasons. Some of them learn because they want to know something, while others may learn because they want to be higher in their working positions (Ellinger, 2004). This means that motivation is one of pivotal factors affecting self-directed learning. As indicating in the study of (Heo & Han, 2018), motivation seemed to be a significant predictor and had influence on self-directed learning readiness among online students (Heo & Han, 2018). Therefore, employees who was motivated to learn new things or get better in their works seemed to be characterized as self-directed learners. In addition, it was also found that one of

prominent factors motivating computing students to learn on their own was projected-related tasks (Mccartney, Boustedt, Eckerdal, Sanders, Thomas, & Zander, 2016). IT employees who was regularly provided to complete numerous project tasks might be motivated to readily learn on their own. Nevertheless, it is the fact that lifelong learners have a previous experience in on-campus taught courses before they start to learn by themselves. They were taught from their schools or university courses, and this can lead them know how they can learn by themselves. Learners possibly have been instructed, and then they can continue to find more information or learn with the help of computers. If they were not guided to learn, it would be difficult for them to learn with self-directedness. Therefore, most of employees who had previous experiences to learn in courses may perceive that self-directed learning was important. They probably learn by themselves easily and have positive attitudes towards self-directed learning. In addition, employees working in the listed companies of SET may employ self-directed learning strategies and skills to make future plan or solve problem for their works. Therefore, they tended to learn with self-directedness frequently. Compared to previous studies in Thailand (Thanapong Sombat et al., 2014; Sriarunrasmee et al., 2015; Suknaisith, 2014). Thai employees and students tended to have same styles of self-directed learning. They have positive attitudes towards self-directed learning; and see that self-directedness is important (Sombat et al., 2014). Yet, Thai students were high in learning with creativeness, while it was not found among Thai employees. This is probably because students are younger than employees. They are in generation of designing new things, so they learn creatively. On the other hand, employees are well skilled. They are surrounded by rules, regulations and laws. They have encountered rejections and failure, so they have to only finish work on time. Creativeness may not be needed during their working. Because of these, learning with creativeness have not found in adult-learning research. Other than this point, it was revealed that learning with self-discipline and self-management were found in this study, but rarely found in the study of self-directed learning among students (Klunklin et al., 2010a). Since the students are younger, they possibly have less skills on management and responsibility. Thus, organizations should concern witch the styles of self-directed learning and support employees to learn by themselves in order to improve working ability and skills.

3.6 The Differences of Self-Directed Learning between IT and Non-IT Employees

For this section, an explanation of how IT and non-IT employees learn differently was provided. This section may be helpful for organizations in order to design course or curriculum for increasing self-directed learning behavior. Since IT and non-IT employees are differently in terms of their studying field, the characteristics of self-directed learning may need to be distinguished. Generally, IT employees are responsible for developing information system, while non-IT employees are users for those systems. IT and non-IT employees were described in detail as follow:

1) IT employees are referred to employees working in listed companies in The Securities Exchange of Thailand (SET) and graduated in Information Technology (IT) field such as Computer Science, Computer Engineering, Information Technology, Information System and Software Engineering, and related field.

2) Non-IT employees can be defined as employees working in listed companies in The Securities Exchange of Thailand (SET). They did not graduate in Information Technology (IT) field and did not work in IT field.

Table 3.9 Independent Sample T-test of Self-Directed Learning between IT and Non-IT Employees

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Learning with intention	Equal variances not assumed	2.16	259	0.03	0.26	0.12	0.02	0.50
Open-mindedness	Equal variances assumed	-1.29	259	0.20	-0.16	0.12	-0.40	0.08
Characteristics of self-discipline	Equal variances assumed	-0.29	259	0.77	-0.37	0.13	-0.29	0.21
Characteristics of self-management	Equal variances assumed	0.16	259	0.88	0.02	0.12	-0.22	0.26
Desire to learn	Equal variances assumed	0.23	259	0.82	0.03	0.12	-0.21	0.27

The independent t-test was run to compare dimension scores of self-directed learning between IT and non-IT employees. According to Levene's test of equality of variances, F-test showed that p value for dimension 1 (Learning with intention) was 0.03 which was less than 0.05, so the equal variances not assumed was selected to present. On the other hand, F-test showed that p values for another four dimensions (Open-mindedness, Characteristics of self-discipline, Characteristics of self-management, and Desire to learn) were greater than 0.05, so the equal variances assumed was considered to present. As Table 3.9 shows, the significance of dimension 1 (Learning with intension) was 0.03 which was less than 0.05. The significant values for dimensions 2-5 were greater than 0.05. It can be concluded that there was a significant difference of Learning with intention between IT and Non-IT employees, which means IT and non-IT employees were significantly different in self-directed learning styles.

Table 3.10 Mean and Standard Deviation of Dimensions of Self-Directed Learning between IT and Non-IT Employees

Factors	**IT**		**Non-IT**	
	Mean	**SD**	**Mean**	**SD**
Learning with intention	3.93	0.49	3.96	0.48
Open-mindedness	4.37	0.46	4.34	0.52
Characteristics of self-discipline	3.98	0.47	3.90	0.51
Characteristics of self-management	4.07	0.44	4.00	0.51
Desire to learn	4.25	0.60	4.24	0.60

In order to understand insight details of differences, descriptive statistics was used to examine whether IT or non-IT employees are better in Learning with intention. As Table 3.10 shows, mean score of Dimension 1 (Learning with intention) of IT employees is 3.93, while mean score of non-IT employees is 3.96. Hence, the score of non-IT employees in Dimension 1 (Learning with intention) was more than the score of IT employees. This means that non-IT employees tend to learn with intention more than IT employees.

3.6.1 The Discussion of Differences of Self-Directed Learning between IT and Non-IT Employees

Among five dimensions, there were only one dimensions which IT and non-IT employees were different: Learning with intention. This means that IT workers were lower in setting their own goals and criteria to evaluate themselves than non-IT employees. This can be understandable since IT workers have studied and work with technology more than non-IT workers. As mentioned above, previous experiences in taught courses may affect employees' learning styles (Mccartney et al., 2016). IT employees graduated in IT field or regularly encountered with IT experiences. They worked with the most of typical IT tasks, and they can learn from computers quickly. They seemed to be familiar with technology and learn through technology normally. Because of this, IT employees seemed to be confident with their ability to learn and learn unintentionally. Their learning through technology seems to be common activity for them. They may not need to set their own goals to learn and set their criteria to measure what they have learn because they were proficient in learning from computer and technology. In addition, they do not need help to find information. So, there was a significant difference in Learning with intention styles between IT and non-IT employees. This means that non-IT employees learn more intentionally than IT employees because non-IT employees tend to attempt and intend to learn with computers and technology which they are not familiar with.

In conclusion, this chapter describes the results of investigating self-directed learning dimensions of Thai employees and find differences between IT and non-IT employees. The results showed that there were five dimensions of self-directed learning styles including 1) Learning with intention; 2) Open-mindedness; 3) Characteristics of self-discipline; 4) Characteristics of self-management; and 5) Desire to learn. Since educational backgrounds and previous experiences seemed to influence on their learning, IT and non-IT workers were different in Dimension 1: Learning with intention. It was revealed that non-IT employees tended to learn with intention more than IT employees.

CHAPTER 4

THE INFLUENCE OF SELF-DIRECTED LEARNING ON THE AWARENESS OF GREEN ICT

4.1 Rationale of the Study about the Influence of Self-Directed Learning on the Awareness of Green ICT

The main purpose of this research study is to investigate dimensions of awareness on Green ICT and find the way to increase awareness of employees. The awareness seemed to be the state of inner and awareness of adults can be increased by encouraging them to acquire knowledge (Masiuliene et al., 2015). Employees, as samples of this study, are adults and have the ability to evaluate what is genuinely best for them. They may be no longer needed to rely on others. Therefore, self-directed learning tended to help employees perceived that Green ICT is important and it may help employees become aware of this issue. The results in Chapter 3 showed that five dimensions of self-directed learning include Learning with intention; Open-mindedness; Characteristics of self-discipline; Characteristics of self-management; and Desire to learn. It can be assumed that employees had positive behavior on self-directed learning. This means that employees intended to learn, learned with open-mindedness, had self-discipline and self-management, and desired to learn by themselves. Since employees were positive to learn, encouraging employees to learn by themselves may be the best way to educate employees and help increasing awareness. Therefore, studying the influence of self-directed learning on awareness of Green ICT may highlight of what dimensions of self-directed learning specifically affect awareness on Green ICT.

4.2 The Multicollinearity of Variables

Research question 3: Does self-directed learning have a significant influence on awareness of Green ICT among employees?

A multiple regression was conducted to find out whether self-directed learning affect awareness on Green ICT or not. Before running a multiple regression, it was necessary to check the assumption of correlation of these two variables. An important step in a multiple regression analysis is to ensure that the assumption of multicollinearity has not been met. Multicollinearity is a statistical phenomenon in which two or more predictor variables in a multiple regression model are highly correlated (Plotts, 2011). In this step, dimension scores of these two variables: awareness on Green ICT and self-directed learning were used to test Pearson Correlation in order to prove multicollinearity of variables. The results were shown in Table 4.1.

Table 4.1 The Relationship among Dimensions of Awareness on Green ICT

Variables	Saving energy and Avoiding using wasteful paper	Using reusable and recyclable equipment and Upgrading devices	Using saving energy function
Saving energy and Avoiding using wasteful paper	1	.000	.000
Using reusable and recyclable equipment and Upgrading devices		1	.000
Using saving energy function			1

As displayed in Table 4.1, Pearson Correlations are calculated among three dimensions of awareness on Green ICT. The output shows that the correlation do not exist among these three variables (r=.00). This means that the multicollinearity among three dimensions of awareness on Green ICT variables was not found, and the assumption was proved.

Table 4.2 The Relationship among Types of Self-directed Learning

Variables	Learning with intention	Open-mindedness	Characteristics of self-discipline	Characteristics of self-management	Desire to learn
Learning with intention	1	.000	.000	.000	.000
Open-mindedness		1	.000	.000	.000
Characteristics of self-discipline			1	.000	.000
Characteristics of self-management				1	.000
Desire to learn					1

As displayed in Table 4.2, Pearson Correlations are calculated among five dimensions of self-directed learning. The output shows that the correlation do not exist among these five variables (r=.00). This means that the multicollinearity among five dimensions of self-directed learning was not found, and the assumption was proved.

Since the basic assumption was tested, there was no multicollinearity among the two variables: awareness on Green ICT and self-directed learning. A multiple regression continued to run in order to investigate influence of self-directed learning on the awareness on Green ICT. The dependent variables were dimension scores on awareness of Green ICT, and the predictors were dimension scores of self-directed learning. The results of the multiple regression were illustrated below.

4.3 The Results of Influence of Self-Directed Learning on Awareness on Green ICT

4.3.1 The Influence of Self-directed Learning on Awareness of Green ICT Dimension 1

A multiple regression analysis was run to find the influence of self-directed learning on awareness of Green ICT Dimension 1. The results were described in Table 4.3.

Table 4.3 The Influence of Self-Directed Learning on Awareness of Green ICT Dimension 1

Self-directed Learning	Beta	t	Sig.
1 (Constant)			.999
Learning with intention	.119	2.112	.036*
Open-mindedness	.286	5.057	.000***
Characteristics of self-discipline	-.012	-.211	.833
Characteristics of self-management	.118	2.087	.038*
Desire to learn	.124	2.193	.029*

Note:*** = p< .001
* = p< .05

As shown in the output, there are four dimensions of self-directed learning influence on awareness of Green ICT Dimension 1 (Saving energy and Avoiding using wasteful paper): Learning with intention (p< .05, beta = .119), Open-mindedness (p< .001, beta = .286), Characteristics of self-management (p< .05, beta = .118), and Desire to learn (p< .05, beta = .124). The most influencing self-directed learning is Open-mindedness because standardized beta values from evaluating of Open-mindedness was the highest among self-directed variables (.286). In addition, the beta value showed a positive relation, which means, if employees learn by themselves highly with open-mindedness, they will be more aware on saving energy and avoiding using wasteful paper. The results of a multiple regression analysis indicated that awareness of Green ICT Dimension 1 (Saving energy and Avoiding using wasteful paper) has a low correlation with Learning with intention, Open-mindedness, Characteristics of self-management, and Desire to learn (r=.354). These four self-learning dimensions accounted for 11.2% of the variance (R^2 = .125, adjusted R^2 =.112, F (4, 274) = 9.799, p<.001) (see Appendix M).

4.3.2 The Influence of Self-Directed Learning on Awareness of Green ICT Dimension 2

A multiple regression analysis was run to find the influence of self-directed learning on awareness of Green ICT Dimension 2. The results were described in Table 4.4.

Table 4.4 The Influence of Self-directed Learning on Awareness of Green ICT Dimension 2

Self-directed Learning	Beta	t	Sig.
1 (Constant)			.999
Learning with intention	.255	4.445	.000***
Open-mindedness	-.007	-.118	.906
Characteristics of self-discipline	.160	2.783	.006*
Characteristics of self-management	.061	1.058	.291
Desire to learn	-.021	-.366	.715

Note: *** = p< .001
* = p< .05

As shown in the output, there are only two dimensions of self-directed learning influence on awareness of Green ICT Dimension 2 (Using reusable and recyclable equipment and Upgrading devices): Learning with intention (p< .001, beta = .255), and Characteristics of self-discipline (p< .05, beta = .160). The most influencing self-directed learning is Learning with intention because standardized beta values from evaluating of Learning with intention was the highest among self-directed variables. In addition, the beta value showed a positive relation, which means, if employees learn with intention highly, they will be more aware on using reusable and recyclable equipment and upgrading devices. The results of a multiple regression analysis indicated that awareness of Green ICT Dimension 2 (Using reusable and

recyclable equipment and Upgrading devices) has a low correlation with Learning with intention and Characteristics of self-discipline (r=.301). These two self-directed learning dimensions accounted for 8.4% of the variance (R^2 = .091, adjusted R^2 =.084, F (2, 276) = 13.750, p<.001) (see Appendix N).

4.3.3 The Influence of Self-Directed Learning on Awareness of Green ICT Dimension 3

A multiple regression analysis was run to find the influence of self-directed learning on awareness of Green ICT Dimension 3. The results were described in Table 4.5.

Table 4.5 The Influence of Self-directed Learning on Awareness of Green ICT Dimension 3

Self-directed Learning	Beta	t	Sig.
1 (Constant)			.999
Learning with intention	.079	1.424	.156
Open-mindedness	.118	2.119	.035*
Characteristics of self-discipline	.205	3.686	.000***
Characteristics of self-management	.302	5.425	.000***
Desire to learn	.070	1.267	.206

Note:*** = p< .001
* = p< .05

As shown in the output, there are three dimensions of self-directed learning influence on awareness of Green ICT Dimension 3 (Using saving energy function): Open-mindedness (p< .05, beta = .118), Characteristics of self-discipline (p< .001, beta = .205), and Characteristics of self-management (p< .001, beta = .302). The most influencing self-directed learning is Characteristics of self-management because

standardized beta values from evaluating of Characteristics of self-management was the highest among self-directed variables. In addition, the beta value showed a positive relation, which means, if employees have self-management in self-directed learning, they will be more aware on Using saving energy function. The results of a multiple regression analysis indicated that awareness of Green ICT Dimension 3 (Using saving energy function) has a low correlation with Open-mindedness, Characteristics of self-discipline, and Characteristics of self-management (r=.384). These three dimensions of self-directed learning accounted for 13.8% of the variance (R^2 = .147, adjusted R^2 =.138, F (3, 275) = 15.836, p<.001) (see Appendix O).

Therefore, research question 3: Does self-directed learning have a significant influence on awareness of Green ICT among employees? was answered. In addition, Ha1: There is a significant influence of self-directed learning on awareness of Green ICT, was approved. In summary, Learning with intention, Open-mindedness, Characteristics of self-management, and Desire to learn influenced awareness of Green ICT Dimension 1 (Saving energy and Avoiding using wasteful paper), while Characteristics of self-discipline did not influence this dimension. The results also implied that the employees will be more aware on saving energy and avoiding using wasteful paper if they learn with high open-mindedness. In addition, Learning with intention and Characteristics of self-discipline influenced awareness of Green ICT Dimension 2 (Using reusable and recyclable equipment and Upgrading devices), while Open-mindedness, Characteristics of self-management, and Desire to learn did not influence this dimension. The results also revealed that the employees will be more aware on using reusable and recyclable equipment and upgrading devices if they learn with high intention. Furthermore, Open-mindedness, Characteristics of self-discipline, and Characteristics of self-management influenced on awareness of Green ICT Dimension 3 (Using saving energy function), while Learning with intention and Desire to learn did not influence this dimension. The results also showed that the employees will be more aware on using saving energy function if they learn with high self-management. The summarization and discussion of self-directed learning on awareness of Green ICT were provided in section 4.4.

4.4 The Discussion of Influence of Self-Directed Learning on Awareness of Green ICT

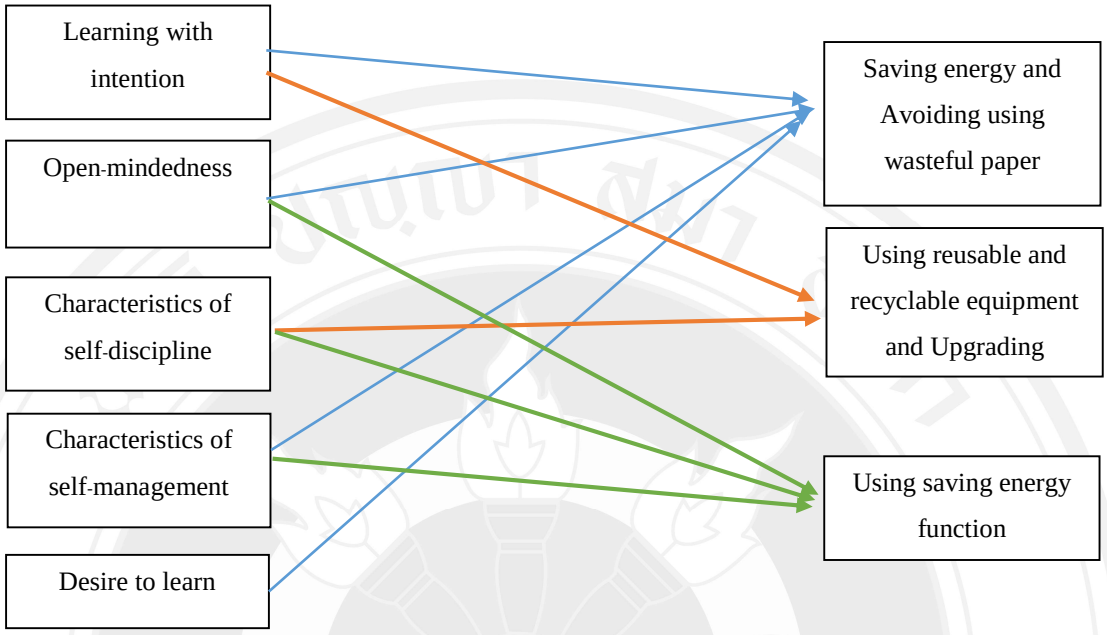

Figure 4.1 Model Summary of the Discussion of Influence of Self-directed Learning on awareness of Green ICT

According to model summary in Figure 4.1, awareness on Green ICT Dimension 1 (Saving energy and Avoiding using wasteful paper) was influenced by self-directed learning Dimension 1 (Learning with intention), self-directed learning Dimension 2 (Open-mindedness), self-directed learning Dimension 4 (Characteristics of self-management) and self-directed learning Dimension 5 (Desire to learn). It was also found that awareness on Green ICT Dimension 2 (Using reusable and recyclable equipment and Upgrading devices) was influenced by self-directed learning Dimension 1 (Learning with intention) and self-directed learning Dimension 3 (Characteristics of self-discipline). In addition, awareness on Green ICT Dimension 3 (Using saving energy function) was influenced by self-directed learning Dimension 2 (Open-mindedness), self-directed learning Dimension 3 (Characteristics of self-discipline), and self-directed learning Dimension 4 (Characteristics of self-management).

4.4.1 The Discussion of the Influence of Self-Directed Learning on Awareness of Green ICT Dimension 1

The claim that Saving energy and Avoiding using wasteful paper is influenced by self-directed learning Dimension 1 (Learning with intention), self-directed learning Dimension 2 (Open-mindedness), self-directed learning Dimension 4 (Characteristics of self-management) and self-directed learning Dimension 5 (Desire to learn) may be criticized because most of self-directed learning styles (4 out of 5) affected this dimension of awareness on Green ICT. This means that awareness on Green ICT can be increased if the employees learn independently. These four dimensions of self-directed learning affected this dimension of awareness on Green ICT might be because of two reasons. Firstly, since energy and paper consumption are one of the most direct and visible impacts to the environment made in corporate offices (Standard Chartered Bank, 2010). Then, the employees seemed to be familiar with this dimension, and frequently save energy and realize wasting paper usage. Moreover, when they learn with themselves and embedded with intention, open-mindedness, self-management, and desire to learn, they may easily concern this dimension since it surrounded them at workplace. Secondly, energy-leakage awareness implies a better education on sustainability, so education is key in this regard (Fitzpatrick & Smith, 2009). It is important to educate and train employees to prevent energy misusing since the education has somewhat relation to energy usage. So, it is not surprising that if employees gained more knowledge from self-directed learning, they will be more aware on saving energy and avoiding using wasteful paper.

4.4.2 The Discussion of the Influence of Self-Directed Learning on Awareness of Green ICT Dimension 2

The claim that Using reusable and recyclable equipment and Upgrading devices is influenced by self-directed learning Dimension 1 (Learning with intention) and self-directed learning Dimension 3 (Characteristics of self-discipline) may be criticized. From the results, it can be implied that the awareness on using reusable and recyclable equipment and upgrading devices can be increased if the employees learn with intention and have self-discipline. Since environmental problems force

companies to collect their end of life products for reuse, recycle and refurbishment (Kianpour, Josoh, Mardani, Steimilkiene, Cavalbara, Nor, and Zavadskas (2017), this dimension of awareness seems to be one of Green ICT campaign in the organizations. The previous studies have illustrated that the environment quality depends essentially on the level of people' s knowledge, attitude, values and their practices (Ajzen, 1991; Rahman & Subramanian, 2012). This could be referred that employees will be more aware on reusing, recycling, and upgrading devices when they gain much more knowledge and practices. They need to intend and have self-discipline to study in order to know much more to reuse, recycle, and upgrade equipment.

4.4.3 The Discussion of the Influence of Self-Directed Learning on Awareness of Green ICT Dimension 3

The claim that Using saving energy function is influenced by self-directed learning Dimension 2 (Open-mindedness), self-directed learning Dimension 3 (Characteristics of self-discipline), and self-directed learning Dimension 4 (Characteristics of self-management) may be criticized. This means that awareness on Using saving energy function can be increased if the employees learn with open-mindedness, self-discipline and self-management. Existing research on environmental behavior in the workplace shows that employees can be encouraged to adopt energy saving behaviors (Lo et al., 2012), yet, in general, employees intended to turn off their computers when they left their desk. The employees may switch things off when they think it is a good thing, and if the social norms of the workplace fit this behavior. However, using saving energy function is not a simple way as turning off computers, or switching off equipment, so the employees need to be educated the way or how to use those saving energy functions. Therefore, the employees who have intention, self-discipline and management seemed to acquire this dimension of awareness on Green ICT. This means that the employees should learn intentionally with self-discipline and management of what energy function is and how it works, then they will perceive the way of using saving energy function.

The results from this chapter shed light on how self-directed learning affected awareness on Green ICT. It may be helpful for designing guideline for increasing awareness on Green ICT which was provided in the next chapter.

CHAPTER 5

GUIDELINE TO INCREASE LEVEL OF AWARENESS ON GREEN ICT

Increasing awareness is important when the organizations prefer their employees to prioritize Green ICT. The developed guideline which was explained in this chapter probably becomes helpful for those who want to increase awareness on Green ICT. This chapter aims to answer research question 4: What is appropriate guideline to increase awareness on green ICT for employees? The details included introduction of the development process of building guidelines which combined with the review of literature about changing behavior, applying self-directed learning for increasing awareness on Green ICT and how to make this guideline trustworthy.

This chapter described the process of guideline development including the method of guideline development and the process of rehearsing and verifying. The details of guideline were also shown.

5.1 The Method of Guideline Development

The guideline was designed based on the applying of 1) The results of awareness on Green ICT 2) The results of self-directed learning 3) The results of influence of self-directed learning on awareness of Green ICT 4) The theoretical framework of change behavior and 5) Theories of andragogy

5.1.1 Applying the Results of Awareness on Green ICT Guideline

As shown in Chapter 2, three dimensions of awareness on Green ICT were found: 1) Saving energy and Avoiding using wasteful paper; 2) Reusing, Recycling, and Upgrading devices; 3) Using saving energy function. These dimensions seemed to be convenient, easy, cheap, and concrete way to save environmental resources. These three dimensions of Green ICT were needed to include in the guideline as topics for

employees to learn by themselves because when the employees initiatively learn from topics which they are familiar, they may perceive that Green ICT is simple way and they are easily to prepare their workplace become Green. So, the dimensions were brought to put as topics which employees needed to learn.

5.1.2 Applying Self-directed Learning on Green ICT Guideline

As shown in Chapter 3, Thai employees working in the listed companies of SET preferred to learn directly by themselves in five different dimensions. The five dimensions included 1) Learning with intention; 2) Open-mindedness; 3) Characteristics of self-discipline; 4) Characteristics of self-management; and 5) Desire to learn. It can be implied that Thai employees have positive attitude towards self-directed learning since they intend to learn, and they are broad-minded to learn from new things and other people. The main purpose of this study is to investigate dimensions of awareness on Green ICT and find the way to increase awareness of employees. The awareness seemed to be the state of inner and awareness of adults can be increased by encouraging them to acquire knowledge (Masiuliene et al., 2015). So, in the process of guideline development, level of awareness on Green ICT seemed to be increased by self-directed learning of employees. Self-directed learning tended to help employees perceived that Green ICT is important and it may help employees become aware of this issue. For this process, CEOs or managers, as leaders of the company, should play their roles as supporters to help employees willingly to learn by themselves or learn by e-learning.

5.1.3 Applying the Results of Influence of Self-Directed Learning on Awareness of Green ICT

It was insisted from the results of Chapter 4 that awareness of Green ICT was influenced by self-directed learning. The results of this section were applied in guideline in part of designing topics which employees educated and trained. The previous studies have illustrated that the environment quality depends essentially on the level of people' s knowledge, attitude, values and their practices (Ajzen, 1991; Rahman & Subramanian, 2012). If employees gained more knowledge from self-

directed learning, they will be more aware on saving energy and avoiding using wasteful paper, reusing, recycling, and upgrading devices, and using saving energy function. Therefore, these topics of Green ICT were mentioned in the guideline as topics for e-learning.

5.1.4 The Theoretical Framework of Change Behavior

Change seems to be important for organizations growing (Hussain et al., 2018). Concepts of change can describe the effectiveness of ability of the organizations to modify their strategies, processes, and structures. When the awareness of Green ICT among employees need to be increased, it means that the employees may change their behaviors which they act at their workplaces. Increasing awareness on Green ICT has to understand change behavior, so the concepts of change management will be applied in the guideline. Change management refers to the change or transitioning people, groups, and companies from one state to another (Anastasia, 2015). Change management involves the application of methods in order to steer business from its current state to a desired state. In order to manage change and implement change strategies, it is important to avoid implementing irrelevant or random methods and try to focus on a suitable plan of action. The models which was employed in guideline development were Lewin's change model and ADKAR model.

5.1.4.1 Lewin's Change Management Model

To begin any successful change process, it is important to start with understanding why the change must take place. As Lewin (1947, as cited in Cummings et al., 2016; Hussain et al., 2018) stated, motivation for change must be generated before change can occur. Lewin's change management model is one of the most popular and effective models for understanding organizational and structured change (Anastasia, 2015). The organizational change of Lewin's (1947, as cited in Cummings, Bridgman, & Brown, 2016; Hussain, Lei, Akram, Haider, Haider, Husain, & Ali, 2018) explains the movement of organization from the current state to desired future state. When there are changes to future state, the employees may concern of uncertainty and not support change unless they are convinced against their status quo (Cummings & Worley, 2007). Consequently, the organizations should take necessary actions in order to motivate employees. For this purpose, the model establishes

general steps which can be adapted to specific situations (Hussain et al., 2018). The model consists of three main stages: unfreeze, change and refreeze.

The first stage of the change process is unfreezing step which involves the preparation for the change. This means that the leaders or administrative of organizations have to prepare for the change and also for the fact that change is crucial and needed. This step is important because employees tend to resist change, and it is important to break this status quo. The key here is to explain to employees why the existing way needs to be changed and how change can bring about profit. This step also involves an organization looking into its core and re-examining it. The second step is changing step where the real transition or change takes place. This step may take time to happen since employees tend to spend time to adopt new things, developments, and changes. At this stage, good leadership and reassurance is important because this step does not only lead the employees to steer forward in the desired future state but also make the process easier for staff or individuals who are involved in the process. Hence, leadership and time seem to be pivotal factors for this stage to take place successfully. The final step is refreezing where the change has been accepted, embraced, and implemented by employees. This is the time that the employees and processes begin to refreeze, and things start going back to their normal pace and routine. Now with a sense of stability, employees get comfortable and confident of the acquired changes (Anastasia, 2015). These three steps of this model were summarized in Figure 7.1.

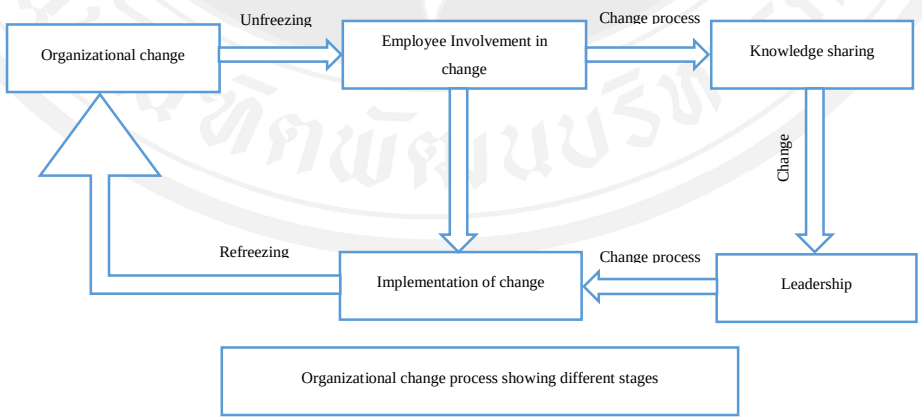

Figure 5.1 Model of Lewin's Organizational Change

Source: Adapted from Hussain et al. (2018).

5.1.4.2 ADKAR Model

ADKAR model is one of many change management models which can assist in the development of a cultural transition. This model focuses on individual change which provides a simple and action-oriented framework for taking control of change. Person can change their behaviors to the desired ways of working and directly related to the goals which they want to reach. This means that while using this model, an individual must get each of the outcomes or results so that the change can be sustained and implemented (Anastasia, 2015). The model can be used by administrative or leaders of the organizations to find out the various holes or gaps in the process of change management so that effective training can be offered to the employees. Prosci (2008, as cited in Goyal & Patwardhan, 2018) explained that effective management of the people requires managing five key goals of ADKAR model. The abbreviation of this model basically stands for: A is for Awareness of the need for change; D is for Desire to support and participate in the change; K is for Knowledge of how to change; A is for Ability to implement the change; R is for Reinforcement to sustain the change (Hiatt, 2006). These elements represent the most basic requirements for a person to achieve and sustain a change. Therefore, in order to make the change happening in the organizations, the administrative or leaders need to create awareness, desire, knowledge, ability, and reinforcement among every individual employee.

5.1.5 Theories of Andragogy

In addition to change behaviors, self-directed learning seems to be importance since the employees should have knowledge about Green ICT before they become aware of. Importantly, the results of the influence of self-directed learning on awareness of Green ICT revealed that dimensions of self-directed learning affected awareness on Green ICT significantly. Since the employees are adults, two predominant theories for adults learning which are applied in this guideline are Knowles' principles of andragogy and Bloom' taxonomy.

5.1.5.1 Knowles' Principles of Andragogy

Knowles' principles of andragogy have been the main theory of adult learning since this theory was put forward over 30 years ago and have relied on older

theories such as Abraham Maslow, Kurt Lewin and B.F. Skinner (Houde, 2006). Knowles' andragogy comprises of four principles including: 1) Adults need to be involved in the planning and evaluation of their instruction; 2) Instruction should be task-orientated instead of memorization – learning activities should be in the context of common tasks performed; 3) Adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life; 4) Adult learning is problem-centered rather than content-orientated.

The first principle of andragogy is "Adults need to be involved in the planning and evaluation of their instruction which can be implied that adults need to know why they need to learn something before undertaking it (Knowles, 1989). When adults learn by themselves, they spend a large amount of energy and time to understand the value of the new learning; either the benefit from learning or the consequence of not learning (Houde, 2006). The adult learner needs either to be told or to be led to discover why certain knowledge is worth learning. This means that adult learners will be motivated to learn if they make it clear that the learning is connected to goals they value and make clear their abilities to learn.

The second principle of andragogy states that the instruction should be task-orientated instead of memorization – learning activities should be in the context of common tasks performed. Andragogy asserts that adults have a need to be self-directing, and they tend to engage in education which they see this need being unfulfilled (Houde, 2006). Adults are more likely to pursue emotional regulating goals, while children are more likely to pursue knowledge related goals (Lang & Carstensen, 2002). Knowledge related goals are about future potential, while emotional regulating goals are present focused. Even in the pursuit of education, adults feel an urge to be responsible for themselves. While younger people are willing to forgo some autonomy in order to pursue knowledge, adults are not looking to exercise autonomy at the current time of a class while learning new knowledge.

The third principle of andragogy proposes that adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life. This means that adults have more and diverse experiences than children. Hence, the learner's experience is a valuable resource in the classroom. Knowles (1989) acknowledged that children have experience as well, but the

relationship between the adults and their experiences were different from the relationship between the children and their experiences. An adult derives self-identity from their experiences, where a child's identity tends to come from social connections, such as family, school, or sports teams. Because of the integral nature of prior experiences to the identity of the adult learner, when their experiences are ignored or devalued, adults will perceive this as rejecting (Knowles, 1989).

The final principle of andragogy mentions that adult learning is problem-centered rather than content-orientated. Since adults have diverse experiences, adult learners may prefer life-problem, or task-centered in their approach to learning. This means that task-centered would be considered more effective if the task is relevant to an important problem, and problem-centered would be most motivating when that problem is related to their lives (Houde, 2006). A task-or problem-oriented method would tap the energy or motivation to study, and consequently, lead to more productive learning (Houde, 2006).

5.1.5.2 Bloom's Taxonomy

Bloom's taxonomy is a set of models used to define and distinguish different levels of human cognition that is thinking, learning, and understanding. Bloom's taxonomy is a multi-tiered model of classifying thinking according to six cognitive levels of complexity (Forehand, 2011). It is a continuum from Lower Order Thinking Skills (LOTS) to Higher Order Thinking Skills (HOTS). Bloom describes each category as a noun including Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. They are arranged below in increasing order, from lower order to higher order.

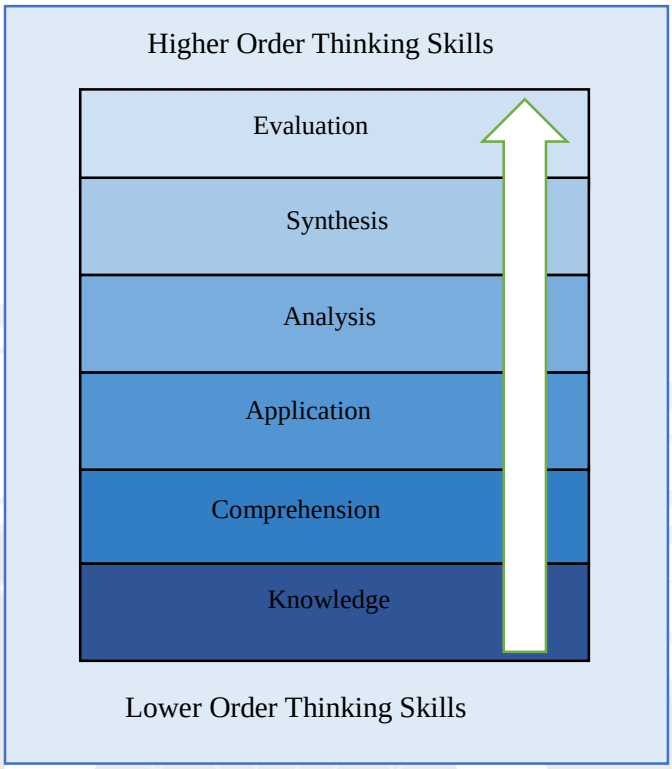

Figure 5.2 Model of Bloom's Taxonomy

Source: Adapted from Churches, (2008).

Then, in the 1990's, a former student of Bloom, Anderson and Krathwohl, revised Bloom's Taxonomy and published Bloom's revised taxonomy in 2001. The revised version includes Remembering, Understanding, Applying, Analyzing, Evaluating (Revised position) and Creating (Revised position). They are arranged below in increasing order, from lower order to higher order.

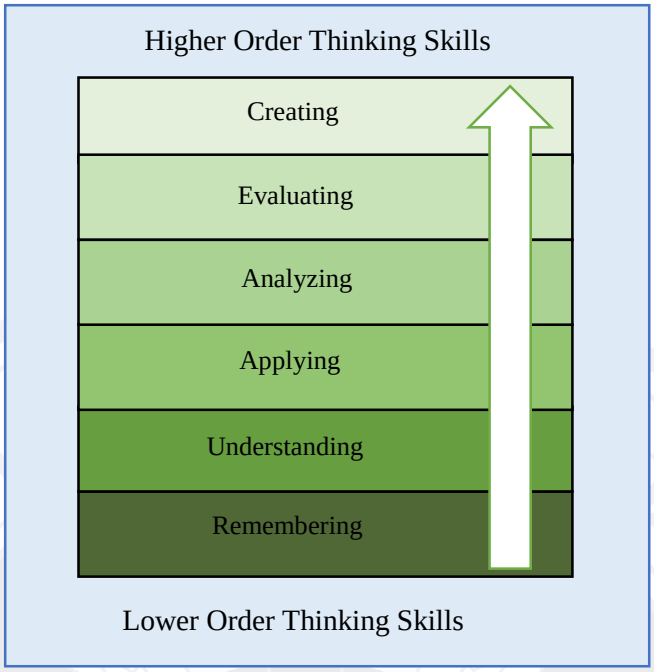

Figure 5.3 Model of Bloom's Revised Taxonomy

Source: Adapted from Churches, (2008).

Changes in terminology between the two versions are perhaps the most obvious differences (Forehand, 2011). Basically, Bloom's six major categories were changed from noun to verb forms. In addition, the lowest level of the original knowledge was renamed and became remembering. Finally, comprehension and synthesis were retitled to understanding and creating. Therefore, Bloom's learning process can be summarized that:

Before the learners can understand a concept, they have to remember it

Before the learners can apply the concept, they must understand it

Before the learners can analyze, they must be able to apply it

Before the learners can evaluate impacts, they must have analyzed it

Before the learners can create, they must have remembered, understood, applied, analyzed, and evaluated.

During decades, Bloom' s taxonomy has given rise to educational concepts. It has also been closely linked with multiple intelligences including problem solving skills, creating, critical thinking, and more recently technology integrating (Noble, 2004).

5.2 The Details of Guideline

The guideline was conducted in three phases: 1) Preparation to green, 2) Adaptation to green, and 3) Evaluation for green. In order to reduce confusion, the original version of guideline was conducted in Thai language. The details of guideline were described below.

5.2.1 Preparation to Green

Since Green ICT adoption may relate to innovation adaptation, one factor that can influence is change behavior and the resistance to change which may lead to the resistance to adopt an innovation (Kennedy, 2018). It is important for organizations to prepare their working areas before adapting Green ICT concept. The step of preparation to green is as way of preparing employees to be ready for increasing awareness. Employees are more motivated towards implementing change when they believe that the change happening is worthwhile and contribution is valuable (Bhatnagar, Budhwar, Srivastava, & Saini, 2010; Ryland & Sadler, 2008). This guideline attempts to make employees see importance of Green ICT, then they may change their behaviors to build Green ICT community. On this way, the employees would continually absorb the importance of Green ICT.

Hence, for preparation to green, the guideline followed basic concept of change acceleration process (Fullan, 2006; Lewin, 1947, as cited in Cummings et al., 2016; Hussain et al., 2018; Winter, 2012, as cited in Signe & Signe, 2017). Change acceleration process is for preparing organizations to accept the change of process (Tanya Pittayapitak & Thanyawich Vicheanpant, 2012). The results from Chapter 3 revealed that employees had positive attitudes towards self-directed learning and were ready to learn. So, at this stage, change acceleration process have to be considered for a successful change initiative to support employees to learn about Green ICT by

themselves. Employees must see the need for change in order for an initiative to be accepted and worked at. When they are opened to learn, they will be gradually convinced that Green ICT is important for them. Change acceleration process is the beginning process for moving the current state of the process to an improved state by catalyzing (speeding up) (Fullan, 2006). It may be the process to change organizations to become Green ICT community. This process consists of two parts: 1) creating environment for learning and 2) being supporters for employees.

According to Scofield, 1997, adult learners are motivated to learn if there is a preparation for learning environment for them. Adult learners, not like young learners, feel relax to learn if they perceive that the environment surrounding them is suitable to learn. As Cummings and Worley (2007) suggested, when there are changes to future state, the employees may concern of uncertainty and not support change unless they are convinced against their status quo. So, the administrators and leaders of organization should provide learning environment in order to help employees gain more knowledge and feel relax before changes happening. The organization should build 1) Physical environment; 2) Interpersonal environment; 3) Share decision making environment; and 4) Co-operation environment in order to prepare and motivate the employees to learn by themselves. For building physical environment, the organizations can start with changing physical environment such as adding Green areas, putting up advertising boards to campaign saving energy, pushing employees to sort out one page-used papers to keep in central area. According to Pat Watanasin (2018), building psychological atmosphere can promote learning in accordance with humanism. This study revealed that changing physical environment can promote active learning among people. According to results of Chapter 3, Thai employees have positive attitudes towards self-directed learning and are ready to learn by themselves. So, creating various environments may help them learning, gaining knowledge of green ICT, and thereby encourage them reach their full potential. After changing physical environment, the organizations should design interpersonal environment to motivate employees having good relationship and participating to change organization. For instance, the organizations should provide area for employees to have a group talk during coffee break and lunch and assign activities or games which facilitate communication and interaction among employees in the same

or different departments. Then, organizations should design share decision making environment such as providing stage for presenting about the Green ICT policy where the employees would share their ideas. For instance, the organizations should hold seminars or workshop which encourage employees to share and exchange their ideas. In this stage, the employees are acquainted with Green ICT and see the importance of protecting and preserving environment. When the employees passed this stage, they seem to be familiar with working co-operatively. Then, the organization should promote co-operative groups environment in order to provide areas for employees staying together. When they passed these four stages, the employees are open-minded to learn and willingly to work with others. These processes will make employees to prepare and be ready to learn about Green ICT for growing Green ICT community.

In addition to environmental part, the supporting part was also important to enhance employees to gain more knowledge on Green ICT and frequently attend in activities about Green ICT policy. In terms of supporting part, there were four process which adapted from Knowles' 4 Principles of Andragogy and Bloom's Taxonomy: Teaching, Advising, Coaching, and Facilitating. For teaching supporting process, the organization should start with inviting professional to teach employees. Knowledge is an important factor which lay the foundation of what Green ICT is. When the employees gain basic knowledge, they can move forwards to the second step which is Advising. At this step, the employees were assigned to create their activities for building Green ICT. The employees will have some advice from the organizations when they find obstacles. Then, the CEOs or leaders of the organization should change to Coaching step in order to make the employees are more highly awareness on Green ICT. After conducting these three steps, if the CEOs or leaders perceive that their employees were ready to use technology for creating Green community, the organizations should facilitate the employees to think by themselves. The employees should freely create campaigns or activities for Green ICT in their workplace. It can support the employees to work cooperatively and become aware on their own.

5.2.2 Adaptation to Green

For this step, the employees would adopt Green ICT concept or obtaining knowledge by self-directed learning. So, the concept of change management process

was employed. Change management process supports the change in the organizations in order to make the organizations accept improved process faster (Tanya Pittayapitak & Thanyawich Vicheanpant, 2012)

The first stage of the change management process is unfreezing step which involves the preparation for the change. The administrators or leaders of organizations have to prepare for the change by teaching the employees of why the change is important and required. So, at this stage, the organization should promote the employees to learn by facilitating the way to learn by themselves. The topics for learning such as Understanding Green ICT, Agile, Auditing, Business performance, Saving energy, IS Strategic, Reusability, Saving environment habit, Optimized business process, and so on. According to the results of this study, IT and non-IT employees are differently in one dimension of self-directed learning: Learning with intention. Therefore, learning method for these two groups should be different. This means that IT employees should be taught by traditional teaching since they seemed to have less intention on self-directed learning. On the other hand, non-IT employees (users) should be taught by e-learning.

The second step is changing step where the real transition or change takes place. This step may take time to happen since employees tend to spend time to adopt new things which they learned from the first stage. At this stage, the administrators and leaders play important role to make the process easier for employees who are involved in the process. According to the results of Chapter 3, Thai employees have positive attitude towards self-directed learning since they intend to learn, and they are broad-minded to learn from new things and other people. In addition, Thai employees are characterized as good self-discipline and management to learn by themselves. So, if they are supported to gain knowledge about Green ICT, they tended to accept the change more easily. When employees stay in learning environment and have more knowledge about Green ICT until they accept the change, then they are refreezed. At this stage employees will implement and settle the ways of making Green ICT community. Then, those Green ICT activities start going back to employees' normal pace and routine. With a sense of stability, employees get comfortable and confident of the acquired changes.

Table 5.1 The Topics of Self-directed Learning for Employees

Stage	Topic	Method	Learner
Preparation to green	Understanding Green ICT	Traditional teaching / E-learning	IT Personal /User (Non-IT)
	Saving environment habit	Traditional teaching / E-learning	IT Personal /User (Non-IT)
Adaptation to green	Agile	Traditional teaching	IT Personal
	Reusability	Traditional teaching / E-learning	IT Personal /User (Non-IT)
	IS Strategic	Traditional teaching / E-learning	IT Personal /User (Non-IT)
Evaluation for green	Auditing	Traditional teaching	IT Personal
	Optimized business process	Traditional teaching / E-learning	IT Personal /User (Non-IT)
	Business performance	Traditional teaching	IT Personal

5.2.3 Evaluation for Green

After preparing and adopting Green ICT, the companies have to evaluate the levels of awareness among employees by using standards or frameworks related to Green ICT. The organizations will pass each level if they follow the guidelines. When the final level was reached, the organizations were acceptable to become green. When organizations follow overall concepts and processes in the guideline mentioned above, the organizations may pass some standards and frameworks, which are International Organization for Standardization (ISO), Public Sector Management Quality Award (PMQA), Capability Maturity Model Integration (CMMI), Stage of integration and Key Target Outcomes (KTO). The reason which these standards were used in ‘evaluation for green’ process because these standards were acceptable to help for green. When the organizations followed the guidelines, they would reach the criteria of each standard. It can be said that the guideline of this study was consistent with the criteria of these standard, and they would come together if the employees

were aware on Green ICT and the organizations were green. Considering details to get these standards and certification, first of all, all business process must be written down in a formal documentation. Business processes are knowledge of the organization at a time. Business processes represent the history of the organization. One way to collect knowledge is writing it down in the documents. Knowledge may be put in term of business rules. Information Systems can record a part of knowledge of the organization or present the history of the organization also. Due to Information Systems followed the business processes and the business processes changed dynamically, when designing Information Systems should concern about rapid and frequent changes of business processes. A business process consists of many subprocesses or activities that related to each other in term of input-process-output manner. Information Systems then were designed based on these broken down subprocesses. Along with each subprocess, it can include models, activities, or even subprocesses of this subprocess to produce its outputs. To finish each one of them, there exist data, knowledges, activities iteratively. When designing Information Systems, processes are broken into subprocess iteratively also. The models, activities, and subprocesses or functions belong to that specific process are put together in the sequence or conditions for supporting the users to finish the outputs. Data used for producing the output should be identified and put as a part of knowledge of that process same as outputs. These information about subprocesses, input data, outputs, models, activities, and functions are put in the document mentioned above and serve as one piece of knowledge or history of the organization. Writing down business processes in documentation as mentioned in ISO standard can support knowledge representation, which is one main activity of knowledge management life cycle (Tarí, Molin-Azorin, & Heras, 2012).

Another standard to evaluate the achievement of Green ICT is Public Sector Management Quality Award (PMQA). Since the Office of the Public Sector Development Commission (OPDC) initiated Thai Public Sector Development Strategic Plan, the public sectors acquired the concept of New Public Management (NPM) by applying the Public Sector Management Quality Awards (PMQA) framework. The PMQA was launched by the OPDC in 2005 to ensure that the public sector has criteria for organizational quality assessment and improvement

(Wipulanusat & Sunkpho, 2013). The OPDC has applied the ideas and criteria from the Malcolm Baldridge National Quality Award (MBNQA) and the Thailand Quality Award (TQA) into the PMQA criteria which are a public sector management approach. The PMQA is the main target of public sector development that aimed at lifting the working level of all aspects to the high-performance organization. The PMQA promotes understanding of the requirements for performance excellence, competitiveness improvement, and sharing of learning of successful performance strategies (OPDC, 2008, as cited in Wipulanusat & Sunkpho, 2013). The PMQA has seven strategic criteria including: 1) Leadership; 2) Strategic Planning; 3) Customers and Stakeholders; 4) Information Technology and KM; 5) Human Resource Focus; 6) Process Management; 7) Result Management (Thoedtida & Thongpoon, 2013). The PMQA criteria are built upon a set of core values and concepts, that is, visionary leadership, client-centered excellence, organizational and personal learning, valuing staff and stakeholder, agility, focus on the future, managing for innovation, management by facts, social responsibility, focus on results and creating value, and systems perspective. If they were used properly, the criteria and guidelines would help organizations to assess their current levels of quality performance (Pun et al., 1999, as cited in Wipulanusat & Sunkpho, 2013).

Additionally, Capability Maturity Model Integration (CMMI) is a model focusing on business processes and behavior to improve efficiency in the organization (Khraiwesh, 2014). Starting from level 1, the initial level, business processes must be identified. In level 2, managed level, the processes were written down to make sure that they covered every activity and had integration for making sure that they provided designed products and services. In this level, the organization focuses on the completely and correctly performance. In level 3, the defined level, the processes are broken down into smaller processes to make sure that they can support the organization goals and strategies effectively, so all processes must be represented and recorded intendedly and carefully as knowledge of the organization. All processes must be known by employees and administrators very well. They were analyzed to see whether they can get any harms, unsuitable work environment, constraints, or missing any of them to provide committed products and services. Level 4, quantitatively managed level, expected the organization to be able to represent the

performance of all processes quantitatively for proactively change, adjustment, or improvement to achieve goals and business objectives. The last level, the optimizing level, expected every process were optimized by trying to identify problems or limitations and then analyzed to find the root causes following by the plan for corrections and prevention to reach the optimized performance level. To pass the all levels of CMMI, IS must be analyzed, objected-oriented software development, and structured chart for process improvement, resource acquisition and human resources development or training.

Stage of integration is integrated between business planning and Information Systems (IS) planning (King & Teo, 1997, as cited in Gottschalk & Solli-Sæther, 2001), the model identified 4 stages of evolution as followed:

Stage 1. Administrative Integration which needed to integrate administrative and non-strategic work processes by developing the technically oriented and non-strategic IS functions in the organization to get operational efficiency and cost minimization. To develop Information Systems in this stage, the organization needed to automate administrative work processes. All business processes related to the back-offices or administrative works must be keep formally and correctly. All work processes are kept in format of programs or information systems represented the knowledge, methods, or activities done by persons working in those business processes.

Stage 2. Sequential Integration which needed to integrate all supported business strategies activities or work processes into the previous stage's IS to make sure that all resources required to support business strategy implementation are collected. To develop Information Systems in this stage, the business goals must be identified first and then analyzed to find the specific business functions, activities, queries, or initiative plans to reach business goals. Information functions then will be developed to support those business functions, models, activities, queries, or plans. Information functions might be small but responsive to the business environment. They needed a lot of data, knowledge, models, and powerful computers and good algorithms when performing to lower cost while getting fast response.

Stage 3. Reciprocal Integration which needed to integrate all supported and influence business strategy activities into the second stage of integration to make sure

that IS collected all resources required to support and influence business strategy. The quality of IS inputs into business strategy formulation and implementation are highly concerned, so business goals and IS capabilities were brought to consider jointly. Due to the business functions, activities, queries, or plans related to supported and influence business strategy dealing with larger size of data, more complex models, complicated activities. In this stage, when developing IS, the computer specifications were important, same as related software. Moreover, the quality of data was highly expected. Designing information functions or Information Systems was important. All information functions must be identified and explained in detail clearly to make sure that all business functions and processes were completely supported by IS while providing high quality of data.

Stage 4. Full Integration which needs to join development of business strategies and IS strategies due to the organization concerned about critical to long-term survival of organization. In stage 3, IS or information functions used completely in the organization. Information functions could be used to get knowledge, answer the business queries, or support the business strategy implementation. However, these were functions or activities that respond to the current business environment mainly. To make sure that organization would survive, Information functions must provide and support long-term impacts on organization based on dynamic and complex business environment the organization faced.

Key Target Outcomes (KTO) is another framework which evaluate the achievement of organizations (Government of United Kingdom, 2013). KTO focuses on using government buying standard or international standards for ICT equipment and services. It suggested that ICT equipment must base on business strategy. User behavior must change to help reducing energy consumption along with appropriate setting of network and operating systems to manage energy and sharing equipment usage. Network auditing and management can help reducing energy usage and sharing services for increasing efficiency. Applications should be met business needs using auditing processes and activities to make sure that applications and services not acquired being unsuitable and useful less, and new development avoided by sharing those available within organization and beyond. Policies for storage management, reusing, recycling ICT are required for reducing number of duplicated data storage,

disposal of ICT, data centers and servers. It suggests letting staffs to involve in the green ICT program for individual change and organization working processes and working environment change. The administration is required to support changes to be green by accessing the environmental costs and benefits across the life cycle of ITC when making any decision. The concept and principles of reuse, share, and virtual team and collaboration tool usage should be clearly stated and brought to use effectively. When designing ICT solutions, the organization should consider business green efficiencies by redesign business process to get most green ICT efficiency. During acquiring and procuring ICT, the organization should try to minimize the consumption and supply chain emission by exploit opportunities for sharing, consolidating, reuse, and recycling. Not only the hardware needs to be considered, applications supported business requirements need to be concerned being green ICT also. The individual changes are important to change organization to be green, so for achieving green ICT employee involvement are needed.

Then, when the organizations reach these standards and frameworks, they can become Green ICT community.

The first-drafted version of guideline was shown below.

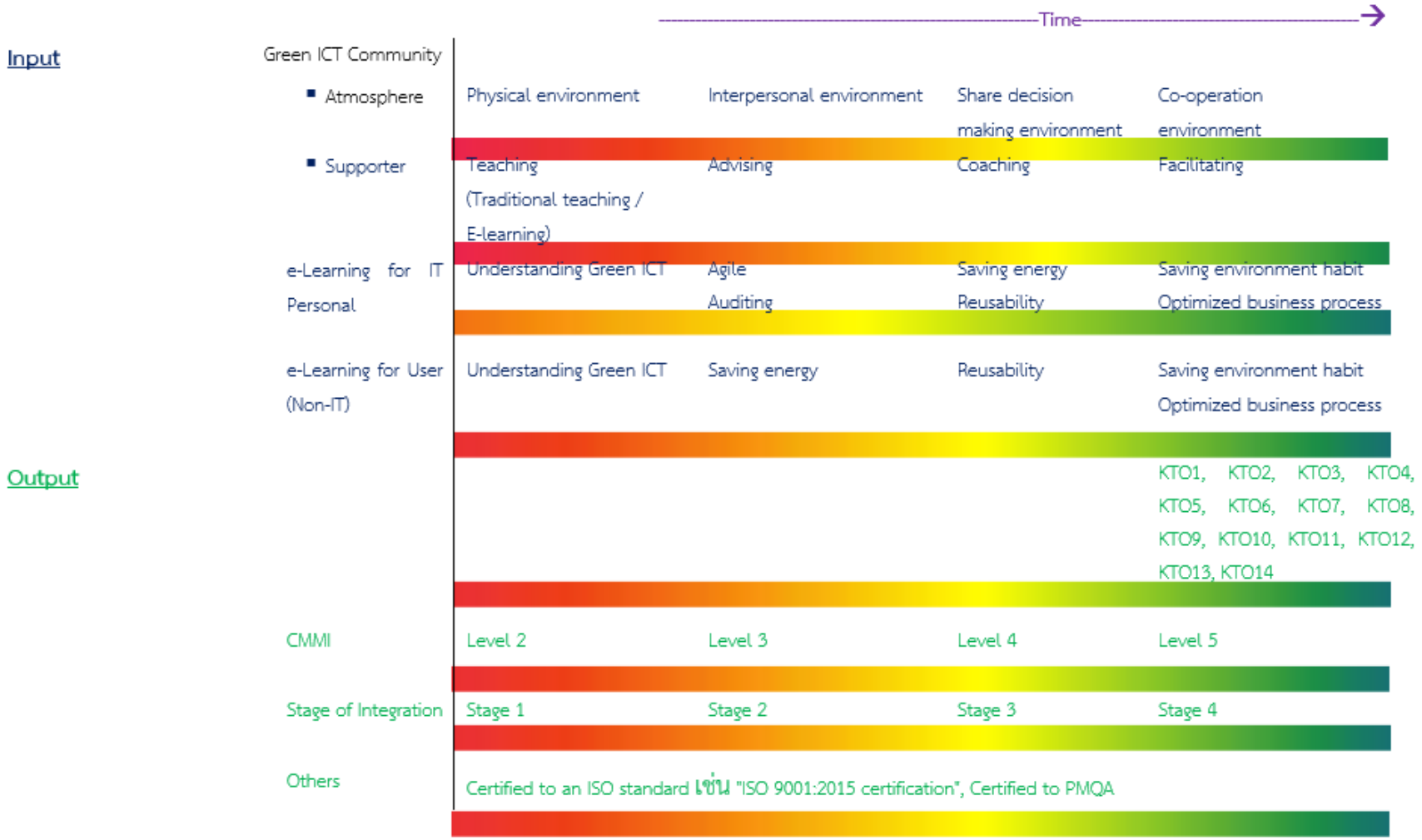

Figure 5.4 The First-drafted Version of Guideline

5.3 The Process of Rehearsing and Verifying Guideline

After guideline development, the guideline was brought to rehearse and verify. The data for this section were collected by semi-structured interview. In terms of semi-structured interview, the samples were selected purposively. Three employees were chosen to attend a pilot test according to their willingness and convenience for improving Green ICT guidelines. Furthermore, five CEOs from five companies were invited to validate guidelines. These five CEOs were recommended by researcher's colleagues. The process of rehearsing and verifying was described below.

5.3.1 Rehearsing Guideline

When the first-drafted guideline was conducted, the researcher asked three employees for doing pilot study to rehearse guideline. The three employees were chosen depending on their accessibility. They were working in the listed companies and were recommended by advisor and colleagues. The purpose of guideline rehearsing was to examine the feasibility or acceptability of this guideline that is intended to be used in organizations. The recommendations and suggestions were needed before validating guideline, so three employees were asked in three broader questions. Their recommendations and suggestions were analyzed thematically. Three open-ended questions were assigned in order to gather comments and suggestions from employees as follow:

1) Is this guideline appropriate for increasing awareness on Green ICT among employees?

2) Is this guideline appropriate to apply in your organization?

3) What are your suggestions for improving the guideline?

For question 1, all three employees revealed that this guideline is appropriate for using to increase awareness on Green ICT. They also suggested that self-directed learning tends to be related with Green ICT. If the employees are educated, they will be more likely to concern this issue. As employee 1 suggested, many employees did not know about saving energy functions, so providing environment for sharing knowledge and do Green ICT campaign together may help employees know more and concern about this topic.

For question 2, all employees revealed that this guideline was appropriate for their organizations. They also suggested that this guideline would be more effective if leaders of the organizations mainly perform according to the steps of guideline. Employee 1 and 2 added the comments that their organizations have campaigns on Green, but it seems to be general campaign for Green, not for Green ICT. The activities or campaigns which their organization created do not work systematically, it will be better to employ this guideline since this guideline is designed the activities step by step with ease to follow. In addition, they all think that supporting Green ICT by promoting self-directed among employees is a new idea for them, yet it tends to be practical and reasonable.

For question 3, employee 2 and 3 suggested that it would be better if the guideline uses white to green color bar (white represented as beginning activities, while green represented as ending activities) instead of red to green color bar (red represented as beginning activities, while green represented as ending activities). They suggested that red to green color bar affects their feelings negatively. They point out that red color is instinctively associated with danger. In addition, red color seems to be color for stop. It is a noticeable color that is often used on signs for signaling caution or warning. According to this context, red color may not be appropriate for starting of making Green ICT. If the guideline starts with red color, it can be referred that the organizations or employees lack knowledge for starting.

According to suggestions, the color bar of guideline was changed from red-green bar to white-green bar in order to make guideline more obvious and positive for ones using guideline.

Therefore, the improved version guideline was shown below.

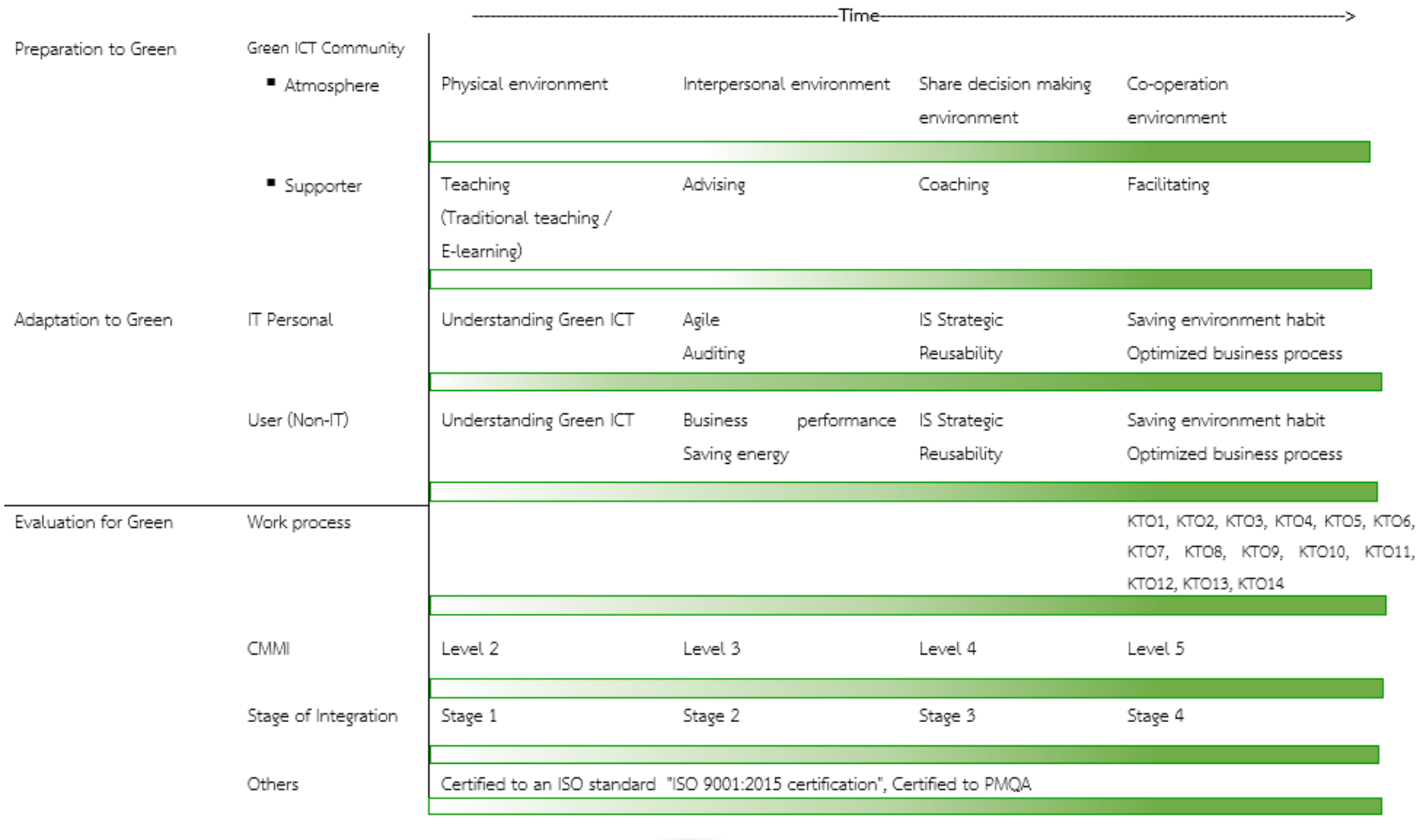

Figure 5.5 The Improved Version Guideline

5.3.2 Verifying Guideline

After guideline verifying, the researcher asked for five organizations to verify the guideline in order to make guideline trustworthy. These five organizations were selected purposively based on the characteristics of organizations. Since the researcher needed to receive validation and feedback from various aspects, the selected organizations aimed to serve customers with different main purposes. The characteristics and backgrounds of the five organizations were described below.

5.3.2.1 The characteristics and backgrounds of participants for verifying (five organizations)

Organization A: is a state enterprise and run their business with important mechanism in the development of the economy and society. Their mission is to provide a complete range of finance-related services in line with relevant government policies, benefiting society and improving Thais' quality of life. This organization aims to promote the use of funds to invest in building or land development.

Organization B: is an organization which develop wide-ranging and fully comprehensive products and services in response to customers of all ages and generations. This organization set their aims of running business together with put important on environment. By this, the organization currently has 1) Environmental reporting; 2) Environmental policy/Management system; 3) Operational eco-efficiency and 4) Biodiversity.

Organization C: is a financial institution where provides the opportunities for the people to thoroughly gain access to sources of investment funds together with provide financial literacy to support economy. This organization also improves the competitiveness of the country and reduce social inequality. This organization has also focused on building balanced sustainability in terms of economic, social, and environmental conditions.

Organization D: is related to airport business operator. The employees of this organization have accumulated experiences and excellent expertise in airport operation management including airport development planning and airport improvement to meet required international standards and to be able to respond to various clients' needs.

Organization E: is committed to helping alleviate traffic problems in Bangkok and its surrounding provinces, through the fully integrated transportation systems. Their main business lay a foundation for business expansion of the routes and the service network. In addition, this organization may extend its businesses to other fast-growing businesses with good returns such as other infrastructure projects, commercial development or real estate development.

In rehearsing phase (5.3.1), the guideline was examined the feasibility or acceptability be three employees. The three employees were asked in three broad open-ended questions. For this phase, three questions were extended in six questions since it was necessary to gain information in detail.

The first question of rehearsing phase “Is this guideline appropriate for increasing awareness on Green ICT among employees” was reformed in “Do you agree with this guideline?” and “Is it possible to employ this guideline to your organization?”.

The second question of rehearsing phase was “Is this guideline appropriate to apply in your organization?”, reformed to three questions in order to verify proposing guideline in each point. The three questions were “Do you agree with input and output process?”, “Are learning environment proposing in this guideline sufficient or appropriate to make organization become Green ICT?”, and “Are learning curriculums or topics proposing in the guideline helpful for organization become Green ICT?”.

The last question of rehearsing phase was “What are your suggestions for improving the guideline?” and employees suggested to change color of bar, so the last question of verifying guideline asked, “Do you agree with using color bar to present timeline of increasing awareness process?” in order to reconfirm of appropriateness of using green-color bar.

Before verifying guideline, informed consent forms and permission letters were sent to the organizations (see Appendix K). Each organization were interviewed by six open-ended questions as follow:

1) Do you agree with this guideline?
2) Is it possible to employ this guideline to your organization?
3) Do you agree with input and output process?

4) Are learning environment proposing in this guideline sufficient or appropriate to make organization become Green ICT?

5) Are learning curriculums or topics proposing in the guideline helpful for organization become Green ICT?

6) Do you agree with using color bar to present timeline of increasing awareness process?

All organizations allowed the researcher to record audio. The interview process of each organization was lasted during 0:40-1:00 hours. There was a total of 3:30 hours of recording. The recording data were converted into written document format by applying edited transcription technique. In the case of an edited transcription, only the relevant audio is transcribed into text (Chabeda et al., 2018). It means that repetitions, interjections and stutters were removed in order to ensure that the transcription was easy to read and easy to gather related data. For this type of transcription, a full and accurate script was formalized and edited for readability and clarity. The transcribers for this study included the researcher and her colleague who obtained a doctorate in Language and Communication; she was present at the interview and became an interview partner. Her resume was available in Appendix L.

After transcribing process, the data were then translated from Thai to English language by the same translator who helped in the questionnaire section (see Appendix A). Only related data which answered interview questions were translated. The translated data were sent back to transcribers in order to ensure the accurate meaning. The summarization of the interview was described in Table 5.1.

Table 5.2 The Summarization of Guideline Verifying Questions.

	Topic	Organization A	Organization B	Organization C	Organization D	Organization E
1)	Do you agree with this guideline?	Yes	Yes	Yes	Yes	Yes
2)	Is it possible to employ this guideline to your organization?	Possible and need to focus on other factors (Leader, Organizational culture, Government regulation)	Possible and need to focus on other factors (Leader, Organizational culture, Government regulation)	Possible and need to focus on other factors (Leader, Organizational culture, Government regulation, The attitudes of customers, Users)	Possible and need to focus on other factors (Leader, Organizational culture, Government regulation)	Possible and need to focus on other factors (Leader, Organizational culture, The ownership of quotient of users)
3)	Do you agree with input and output process?	Yes	Yes	Yes	Yes	Yes
4)	Are learning environment proposing in this guideline sufficient or appropriate to make organization become Green ICT?	Yes	Yes	Yes	Yes	Yes

	Topic	Organization A	Organization B	Organization C	Organization D	Organization E
5)	Are learning curriculums or topics proposing in the guideline helpful for organization become Green ICT?	Yes	Yes	Yes	Yes	Yes
6)	Do you agree with using color bar to present timeline of increasing awareness process?	Yes	Yes	Yes	Yes	Yes

According to the interview of five organizations, it was revealed that all of them agreed with this guideline. They also thought that the guideline was useful, and it was possible to employ this guideline to their organizations. The input and output process proposed in the guideline was practical. Additionally, they all thought that environment proposing in this guideline was sufficient or appropriate and learning curriculums or topics proposing in the guideline was helpful for making organization become Green ICT. For the last question, they all agreed that the use of color bar represented timelines was reasonable.

According to question 2 “Is it possible to employ this guideline to your organization?”, all organizations recommended that employing the guideline could help employees’ awareness on Green ICT increased, yet there were some components which needed to emphasize on in order to make this guideline more effectively. The details of suggestions were represented in Table 5.2.

Table 5.3 The Additional Suggestions for Making Guidelines Successful

Organization A	**Organization B**	**Organization C**	**Organization D**	**Organization E**
Leader	Leader	Leader	Leader	Leader
Organizational culture	Organizational culture	Organizational culture	Organizational culture	Organizational culture
Government regulation	Government regulation	Government regulation	Government regulation	-
		The attitudes of customers (The majority of customers were farmers who still need paper receipts from ATM machine)		
		Users (Employees need to be taught more knowledge to increase awareness)		The ownership quotient of users (Employees need to concern that they are owners of Green ICT project, and they will have more motivation to complete.)

Basically, all five organizations agreed that the guideline was helpful and practical for increasing awareness on Green ICT. They also suggested additional topics which was related to guideline and was considered when applying the guideline. The first two considerable topics were leadership and culture. Since the leadership seemed to be bound with culture that could not be changed easily (Kostovski et al., 2015). Moreover, these two concepts seemed inherently interdependent and were linked to the organizational performance. Therefore, as suggested by the organizations, leadership and culture were two considerable subjects when applying this guideline.

In terms of leadership, all organization confirmed that leader was the most important factor for driving this guideline. As organization A stated:

> Before meeting, if the CEOs assign secretary for preparing electronic files instead of paper and send them to all attendance, the employees will be afraid of printing the document. Then, they will reduce paper as their routine and policy for reducing paper will be more easily effective.

In addition, Organization C mentioned: If the leaders see the importance of policy and follow the activities, the employees will do as their leaders do

It can be assumed that the guideline would be more effective if it was top-down policy: regulated from the leaders. As Kostovski et al. (2015) stated, the key factor that could determine the future of the organization was the quality of leadership talent that they could manage to grow or acquire. Leadership could be defined as communication, motivation, encouragement and involvement of the people (Notar et al., 2008). In addition, leadership was a vision, idea, direction, required ability to motivation people to complete their tasks without being closely supervised (Bennis, 2007). Leadership was also about the ability to influence, to motivate and to allow others to contribute to the effectiveness and success of the organization (House, 1971, as cited in Kostovski et al., 2015). The effective leadership, while emphasizing the importance of work the employees perform, positively affected the motivation and drove people to carry out and complete the tasks (Mullins, 2005). A good leader could inspire others and helped their followers to accept the change and to understand it as a

challenge. Consequently, good leaders were those who had the ability to choose the styles that best fits the situation and could transform their organizations. Therefore, when the guideline for increasing awareness on Green ICT was used in the organizations, the person in the position of executive, administrator, manager, or director played a pivotal role. They should see importance of increasing awareness on Green ICT and governed the employees intensively, then the employees would follow with ease. In addition, it would be effective if the leaders did as a role model. If the leaders design the rules for supporting the guideline effective, employees will intend to use those rules. Then, the employees may realize and consider this issue, or at least, they may follow because of requirements from leaders.

Another most important factor for helping the guideline more effective was organizational culture. One of the most critical components that might ultimately impact the success of organizations' campaigns or activities was the value and culture of the organizations (Shahzad et al., 2012). In other words, it can be said that a large contributing factor to the successful results is the internal culture. The culture included the organization's vision, values, norms, systems, symbols, language, assumptions, beliefs, and habits (Kostovski et al., 2015). Additionally, culture set a framework for the desired intentions or strategy to be achieved. Simply to say, culture was about gaining knowledge, explanation, value, belief, communication and behavior of a large group of people at the same time and same place. As suggested by Shahzad et al. (2012), organizational culture had deep impact on the variety of organizations process and employees' performance. Additionally, organization culture worked as social glue to bond the employees together and made them perceive that they become a strong part of the organizations. If employees are committed to have the same norms and value which the organizations have, their performance towards achieving organizations' goals can be increased. Some suggestions from organizations in verifying guideline process revealed that the employees seemed to embed with traditional culture and might not prepare to change their behaviors, managers and leaders are recommended to develop the strong culture in the organization.

Additionally, most of organizations (4 out of 5) suggested that government regulations seemed to be obstruction for doing Green ICT. The regulations such as

procurement, reporting, have to submit printed documents to any government organizations since the government rules asked for authentic materials. This seemed to be impossible to be paperless. Yet, it might be possible if the government change the policy. Top-down policies may be the best way for increasing awareness on Green ICT.

Furthermore, one of considered topic for doing Green is the attitude towards customers. As Organization C stated, most of their customers preferred using paper instead of technology. The fear of using electronic was quite unchangeable; it might need attempts and time to change.

In addition to attitude of customers, it is accepted from the organizations that the employees need to be taught more knowledge to increase awareness on Green ICT and this guideline is helpful for the organization as it explains the ways of self-directed learning step by step, from the beginning stage to the ending stage.

Moreover, attitudes of employees seemed to be important. As Organization D suggested, the guidelines were very helpful, and it would be more successful if the employees had the ownership quotient of users. It is simply to say that everyone would make the best when they felt they were the owners of those thing. Therefore, the employees should be fostered to gain this feeling.

During the process guideline validation, the researcher has learned that the organizations in Thailand seem to be aware on Green and attempt to conduct Green ICT campaigns (see Table 5.3).

Table 5.4 The Currently Running Green ICT Campaigns of Each Organization

Organization A	**Organization B**	**Organization C**	**Organization D**	**Organization E**
Paperless campaign	Paperless campaign	Paperless campaign	Paperless campaign	Paperless campaign
Shared printer regulation	Shared printer regulation	Shared printer regulation	Shared printer regulation	Shared printer regulation
Procurement	Procurement	Procurement	Procurement	Procurement
Organizational culture for building Green		Policy “The second house” for promoting employees love their workplaces as their houses		Focusing on value creation and wastes elimination by shorten product development cycles and rapidly discover if a given business concept is viable (Lean management)

Basically, all organizations push their employees to use paperless. They thought that paperless campaign is rather easy for going Green in the workplace. As Organization D stated:

> Our organization intended to use paperless campaign. To make it more efficient, we started with the manager level. When we had the meeting, we didn't print meeting document anymore. We created QR code for scanning the document. It is quite hard for some managers, yet we thought that it can help environmental problem and was indirectly beneficial for our company to save budget for paper. Therefore, we continuously followed this campaign. Then, the secretary and employees might be ashamed if they printed the thick document in the meeting.

The organization A also added:

> One thing that we can change was the printed circular. We started to change the circular document system by lending and borrowing document instead of copying the document. We tried to educate the employees to know that although they get many copies of document, one day those documents would be wastes. They should print only very necessary document or if it is possible, make zero percent for printing.

The idea of paperless campaign was supported by Organization C who revealed that:

> Our company created paperless campaign, and the executives thought that we should have competition between departments. The lowest printing documents would be get awarded. Initially, the employees did not concern more about Green, they just want to win in the campaign. Yet, after campaigned finished, they are aware of printing as their routine job.

The second campaign which all organization followed was shared printer regulation and procurement. This campaign was started after the paperless campaign. When the organizations employed these two campaigns, they found that they can save unnecessary cost of organizations. Moreover, when the employees feel that it is difficult to print since the printer is shared, they will print only necessary document and they are afraid if their colleague see that they print wastefully. As Organization E revealed:

> Shared printer regulation helps my department save paper significantly. The employees avoid printing documents. When the printers were located far away from their desks, they may think carefully before printing since they seemed to be lazy to pick the paper from printers [laugh].

Additionally, the organizations tended to create different campaign for making Green ICT in their workplace such as Motivating organizational culture for building Green, Making policy "The second house" for promoting employees love their workplaces as their houses, and Focusing on value creation and wastes elimination by shorten product development cycles and rapidly discover if a given business concept is viable (Lean management). These campaigns are interesting and if the employees do cooperatively, our countries may definitely reach Green ICT goals.

After rehearsing and verifying guideline, the suggestions were used in order to make guideline more effective. The completed guideline was shown below.

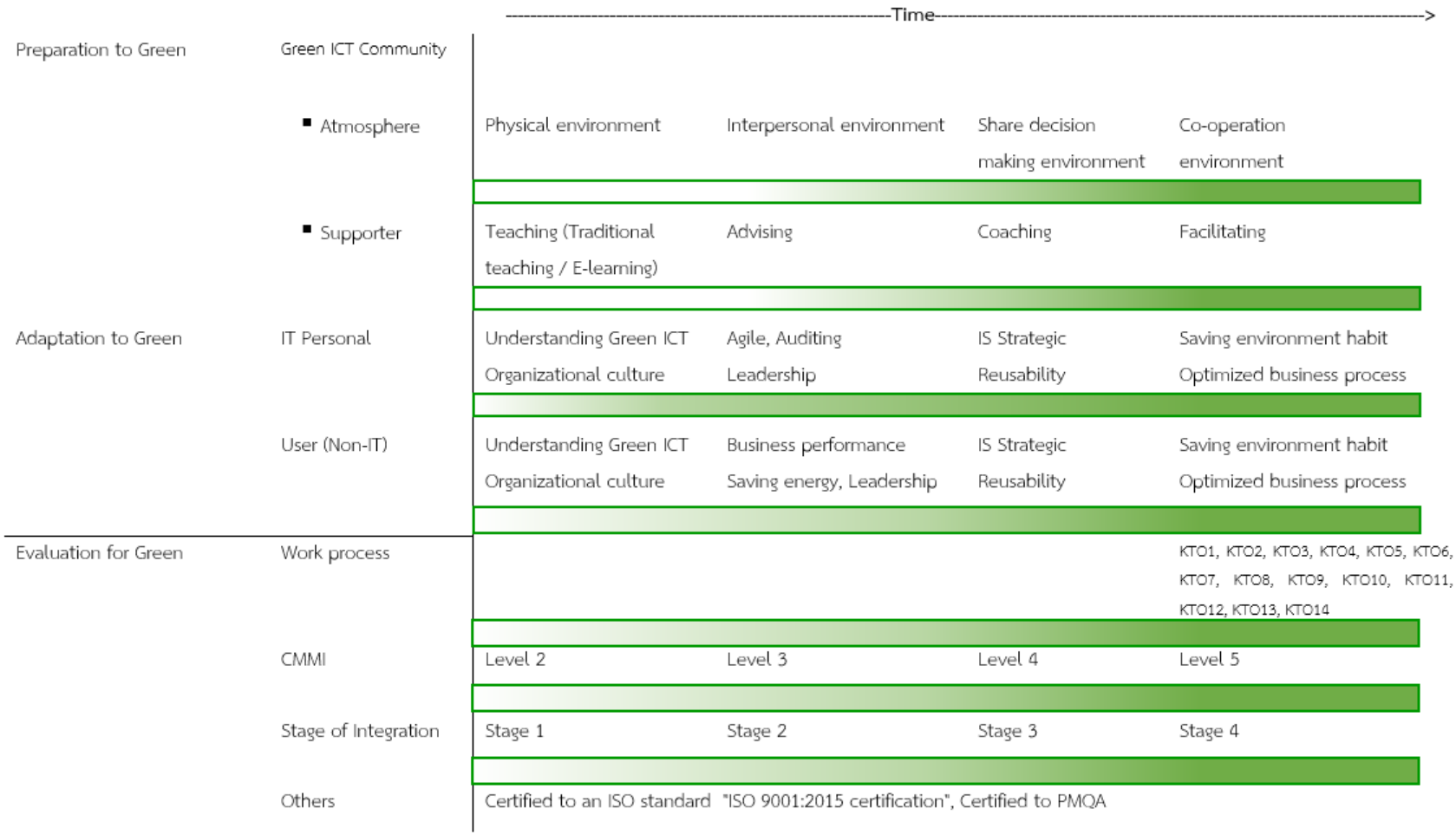

Figure 5.6 The Completed Guideline

According to comments, the current guideline is developed by placing importance on the roles of organization leaders. If the leaders give priority to Green ICT and support their employees both directly and indirectly such as rewarding, make a regulation or punishment, and setting criteria for work evaluation, the goal of this guideline can be reached easily. In addition, the guideline will be successful sustainably and efficiently if the employees accept and have awareness on this issue. Therefore, this guideline emphasizes the way to make employees become a part of Green ICT by proposing the way to change both physical and emotional variables. For this guideline, there is not timeline limitation. Each organization can adapt activities in the guideline flexibly depending on their convenience. The guideline shows the process of Green ICT building with color bar. The beginning activity is presented as red color, followed by orange, yellow, and green when Green ICT process is completed. The organization can adopt depending on their contexts.

CHAPTER 6

CONCLUSION, IMPLICATIONS, LIMITATIONS, AND RECOMMENDATIONS

6.1 Conclusion

The four research questions were answered. According to research question 1, the three dimensions of awareness on Green ICT were revealed. It included 1) Saving energy and Avoiding using wasteful paper; 2) Using reusable and recyclable equipment and Upgrading devices; 3) Using saving energy function.

From research question 2, there were five dimensions of self-directed learning: 1) Learning with intention; 2) Open-mindedness; 3) Characteristics of self-discipline; 4) Characteristics of self-management; and 5) Desire to learn. It was also found that there was a significant difference of Learning with intention between IT and non-IT employees, which means IT and non-IT employees were significantly different in self-directed learning styles. The mean score of non-IT employees in this dimension was more than the score of IT employees. It can be implied that non-IT employees tend to learn with intention more than IT employees.

Additionally, the research question 3 which aimed to study about the impact of self-directed learning on awareness of Green ICT was answered. The awareness on Green ICT Dimension 1 (Saving energy and Avoiding using wasteful paper) was influenced by self-directed learning Dimension 1 (Learning with intention), self-directed learning Dimension 2 (Open-mindedness), self-directed learning Dimension 4 (Characteristics of self-management) and self-directed learning Dimension 5 (Desire to learn). It was also found that the awareness on Green ICT Dimension 2 (Using reusable and recyclable equipment and Upgrading devices) was influenced by self-directed learning Dimension 1 (Learning with intention) and self-directed learning Dimension 3 (Characteristics of self-discipline). In addition, the awareness on Green ICT Dimension 3 (Using saving energy function) was influenced by self-

directed learning Dimension 2 (Open-mindedness), self-directed learning Dimension 3 (Characteristics of self-discipline), and self-directed learning Dimension 4 (Characteristics of self-management).

The research question 4 was about development appropriate guideline to increase level of awareness on green ICT for employees. There were three processes of guideline development: 1) designing guideline, 2) rehearsing guideline, and 3) verifying guideline. The completed guideline was available in Appendix J.

6.2 Implications

The implication of this study shed light on the dimension of awareness on Green ICT which were influenced by self-directed learning. The results of this study reflected that Thai employees realize on Green ICT, yet they need more motivation to do. In addition, the employees are ready to learn independently, and this may help them to be more aware on Green ICT. Because of this, the guideline for increasing awareness on Green ICT was designed. The guideline for this study has been verified and approved by organizations in Thailand. The recommendation for making the guideline successful is considering two main points: 1) role of leaders and 2) organizational culture.

6.3 Limitations

The limitations of this study were categorized into two points. Firstly, there was a lack of demographic information on participants in terms of fields they graduated and frequency of computer and technology access. The participants were required to indicate they worked or graduated in IT or non-IT fields. Unfortunately, dimensions of self-directed learning styles among various fields of the participants could not revealed in this study. Obtaining this information in future research may be important. In addition, the use of technology and mobile device might be related with the characteristics of self-directedness. It was supported by the study of Rashid and Asghar (2016) which showed that the use of technology had a direct positive relationship with students' engagement and self-directed learning (Rashid & Asghar,

2016). In addition, average time spent with technology and mobile device use may influence on self-directed learning score (Bartholomew et al., 2017). Secondly, this study was conducted among employees working in the listed companies of SET. The resulted may be limited to employees working in this type of company.

6.4 Recommendations

6.4.1 Recommendation for Further Research

The future research may investigate the dimensions of self-directed learning among employees with different background such as their income, their background of education and their average time with technology and mobile devices. The results from these angles may be challenging and interesting.

In addition, it will be better if future research will conduct with different types of companies such as SMEs. Since the employees from different types of companies may be different in terms of culture, it will be interesting to investigate Green ICT and self-directed learning among them.

6.4.2 Recommendation for Organizations

Organizations is an important part for helping environment sustainable. The researcher intentionally devotes herself to design and improve with hope that it may help our community Green. If there are any opportunities, it may be beneficial if the leaders see importance and employed the guideline to increase both self-directed learning behavior and awareness on Green ICT.

6.4.3 Recommendation for Employees

It is known that changing something which we did it for a long time is very difficult. Yet, environmental problem is very urgent and important problem in Thailand. For solving this problem, we need the collaboration from all section. As an employee, the recommendation is that realizing of wasted energy, wasted paper, reusing, recycling, upgrading devices, using saving energy function seemed to be the easy way to do. In addition, improving yourself to learn with self-directedness will open your world and help you become aware of issue surrounding you.

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APPENDICES

Appendix A

Resume of English Professional Translator

MS. MALIWAN BUNSORN (นางสาวมลิวัลย์ บุญสอน)

2172/178-179 Soi Paholyothin 36 Khwaeng Senanikhom Khet Chatuchak,

Bangkok 10900

Tel. 08-0733-5683

E-mail: wanmalee@hotmail.com

PERSONAL INFORMATION

Date of Birth: December 1st, 1983

Height: 156 cm.

Weight: 62 kg.

Marital Status: Single

Nationality: Thai

Religion: Buddhism

Personality: Punctual, Fast Learning, Honest, Generous, Flexible, etc.

EDUCATION

Chulalongkorn University, 2016-present

Doctor of Philosophy

English as an International Language (EIL), English Linguistics Track, *3.88 GPA*

Kasetsart University, Class of 2010

Master of Arts

English for Specific Purposes (ESP), *3.44 GPA*

Khon Kaen University, Faculty of Humanities and Social Sciences **Class of 2006**

Bachelor of Arts in English,

Majored in English,

Minored in Spanish, *GPA 3.73*

Surawithayakarn School, Surin Class of 2002

Majored in French, *3.53 GPA*

TEACHING EXPERIENCES

Full-time Lecturer at the University of Technology Tawan-Ok (Chakrabongse Bhuvanarth Campus)

- Instructor for *Introduction to Translation* Course (For English major students)
- Instructor for *English to Thai Translation* Course (For English major students)
- Instructor for *English Reading* Course (For Business Administration students)
- Instructor for *English Writing in Daily Life* Course (For Business Administration students)
- Instructor for *English for Study Skills* (For Business Administration students)

Assessment Skills

- Develop grade exams, quizzes, and tests that assess student mastery of subject matter.
- Create assignments that provide opportunities the students practice what they have learned.

Clerical Works

- Support the admission e.g. interview applicants
- Be a committee for managing and collecting papers for self assessment reports or SAR
- Be responsible for four primary missions: teaching, conducting research, providing academic services and preserving Thai art and culture.

Teaching

- Provide knowledge and skills to enable students to cope successfully in life.

Research

- Conduct pure and applied researches to support the country' s goal of self-reliance for continuing social and economic development.

Provision of Academic Services to Community

- Provide various kinds of academic services to the community, to help the inhabitants for the community development.

Preserve Art and Culture

- Promote, conserve and maintain the heritage and values of Thai culture.

Special Training

- Participate for the **Cooperative Education** training
- Participate for the seminar on the topic of " **Academic Professional Development"**

Professional Development

- Certificate of Advanced English Vocabulary course, Kasetsart University

Professional and Communities Activities

- Be a committee and organize for English academic service project " English for Taxi Driver"
- Be a committee and organize as well as be a speaker for English academic service project "English in Daily Life for General People"
- Be a committee and speaker for academic service project " The Path of Tourism for Learning to Thai Puan Community"

Conferences Attended

- International Conference ' Voices in ELT' , organized by Thammasat University 2012
- International Conference ' FLLT Foreign Language Teaching and Learning, organized by the Language Institute of Thammasat University, 2013

Current Research Interest

Translation

-Obtained scholarship to conduct research on the topic of **" Study of News Translation from Thai to English in the Foreign Ministry Affair Website"** This research is called for presenting in **the International conference "ELT'** organized by Thammasat University and **International Conference on ' Applied Linguistics and ELT'** organized by ELT Faculty of Education, Cukurova, Andana, Turkey.

Research in progress

- **Transfer of Expressive Meaning in the Translation of Thai Amplifiers in Literary Works into English**, Ph. D. dissertation in EIL (English as an International Language), Chulalongkorn University, 2015 - present

REFERENCE: Release upon request

Appendix B

Green ICT Questionnaire Evaluation Index of Item-Objective Congruence (IOC)

Statement	Awareness on Green ICT						
	S1	S2	S3	S4	S5	Total	IOC
1. ใช้ฟังก์ชัน Screen saver (Use the screen saver function)	1	1	1	1	1	**5**	**1**
2. ใช้ฟังก์ชันหน้าจอ Sleep mode (Use the monitor sleep function)	1	1	1	1	1	**5**	**1**
3. ใช้ฟังก์ชันระบบ Sleep (Use the system sleep function)	1	1	1	1	1	**5**	**1**
4. เปิดคอมพิวเตอร์เมื่อจำเป็นเท่านั้น (Turn on computer only when the need arises)	1	1	1	1	1	**5**	**1**
5. เปิดคอมพิวเตอร์อย่างต่อเนื่อง (Keep the computer turned on even when away)	1	1	1	1	1	**5**	**1**
6. พยามลดเวลาในการใช้งานคอมพิวเตอร์ (Try to reduce amount of time spent using computers)	1	1	1	1	1	**5**	**1**
7. เปิดอุปกรณ์ต่อพ่วงทั้งหมดทุกครั้งที่คอมพิวเตอร์เปิดอยู่ (Turn on all peripherals every time the computer is turned on)	1	1	1	1	1	**5**	**1**
8. เปิดอุปกรณ์ต่อพ่วงเฉพาะที่จำเป็นต้องใช้ (Turn on peripherals only when I need to use it)	1	1	1	1	1	**5**	**1**
9. ปิดระบบงานคอมพิวเตอร์ทั้งหมดเมื่อต้องการพักเป็นเวลานาน (Turn off entire computer system when out for a long break)	1	1	1	1	1	**5**	**1**
10. พิมพ์กระดาษออกมาเมื่อจำเป็นเท่านั้น (Print on paper only when necessary)	1	1	1	1	1	**5**	**1**
11. พิมพ์กระดาษหน้าหลัง (Print on both sides of the paper if possible)	1	1	1	1	1	**5**	**1**
12. บันทึกเอกสารบนอุปกรณ์บันทึกข้อมูลมากกว่าที่จะพิมพ์บนกระดาษ (Save documents on disk rather than printing on paper)	1	1	1	1	1	**5**	**1**
13. ส่งเอกสารทาง e-mail มากกว่าทางไปรษณีย์ (Send documents via email rather than by post/hardcopy)	1	1	1	1	1	**5**	**1**
14. พยามจัดหน้าเอกสารเพื่อลดจำนวนหน้ากระดาษ (Try to reduce the number of pages when creating document)	1	1	1	1	1	**5**	**1**
15. ใช้การพิมพ์แบบหลายหน้าต่อแผ่น (Use multi-page printing)	1	1	1	1	1	**5**	**1**

Statement	Awareness on Green ICT						
	S1	S2	S3	S4	S5	Total	IOC
16. ส่งเอกสารหมุนเวียนโดยใช้ไฟล์แทนการพิมพ์เป็นเอกสาร (Circulate soft-copies rather than printing out)	1	1	1	1	1	**5**	**1**
17. ใช้อุปกรณ์คอมพิวเตอร์ที่มีประสิทธิภาพด้านพลังงาน (Use energy efficient computer equipment)	1	1	1	0	1	**4**	**0.8**
18. ซื้อผลิตภัณฑ์คอมพิวเตอร์ที่มีบรรจุภัณฑ์เป็นมิตรต่อสิ่งแวดล้อม (Buy computer products which are eco-friendly packaging)	1	1	1	1	1	**5**	**1**
19. ใช้กระดาษซ้ำในการทดสอบการพิมพ์ (Reuse printed papers for testing printers)	1	1	1	1	1	**5**	**1**
20. ใช้หมึกพิมพ์แบบเติม (Use refills for ink cartridges)	0	1	1	0	1	**3**	**0.6**
21. ใช้อุปกรณ์การเก็บข้อมูลแบบบันทึกซ้ำได้ (Use rewritable storage media)	1	1	1	1	1	**5**	**1**
22. นำโทนเนอร์หมึกกลับมาใช้ใหม่ (Recycle ink and toner cartridges)	0	1	1	0	1	**3**	**0.6**
23. นำกระดาษที่ไม่ได้ต้องการกลับมาใช้ใหม่ (Recycle unwanted paper printouts)	1	1	1	1	1	**5**	**1**
24. นำแบตเตอรี่โน้ตบุคที่ไม่ต้องการกลับมาใช้ใหม่ (Recycle unwanted lithium (laptop) batteries)	1	1	1	1	0	**4**	**0.8**
25. นำอุปกรณ์คอมพิวเตอร์ที่ไม่ต้องการกลับมาใช้ใหม่ (Recycle unwanted computer equipment)	1	1	1	1	1	**5**	**1**
26. ซื้ออุปกรณ์คอมพิวเตอร์เมื่อมีรุ่นใหม่ผลิตออกมา (Buy computer device whenever a new model available)	1	1	1	1	1	**5**	**1**
27. ซื้ออุปกรณ์คอมพิวเตอร์เมื่อจำเป็นเท่านั้น (Buy computer device only when needed)	1	1	1	1	1	**5**	**1**
28. อัพเกรดอุปกรณ์คอมพิวเตอร์ (Upgrade existing computer equipment where possible)	1	1	1	1	1	**5**	**1**
29. ซื้ออุปกรณ์คอมพิวเตอร์มือสอง (Buy recyclable computer equipment where possible)	1	1	1	1	1	**5**	**1**

Statement	Awareness on Green ICT						
	S1	S2	S3	S4	S5	Total	IOC
30. บริจาคเครื่องคอมพิวเตอร์และอุปกรณ์ ICT ที่ไม่ใช้แล้วแต่มีสภาพดีให้กับผู้อื่น (Donate unwanted computer and ICT devices which are still in good condition to others)	1	1	1	1	1	**5**	**1**
31. ใช้เครื่องพิมพ์ที่ออกแบบมาเพื่อเป็นมิตรกับสิ่งแวดล้อม (Use printer which is designed for green)	1	1	1	1	1	**5**	**1**
32. ใช้โทรศัพท์มือถือที่ผ่านการนำกลับมาผลิตใหม่ (Use refurbished mobile phone)	1	1	1	1	0	**4**	**0.8**
33. ซื้อโทรศัพท์มือถือเมื่อมีรุ่นใหม่ผลิตออกมา (Buy mobile phone whenever a new model available)	1	1	1	1	1	**5**	**1**
34. อ่านหนังสืออิเล็กทรอนิกส์ (Read E-book)	1	1	1	1	1	**5**	**1**
35. ใช้ระบบนำทาง GPS คำนวณระยะทางในการเดินทาง (Use GPS to calculate distance)	1	1	1	1	1	**5**	**1**
36. ใช้การประชุมทางไกล (Use video conference)	1	1	1	1	0	**4**	**0.8**
37. ใช้โทรศัพท์มือถือมือสอง (Use seconded-hand mobile phone)	1	1	1	1	1	**5**	**1**
	35	**37**	**37**	**34**	**34**		

Appendix C

The Cronbach's Alpha Value of Green ICT Questionnaire

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.934	37

Appendix D

The Final Version of Questionnaire

แบบสอบถาม

เรื่อง ความตระหนักในเรื่องเทคโนโลยีเป็นมิตรกับสิ่งแวดล้อมและกระบวนการเรียนรู้ด้วยตัวเอง

(The Development of Awareness on Green ICT through The Implications of Self-Directed Learning)

วัตถุประสงค์ เพื่อศึกษาความตระหนักในเรื่องเทคโนโลยีเป็นมิตรกับสิ่งแวดล้อมและการเรียนรู้ด้วยตนเองของพนักงาน เพื่อเป็นแนวทางพัฒนานโยบายขององค์การในการส่งเสริมความตระหนักในเรื่องเทคโนโลยีเป็นมิตรกับสิ่งแวดล้อม

หมายเหตุ *ข้อมูลที่ได้จากแบบสอบถามนี้จะถูกเก็บเป็นความลับ โดยจะนำไปใช้ประกอบในการทำวิทยานิพนธ์เท่านั้น*

ตอนที่ 1 ข้อมูลทั่วไปเกี่ยวกับผู้ตอบแบบสอบถาม (Section 1: Socioeconomic Background)

โปรดทำเครื่องหมาย ✓ ในข้อที่เป็นจริงและเหมาะสมกับท่านมากที่สุด (Please check✓ in the box)

1.1 เพศ (Sex)

☐ ชาย (Male) ☐ หญิง (Female)

1.2 อายุ (Age).....ปี (Years)

1.3 ระดับการศึกษา (Education)

☐ มัธยมศึกษาตอนปลาย (Secondary Education) ☐ อนุปริญญาหรือเทียบเท่า (Diploma)

☐ ปริญญาตรี (Bachelor's degree) ☐ ปริญญาโท (Master's degree)

☐ ปริญญาเอก (Doctor's degree)

1.4 สาขาวิชาที่ท่านจบการศึกษา

☐ เกี่ยวกับเทคโนโลยีสารสนเทศ (IT) (โปรดระบุ).....

☐ ไม่เกี่ยวกับเทคโนโลยีสารสนเทศ (Non-IT)

1.5 ชื่อบริษัท (Company's name) .....

1.6 ตำแหน่งงานในปัจจุบัน (Position) .....

1.7 ประสบการณ์การทำงานในตำแหน่งข้อ 1.6 และในองค์การนี้ (Work Experience).....ปี (Years)

1.8 รายได้ต่อเดือน (Income per month)

☐ น้อยกว่าหรือเท่ากับ 15,000 บาท (less than or equal 15,000 baht)

☐ 15,001-30,000 บาท (baht)

☐ 30,001- 45,000 บาท (baht)

☐ มากกว่า 45,000 บาท (more than 45,000 baht)

1.9 องค์การของท่านมีนโยบาย/โครงการเกี่ยวกับเทคโนโลยีเป็นมิตรกับสิ่งแวดล้อมหรือไม่

☐ มี (โปรดระบุ).....

☐ ไม่มี

☐ ไม่แน่ใจ

ตอนที่ 2 แบบสำรวจความตระหนักในเรื่องเทคโนโลยีเป็นมิตรกับสิ่งแวดล้อม

(Section 2: awareness on Green ICT)

2.1) จากคำศัพท์ที่เกี่ยวข้องกับเทคโนโลยีเป็นมิตรกับสิ่งแวดล้อม (Green ICT) เหล่านี้

โปรดทำเครื่องหมาย ✓ ให้ตรงกับท่านมากที่สุด

(Please check ✓ indicate the degree of your agreement from vocabulary)

- **Green ICT:** ไอซีทีที่นำมาใช้โดยคำนึงถึงสิ่งแวดล้อมและส่งผลให้สิ่งแวดล้อมมีความยั่งยืน
- **ICT for Green:** การนำไอซีทีมาใช้เพื่อส่งเสริมและสนับสนุนให้สิ่งแวดล้อมมีความยั่งยืน
- **Green IS:** ระบบสารสนเทศที่นำมาใช้โดยคำนึงถึงสิ่งแวดล้อมและส่งผลให้สิ่งแวดล้อมมีความยั่งยืน
- **IS for Green:** ระบบสารสนเทศที่สนับสนุนกระบวนการต่าง ๆ ที่ทำให้เกิดสิ่งแวดล้อมอย่างยั่งยืน
- **Green IT:** เทคโนโลยีสารสนเทศที่นำมาใช้โดยคำนึงถึงสิ่งแวดล้อมและส่งผลให้สิ่งแวดล้อมมีความยั่งยืน
- **IT for Green:** เทคโนโลยีสารสนเทศที่สนับสนุนกิจกรรมต่าง ๆ ที่ทำให้เกิดสิ่งแวดล้อมอย่างยั่งยืน
- **Green Computing:** การประมวลผลที่นำมาใช้โดยคำนึงถึงสิ่งแวดล้อมและส่งผลให้สิ่งแวดล้อมมีความยั่งยืน ยกตัวอย่างเช่นการประมวลผลให้ได้ประสิทธิภาพอย่างคุ้มค่าที่สุด เมื่อเทียบกับพลังงานไฟฟ้า และวัสดุต่างๆ ที่ต้องใช้งานไป
- **Carbon Footprint:** ปริมาณก๊าซเรือนกระจกที่ปล่อยออกมาจากผลิตภัณฑ์แต่ละหน่วย ตลอดวัฏจักรชีวิตของผลิตภัณฑ์ ตั้งแต่การได้มาซึ่งวัตถุดิบ การขนส่ง การประกอบชิ้นส่วน การใช้งาน และการจัดการซากผลิตภัณฑ์หลังใช้งาน
- **E-waste:** ขยะอิเล็กทรอนิกส์ เช่น ตะกั่ว ปรอท แคดเมียม ซึ่งอาจรั่วไหลออกมาจากเครื่องคอมพิวเตอร์หรือโทรศัพท์มือถือที่เลิกใช้แล้ว
- **Energy Star:** การกำหนดมาตรฐานการใช้พลังงานของอุปกรณ์ไฟฟ้าให้สามารถใช้ไฟฟ้าได้อย่างคุ้มค่ามากที่สุด
- **E-PEAT (Electronic Product Environmental Assessment Tool):** ระบบที่อาศัยมาตรฐานของ IEEE 1680 เป็นตัวกำหนดระดับความเป็นมิตรกับสิ่งแวดล้อมของสินค้าอิเล็คทรอนิกส์ โดยEPEAT แบ่งเป็น 3 ระดับคือ Gold, Silverและ Bronze

Green ICT Vocabulary	รู้จัก	ไม่รู้จัก	ไม่แน่ใจ
1. Green ICT			
2. ICT for Green			
3. Green IS			
4. IS For Green			
5. Green IT			
6. IT for Green			
7. Green PC			
8. Carbon Footprint			
9. E-waste			
10. Energy Star			
11. E-PEAT			

2.2) โปรดทำเครื่องหมาย ✓ ให้ตรงกับท่านมากที่สุด

(Please check ✓ indicate the degree of your agreement)

หัวข้อ (Topic)	ทำเป็นประจำ (Always)	ทำบ่อยครั้ง (Often)	ทำเป็นบางครั้ง (Sometimes)	ทำนานๆ ครั้ง (Rarely)	ไม่เคยทำ (Never)
1. ใช้ฟังก์ชัน Screen saver (Use the screen saver function)					
2. ใช้ฟังก์ชันหน้าจอ Sleep mode (Use the monitor sleep function)					
3. ใช้ฟังก์ชันระบบ Sleep (Use the system sleep function)					
4. เปิดคอมพิวเตอร์เมื่อจำเป็นเท่านั้น (Turn on computer only when the need arise)					
5. เปิดคอมพิวเตอร์อย่างต่อเนื่อง (Keep the computer turned on even when away)					
6. พยายามลดเวลาในการใช้งานคอมพิวเตอร์ (Try to reduce amount of time spent using computers)					
7. เปิดอุปกรณ์ต่อพ่วงทั้งหมดทุกครั้งที่คอมพิวเตอร์เปิดอยู่ (Turn on all peripherals every time the computer is turned on)					

หัวข้อ (Topic)	ทำเป็นประจำ (Always)	ทำบ่อยครั้ง (Often)	ทำเป็นบางครั้ง (Sometimes)	ทำนานๆ ครั้ง (Rarely)	ไม่เคยทำ (Never)
8. เปิดอุปกรณ์ต่อพ่วงเฉพาะที่จำเป็นต้องใช้ (Turn on peripherals only when I need to use it)					
9. ปิดระบบงานคอมพิวเตอร์ทั้งหมดเมื่อต้องการพักเป็นเวลานาน (Turn off entire computer system when out for a long break)					
10. พิมพ์กระดาษออกมาเมื่อจำเป็นเท่านั้น (Print on paper only when necessary)					
11. พิมพ์กระดาษหน้าหลัง (Print on both sides of the paper if possible)					
12. บันทึกเอกสารบนอุปกรณ์บันทึกข้อมูลมากกว่าที่จะพิมพ์บนกระดาษ (Save documents on disk rather than printing on paper)					
13. ส่งเอกสารทาง e-mail มากกว่าทางไปรษณีย์ (Send documents via email rather than by post/hardcopy)					
14. พยายามจัดหน้าเอกสารเพื่อลดจำนวนหน้ากระดาษ (Try to reduce the number of pages when creating document)					
15. ใช้การพิมพ์แบบหลายหน้าต่อแผ่น (Use multi-page printing)					
16. ส่งเอกสารหมุนเวียนโดยใช้ไฟล์แทนการพิมพ์เป็นเอกสาร (Circulate soft-copies rather than printing out)					
17. ใช้อุปกรณ์คอมพิวเตอร์ที่มีประสิทธิภาพด้านพลังงาน (Use energy efficient computer equipment)					
18. ซื้อผลิตภัณฑ์คอมพิวเตอร์ที่มีบรรจุภัณฑ์เป็นมิตรต่อสิ่งแวดล้อม (Buy computer products which are eco-friendly packaging)					
19. ใช้กระดาษซ้ำในการทดสอบการพิมพ์ (Reuse printed papers for testing printers)					

หัวข้อ (Topic)	ทำเป็นประจำ (Always)	ทำบ่อยครั้ง (Often)	ทำเป็นบางครั้ง (Sometimes)	ทำนานๆ ครั้ง (Rarely)	ไม่เคยทำ (Never)
20. ใช้หมึกพิมพ์แบบเติม (Use refills for ink cartridges)					
21. ใช้อุปกรณ์การเก็บข้อมูลแบบบันทึกซ้ำได้ (Use rewritable storage media)					
22. นำโทนเนอร์หมึกกลับมาใช้ใหม่ (Recycle ink and toner cartridges)					
23. นำกระดาษที่ไม่ได้ต้องการกลับมาใช้ใหม่ (Recycle unwanted paper printouts)					
24. นำแบตเตอรี่โน้ตบุคที่ไม่ต้องการกลับมาใช้ใหม่ (Recycle unwanted lithium (laptop) batteries)					
25. นำอุปกรณ์คอมพิวเตอร์ที่ไม่ต้องการกลับมาใช้ใหม่ (Recycle unwanted computer equipment)					
26. ซื้ออุปกรณ์คอมพิวเตอร์เมื่อมีรุ่นใหม่ผลิตออกมาท (Buy computer device whenever a new model available)					
27. ซื้ออุปกรณ์คอมพิวเตอร์เมื่อจำเป็นเท่านั้น (Buy computer device only when needed)					
28. อัพเกรดอุปกรณ์คอมพิวเตอร์ (Upgrade existing computer equipment where possible)					
29. ซื้ออุปกรณ์คอมพิวเตอร์มือสอง (Buy recyclable computer equipment where possible)					
30. บริจาคเครื่องคอมพิวเตอร์และอุปกรณ์ ICT ที่ไม่ใช้แล้วแต่มีสภาพดีให้กับผู้อื่น (Donate unwanted computer and ICT devices which are still in good condition to others)					
31. ใช้เครื่องพิมพ์ที่ออกแบบมาเพื่อเป็นมิตรกับสิ่งแวดล้อม (Use printer which is designed for green)					
32. ใช้โทรศัพท์มือถือที่ผ่านการนำกลับมาผลิตใหม่ (Use refurbished mobile phone)					

หัวข้อ (Topic)	ทำเป็นประจำ (Always)	ทำบ่อยครั้ง (Often)	ทำเป็นบางครั้ง (Sometimes)	ทำนานๆ ครั้ง (Rarely)	ไม่เคยทำ (Never)
33. ซื้อโทรศัพท์มือถือเมื่อมีรุ่นใหม่ผลิตออกมา (Buy mobile phone whenever a new model available)					
34. อ่านหนังสืออิเล็กทรอนิกส์ (Read E-book)					
35. ใช้ระบบนำทาง GPS คำนวณระยะทางในการเดินทาง (Use GPS to calculate distance)					
36. ใช้การประชุมทางไกล (Use video conference)					
37. ใช้โทรศัพท์มือถือมือสอง (Use seconded-hand mobile phone)					

2.3) โปรดทำเครื่องหมาย ✓ ที่ตรงกับความคิดเห็นของท่าน (Please check ✓ indicate the degree of your agreement or disagreement with each topic by choosing one of the five alternatives)

5 หมายถึง มีความสำคัญมากที่สุด (The most important)
4 หมายถึง มีความสำคัญมาก (Important)
3 หมายถึง เฉย ๆ (Neutral)
2 หมายถึง มีความสำคัญน้อย (Less important)
1 หมายถึง ไม่มีความสำคัญ (Not important)

หัวข้อ (Topic)	ลำดับความสำคัญ				
	5	4	3	2	1
1. ใช้ฟังก์ชัน Screen saver (Use the screen saver function)					
2. ใช้ฟังก์ชันหน้าจอ Sleep mode (Use the monitor sleep function)					
3. ใช้ฟังก์ชันระบบ Sleep (Use the system sleep function)					
4. เปิดคอมพิวเตอร์เมื่อจำเป็นเท่านั้น (Turn on computer only when the need arise)					
5. เปิดคอมพิวเตอร์อย่างต่อเนื่อง (Keep the computer turned on even when away)					
6. พยายามลดเวลาในการใช้งานคอมพิวเตอร์ (Try to reduce amount of time spent using computers)					
7. เปิดอุปกรณ์ต่อพ่วงทั้งหมดทุกครั้งที่คอมพิวเตอร์เปิดอยู่ (Turn on all peripherals every time the computer is turned on)					
8. เปิดอุปกรณ์ต่อพ่วงเฉพาะที่จำเป็นต้องใช้ (Turn on peripherals only when I need to use it)					

หัวข้อ (Topic)	ลำดับความสำคัญ				
	5	4	3	2	1
9. ปิดระบบงานคอมพิวเตอร์ทั้งหมดเมื่อต้องการพักเป็นเวลานาน (Turn off entire computer system when out for a long break)					
10. พิมพ์กระดาษออกมาเมื่อจำเป็นเท่านั้น (Print on paper only when necessary)					
11. พิมพ์กระดาษหน้าหลัง (Print on both sides of the paper if possible)					
12. บันทึกเอกสารบนอุปกรณ์บันทึกข้อมูลมากกว่าที่จะพิมพ์บนกระดาษ (Save documents on disk rather than printing on paper)					
13. ส่งเอกสารทาง e-mail มากกว่าทางไปรษณีย์ (Send documents via email rather than by post/hardcopy)					
14. พยามจัดหน้าเอกสารเพื่อลดจำนวนหน้ากระดาษ (Try to reduce the number of pages when creating document)					
15. ใช้การพิมพ์แบบหลายหน้าต่อแผ่น (Use multi-page printing)					
16. ส่งเอกสารหมุนเวียนโดยใช้ไฟล์แทนการพิมพ์เป็นเอกสาร (Circulate soft-copies rather than printing out)					
17. ใช้อุปกรณ์คอมพิวเตอร์ที่มีประสิทธิภาพด้านพลังงาน (Use energy efficient computer equipment)					
18. ซื้อผลิตภัณฑ์คอมพิวเตอร์ที่มีบรรจุภัณฑ์เป็นมิตรต่อสิ่งแวดล้อม (Buy computer products which are eco-friendly packaging)					
19. ใช้กระดาษซ้ำในการทดสอบการพิมพ์ (Reuse printed papers for testing printers)					
20. ใช้หมึกพิมพ์แบบเติม (Use refills for ink cartridges)					
21. ใช้อุปกรณ์การเก็บข้อมูลแบบบันทึกซ้ำได้ (Use rewritable storage media)					
22. นำโทนเนอร์หมึกกลับมาใช้ใหม่ (Recycle ink and toner cartridges)					
23. นำกระดาษที่ไม่ได้ต้องการกลับมาใช้ใหม่ (Recycle unwanted paper printouts)					
24. นำแบตเตอรี่โน้ตบุคที่ไม่ต้องการกลับมาใช้ใหม่ (Recycle unwanted lithium (laptop) batteries)					
25. นำอุปกรณ์คอมพิวเตอร์ที่ไม่ต้องการกลับมาใช้ใหม่ (Recycle unwanted computer equipment)					
26. ซื้ออุปกรณ์คอมพิวเตอร์เมื่อมีรุ่นใหม่ผลิตออกมา (Buy computer device whenever a new model available)					
27. ซื้ออุปกรณ์คอมพิวเตอร์เมื่อจำเป็นเท่านั้น (Buy computer device only when needed)					
28. อัพเกรดอุปกรณ์คอมพิวเตอร์ (Upgrade existing computer equipment where possible)					
29. ซื้ออุปกรณ์คอมพิวเตอร์มือสอง (Buy recyclable computer equipment where possible)					
30. บริจาคเครื่องคอมพิวเตอร์และอุปกรณ์ ICT ที่ไม่ใช้แล้วแต่มีสภาพดีให้กับผู้อื่น (Donate unwanted computer and ICT devices which are still in good condition to others)					
31. ใช้เครื่องพิมพ์ที่ออกแบบมาเพื่อเป็นมิตรกับสิ่งแวดล้อม (Use printer which is designed for green)					

หัวข้อ (Topic)	ลำดับความสำคัญ				
	5	4	3	2	1
32. ใช้โทรศัพท์มือถือที่ผ่านการนำกลับมาผลิตใหม่ (Use refurbished mobile phone)					
33. ซื้อโทรศัพท์มือถือเมื่อมีรุ่นใหม่ผลิตออกมา (Buy mobile phone whenever a new model available)					
34. อ่านหนังสืออิเล็กทรอนิกส์ (Read E-book)					
35. ใช้ระบบนำทาง GPS คำนวณระยะทางในการเดินทาง (Use GPS to calculate distance)					
36. ใช้การประชุมทางไกล (Use video conference)					
37. ใช้โทรศัพท์มือถือมือสอง (Use seconded-hand mobile phone)					

ตอนที่ 3 แบบสำรวจระดับการเรียนรู้ด้วยตนเอง (Section 3: Self-Directed Learning)

โปรดทำเครื่องหมาย ✓ ที่ตรงกับความคิดเห็นของท่าน (Please check ✓ indicate the degree of your agreement or disagreement with each topic by choosing one of the five alternatives)

5 หมายถึง เห็นด้วยอย่างยิ่ง (Strongly Agree)
4 หมายถึง เห็นด้วย (Agree)
3 หมายถึง เฉย ๆ (Neither Agree or Disagree)
2 หมายถึง ไม่เห็นด้วย (Disagree)
1 หมายถึง ไม่เห็นด้วยอย่างยิ่ง (Strongly Disagree)

หัวข้อ (Topic)	ระดับความคิดเห็น (Attitude)				
	5	4	3	2	1
1. ข้าพเจ้ามีการวางแผนในการแก้ปัญหา (I plan when solving problems)					
2. ข้าพเจ้าจัดลำดับความสำคัญของงานตนเอง (I prioritize my work)					
3. ข้าพเจ้าชอบตอบปัญหา/ไขปริศนา (I like to solve (answer) puzzles/questions)					
4. ข้าพเจ้าจัดการเวลาของตนเองได้เป็นอย่างดี (I manage my time well)					
5. ข้าพเจ้ามีทักษะด้านการบริหารจัดการที่ดี (I have good management skills)					
6. ข้าพเจ้ากำหนดกรอบเวลาอย่างเคร่งครัด (I set strict time frames)					

หัวข้อ (Topic)	ระดับความคิดเห็น (Attitude)				
	5	4	3	2	1
7. ข้าพเจ้าชอบวางแผนการเรียนรู้ของตัวเอง (I prefer to plan my own learning)					
8. ข้าพเจ้าชอบที่จะเรียนรู้ด้วยตนเอง (I prefer to direct my own learning)					
9. ข้าพเจ้าเชื่อว่าบทบาทของผู้สอน/ผู้บรรยาย/วิทยากร คือการแสดงออกของผู้ทรงความรู้ (I believe the role of the instructor/lecturer/expert is to act as a resource person)					
10. ข้าพเจ้าเรียนรู้ด้วยตนเองอย่างเป็นระบบ (I learn by myself systematically)					
11. ข้าพเจ้ามีสมาธิอยู่กับปัญหา (I am able to focus on a problem)					
12. ข้าพเจ้ามักจะทบทวนวิธีการทำงานที่เคยทำ (I often review the way working practices are conducted)					
13. ข้าพเจ้าต้องการที่จะรู้สาเหตุของปัญหา (I need to know why)					
14. ข้าพเจ้าประเมินความคิดใหม่ ๆ อย่างพินิจพิเคราะห์ (I critically evaluate new ideas)					
15. ข้าพเจ้าชอบกำหนดเป้าหมายในการเรียนรู้ของตนเอง (I prefer to set my own learning goals)					
16. ข้าพเจ้ายินดีที่จะเปลี่ยนความคิดของตนเอง (I am willing to change my ideas)					
17. ข้าพเจ้าจะขอความช่วยเหลือในการเรียนรู้เมื่อจำเป็น (I will ask for help in my learning when necessary)					
18. ข้าพเจ้ายินดีรับคำแนะนำจากผู้อื่น (I am willing to accept advice from others)					
19. ข้าพเจ้าเรียนรู้จากความผิดพลาดของตนเอง (I learn from my mistakes)					
20. ข้าพเจ้าจะปรับเปลี่ยนพฤติกรรมของตนเองเมื่อมีความจริงมาพิสูจน์ (I will alter my practices when presented with the facts)					
21. ข้าพเจ้าเปิดรับโอกาสการเรียนรู้ใหม่ๆ (I am open to new learning opportunities)					
22. ข้าพเจ้าเปิดรับความคิดเห็นใหม่ ๆ (I am open to new ideas)					

หัวข้อ (Topic)	ระดับความคิดเห็น (Attitude)				
	5	4	3	2	1
23. ถ้าเจอปัญหาแล้วข้าพเจ้าไม่สามารถแก้ปัญหานั้นได้ ข้าพเจ้าจะขอความช่วยเหลือ (When facing with a problem I cannot solve, I will ask for assistance)					
24. ข้าพเจ้ามีความรับผิดชอบ (I am a responsible person)					
25. ข้าพเจ้าชอบประเมินในสิ่งที่ตนเองทำ (I like to evaluate what I do)					
26. ข้าพเจ้ามีความคาดหวังสูง (I have high personal expectations)					
27. ข้าพเจ้ามีมาตรฐานส่วนตัวสูง (I have high personal standards)					
28. ข้าพเจ้าเชื่อมั่นในความสามารถของตนเอง (I have high beliefs in my abilities)					
29. ข้าพเจ้าตระหนักในข้อจำกัดของตนเอง (I am aware of my own limitations)					
30. ข้าพเจ้าเป็นคนมุ่งมั่น (I am assertive)					
31. ข้าพเจ้ามั่นใจความสามารถในการค้นหาข้อมูล (I am confident in my ability to search out information)					
32. ข้าพเจ้าสนุกกับการเรียนรู้ (I enjoy studying)					
33. ข้าพเจ้ามีความต้องการที่จะเรียนรู้ (I have a need to learn)					
34. ข้าพเจ้าชอบความท้าทาย (I enjoy a challenge)					
35. ข้าพเจ้าต้องการเรียนรู้ข้อมูลใหม่ ๆ (I want to learn about new information)					
36. ข้าพเจ้ารู้สึกสนุกในการเรียนรู้ข้อมูลใหม่ ๆ (I enjoy learning about new information)					
37. ข้าพเจ้ามีการกำหนดเวลาสำหรับการเรียนของตนเอง (I set specific times for my study)					
38. ข้าพเจ้ามีระเบียบวินัยในตัวเอง (I am self-disciplined)					
39. ข้าพเจ้ามักจะรวบรวมข้อมูลที่เป็นจริงก่อนตัดสินใจ (I like to gather the facts before I make a decision)					
40. ข้าพเจ้าเป็นคนจัดการอะไรได้ดี (I am organized)					
41. ข้าพเจ้าเป็นคนมีตรรกะ (I am logical)					
42. ข้าพเจ้าเป็นคนมีระบบระเบียบในการทำงาน (I am methodical)					

หัวข้อ (Topic)	ระดับความคิดเห็น (Attitude)				
	5	4	3	2	1
43. ข้าพเจ้าประเมินความสามารถของตนเอง (I evaluate my own performance)					
44. ข้าพเจ้าชอบกำหนดกฎเกณฑ์ในการประเมินความสามารถของตนเอง (I prefer to set my own criteria on which to evaluate my performance)					
45. ข้าพเจ้ามีความรับผิดชอบต่อการตัดสินใจหรือการกระทำด้วยตนเอง (I am responsible for my own decisions/actions)					
46. ข้าพเจ้าเชื่อถือว่าข้าพเจ้าจะสามารถเรียนรู้ด้วยตนเองต่อไปได้ (I can be trusted to pursue my own learning)					
47. ข้าพเจ้าค้นหาข้อมูลเองได้ (I can find out information by myself)					
48. ข้าพเจ้าต้องการความช่วยเหลือเพียงเล็กน้อยในการค้นหาข้อมูล (I need minimal help to find information)					
49. ข้าพเจ้าชอบตัดสินใจด้วยตัวเอง (I like to make decisions by myself)					
50. ข้าพเจ้าชอบกำหนดเป้าหมายของตนเอง (I prefer to set my own goals)					
51. ข้าพเจ้าควบคุมชีวิตของตนเองได้ (I am in control of my life)					
52. ข้าพเจ้าต้องการการดูแลเมื่อข้าพเจ้าเรียนรู้ (I need to be in control of what I learn)					

Appendix E

Questionnaire Consent Form

Questionnaire Consent Form

The Development of Awareness on Green ICT through The Implications of Self-Directed Learning

Kultida Malison
Faculty of Business Administration and Information Technology
Rajamangala University of Technology Tawan-Ok,
Chakrabongse Bhuvanarth Campus
Mobile phone number: 082-498-1945
Email address: kultida_m@yahoo.com

I understand that I am invited to take part in a research survey about Green ICT and self-directed learning. The purposes of this survey research are to investigate the dimensions of awareness on Green ICT and dimensions of self-directed learning among employees, and to investigate the influence of self-directed learning on awareness of Green ICT. The results of survey will be used to develop guideline to increase Green ICT awareness among employees. There are no risks or discomforts associated with this survey. This survey will help to improve Green ICT awareness which is important for helping environment. I have been given some general information about this research and the types of questions I can expect to answer.

I understand that my participation in this survey is completely voluntary and that I am free to decline to participate, without consequence, at any time prior to or at any point during the survey. I understand that any information I provide will be kept strictly confidential, used only for the purposes of completing this questionnaire, and will not be used in any way that can identify me. All questionnaire responses will be

kept in a secured environment. And none of the information I provide will be published, in any form, in any journals or conference proceedings.

I have read the information above. By signing below and returning this form, I am consenting to participate in this survey.

Signature of research participant *Date*

_____ _____

(_____)

Signature of researcher *Date*

_____ _____

(_____)

Appendix F

Asking Permission to Use Self-Directed Learning Questionnaire

Asking for a permission to use your self-directed learning questionnaire

Me
To murray.fisher@sydney.edu.au
4 Apr 2560 at 16:58

Dear Associate Professor Fisher:

My name is Kultida Malison. I am a Thai Ph.D. student who are interested in doing research about Information System. I am going to conduct my dissertation about the level of self-directed learning and the level of awareness on green ICT concepts among employees in Bangkok. So, exploring the level of self-directed learning is the first part of my research.

As I have learned from the studies about self-directed learning, you have conducted many research about self-directed learning for nursing education. I have also seen that your questionnaire is very helpful for my first-part study. In addition, most of items match with my goal to measure self-directed learning among Thai employees. So, I would like to ask for your permission to use your questionnaire in my dissertation. In this case, the items which do not match with my participants will be eliminated. In the same way, I will add some items if I find that it helps me to find the results.

Because you questionnaire is useful for educational context, please do not hesitate to tell me if you have any suggestions.

I am looking forward to hearing from you.

Best regards,

Kultida Malison

Appendix G

Self-directed Learning Questionnaire Evaluation Index of Item-Objective Congruence (IOC)

Statement	Self-directed Learning						
	S1	S2	S3	S4	S5	Total	IOC
1. ข้าพเจ้ามีการวางแผนในการแก้ปัญหา (I plan when solving problems)	1	1	1	1	1	**5**	**1**
2. ข้าพเจ้าจัดลำดับความสำคัญของงานตนเอง (I prioritize my work)	1	1	1	1	1	**5**	**1**
3. ข้าพเจ้าชอบตอบปัญหา/ไขปริศนา (I like to solve (answer) puzzles/questions)	1	1	1	1	1	**5**	**1**
4. ข้าพเจ้าจัดการเวลาของตนเองได้เป็นอย่างดี (I manage my time well)	1	1	1	1	1	**5**	**1**
5. ข้าพเจ้ามีทักษะด้านการบริหารจัดการที่ดี (I have good management skills)	1	1	1	1	1	**5**	**1**
6. ข้าพเจ้ากำหนดกรอบเวลาอย่างเคร่งครัด (I set strict time frames)	1	1	1	1	0	**4**	**0.8**
7. ข้าพเจ้าชอบวางแผนการเรียนรู้ของตัวเอง (I prefer to plan my own learning)	1	1	1	1	1	**5**	**1**
8. ข้าพเจ้าชอบที่จะเรียนรู้ด้วยตนเอง (I prefer to direct my own learning)	1	1	1	1	1	**5**	**1**
9. ข้าพเจ้าเชื่อว่าบทบาทของครูคือการแสดงออกของผู้ทรงความรู้ (I believe the role of the teacher is to act as a resource person)	0	-1	1	1	1	**2**	**0.4**
10. ข้าพเจ้าเรียนรู้ด้วยตนเองอย่างเป็นระบบ (I learn by myself systematically)	1	1	0	1	1	**4**	**0.8**
11. ข้าพเจ้ามีสมาธิอยู่กับปัญหา (I am able to focus on a problem)	1	1	1	1	1	**5**	**1**
12. ข้าพเจ้ามักจะทบทวนวิธีการทำงานที่เคยทำ (I often review the way working practices are conducted)	1	1	0	1	0	**3**	**0.6**
13. ข้าพเจ้าต้องการที่จะรู้สาเหตุ (I need to know why)	1	1	1	1	1	**5**	**1**
14. ข้าพเจ้าประเมินความคิดใหม่ ๆ อย่างพินิจพิเคราะห์ (I critically evaluate new ideas)	1	1	1	1	1	**5**	**1**

Statement	Self-directed Learning						
	S1	S2	S3	S4	S5	Total	IOC
15. ข้าพเจ้าชอบกำหนดเป้าหมายในการเรียนรู้ของตนเอง (I prefer to set my own learning goals)	1	1	1	0	1	**4**	**0.8**
16. ข้าพเจ้ายินดีที่จะเปลี่ยนความคิดของตนเอง (I am willing to change my ideas)	1	1	1	1	1	**5**	**1**
17. ข้าพเจ้าจะขอความช่วยเหลือในการเรียนรู้เมื่อจำเป็น (I will ask for help in my learning when necessary)	1	1	1	1	1	**5**	**1**
18. ข้าพเจ้ายินดีรับคำแนะนำจากผู้อื่น (I am willing to accept advice from others)	1	1	1	1	1	**5**	**1**
19. ข้าพเจ้าเรียนรู้จากความผิดพลาดของตนเอง (I learn from my mistakes)	1	1	1	1	1	**5**	**1**
20. ข้าพเจ้าจะปรับเปลี่ยนพฤติกรรมของตนเองเมื่อมีความจริงมาพิสูจน์ (I will alter my practices when presented with the facts)	1	1	1	-1	1	**3**	**0.6**
21. ข้าพเจ้าเปิดรับโอกาสการเรียนรู้ใหม่ ๆ (I am open to new learning opportunities)	1	1	1	1	1	**5**	**1**
22. ข้าพเจ้าเปิดรับความคิดเห็นใหม่ ๆ (I am open to new ideas)	1	1	1	-1	1	**3**	**0.6**
23. ถ้าเจอปัญหาแล้วข้าพเจ้าไม่สามารถแก้ปัญหานั้นได้ ข้าพเจ้าจะขอความช่วยเหลือ (When facing with a problem I cannot solve, I will ask for assistance)	1	1	1	-1	1	**3**	**0.6**
24. ข้าพเจ้ามีความรับผิดชอบ (I am a responsible person)	1	1	0	1	1	**4**	**0.8**
25. ข้าพเจ้าชอบประเมินในสิ่งที่ตนเองทำ (I like to evaluate what I do)	1	1	0	1	1	**4**	**0.8**
26. ข้าพเจ้ามีความคาดหวังสูง (I have high personal expectations)	0	1	1	1	1	**4**	**0.8**
27. ข้าพเจ้ามีมาตรฐานสูง (I have high personal standards)	0	0	0	0	1	**1**	**0.2**

Statement	Self-directed Learning						
	S1	S2	S3	S4	S5	Total	IOC
28. ข้าพเจ้าเชื่อมั่นในความสามารถของตนเอง (I have high beliefs in my abilities)	1	1	0	1	1	4	0.8
29. ข้าพเจ้าตระหนักในข้อจำกัดของตนเอง (I am aware of my own limitations)	1	1	1	1	1	5	1
30. ข้าพเจ้าเป็นคนมุ่งมั่น (I am assertive)	1	1	1	1	1	5	1
31. ข้าพเจ้ามั่นใจความสามารถในการค้นหาข้อมูล (I am confident in my ability to search out information)	1	1	1	1	1	5	1
32. ข้าพเจ้ารู้สึกสนุกในการเรียน (I enjoy studying)	0	0	1	0	1	2	0.4
33. ข้าพเจ้ามีความต้องการที่จะเรียนรู้ (I have a need to learn)	1	1	1	1	1	5	1
34. ข้าพเจ้าชอบความท้าทาย (I enjoy a challenge)	1	1	1	1	1	5	1
35. ข้าพเจ้าต้องการเรียนรู้ข้อมูลใหม่ ๆ (I want to learn new information)	1	1	1	1	1	5	1
36. ข้าพเจ้ารู้สึกสนุกในการเรียนรู้ข้อมูลใหม่ ๆ (I enjoy learning about new information)	1	1	1	1	1	5	1
37. ข้าพเจ้ามีการกำหนดเวลาสำหรับการเรียนของตนเอง (I set specific times for my study)	1	1	1	1	1	5	1
38. ข้าพเจ้ามีระเบียบวินัยในตัวเอง (I am self-disciplined)	1	1	1	0	1	4	0.8
39. ข้าพเจ้ามักจะรวบรวมข้อมูลที่เป็นจริงก่อนตัดสินใจ (I like to gather the facts before I make a decision)	1	1	1	1	1	5	1
40. ข้าพเจ้าเป็นคนจัดการอะไรได้ดี (I am organized)	1	1	1	0	1	4	0.8
41. ข้าพเจ้าเป็นคนมีตรรกะ (I am logical)	1	1	0	0	1	3	0.6
42. ข้าพเจ้าเป็นคนมีระบบระเบียบในการทำงาน (I am methodical)	1	1	0	0	1	3	0.6
43. ข้าพเจ้าประเมินความสามารถของตนเอง (I evaluate my own performance)	1	1	1	1	1	5	1

Statement	Self-directed Learning						
	S1	S2	S3	S4	S5	Total	IOC
44. ข้าพเจ้าชอบกำหนดกฎเกณฑ์ต่อการประเมินความสามารถของตนเอง (I prefer to set my own criteria on which to evaluate my performance)	1	1	1	1	1	**5**	**1**
45. ข้าพเจ้ามีความรับผิดชอบต่อการตัดสินใจหรือการกระทำของตนเอง (I am responsible for my own decisions/actions)	1	1	1	1	1	**5**	**1**
46. ข้าพเจ้าเชื่อมั่นว่าข้าพเจ้าจะสามารถเรียนรู้ด้วยตนเองต่อไปได้ (I can be trusted to pursue my own learning)	1	1	1	1	1	**5**	**1**
47. ข้าพเจ้าสามารถค้นหาข้อมูลเอง (I can find out information by myself)	1	1	1	1	1	**5**	**1**
48. ข้าพเจ้าต้องการความช่วยเหลือเพียงเล็กน้อยในการค้นหาข้อมูล (I need minimal help to find information)	1	1	1	0	1	**4**	**0.8**
49. ข้าพเจ้าชอบตัดสินใจด้วยตัวเอง (I like to make decisions by myself)	1	1	1	1	0	**4**	**0.8**
50. ข้าพเจ้าชอบกำหนดเป้าหมายของตนเอง (I prefer to set my own goals)	1	1	1	0	1	**4**	**0.8**
51. ข้าพเจ้าควบคุมชีวิตของตนเองได้ (I am in control of my life)	1	1	1	1	0	**4**	**0.8**
52. ข้าพเจ้าต้องการการดูแลเมื่อข้าพเจ้าเรียนรู้ (I need to be in control of what I learn)	1	1	1	0	1	**4**	**0.8**
	46	**48**	**42**	**36**	**48**		

Appendix H

The Cronbach's Alpha Value of Self-directed Learning Questionnaire

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.966	52

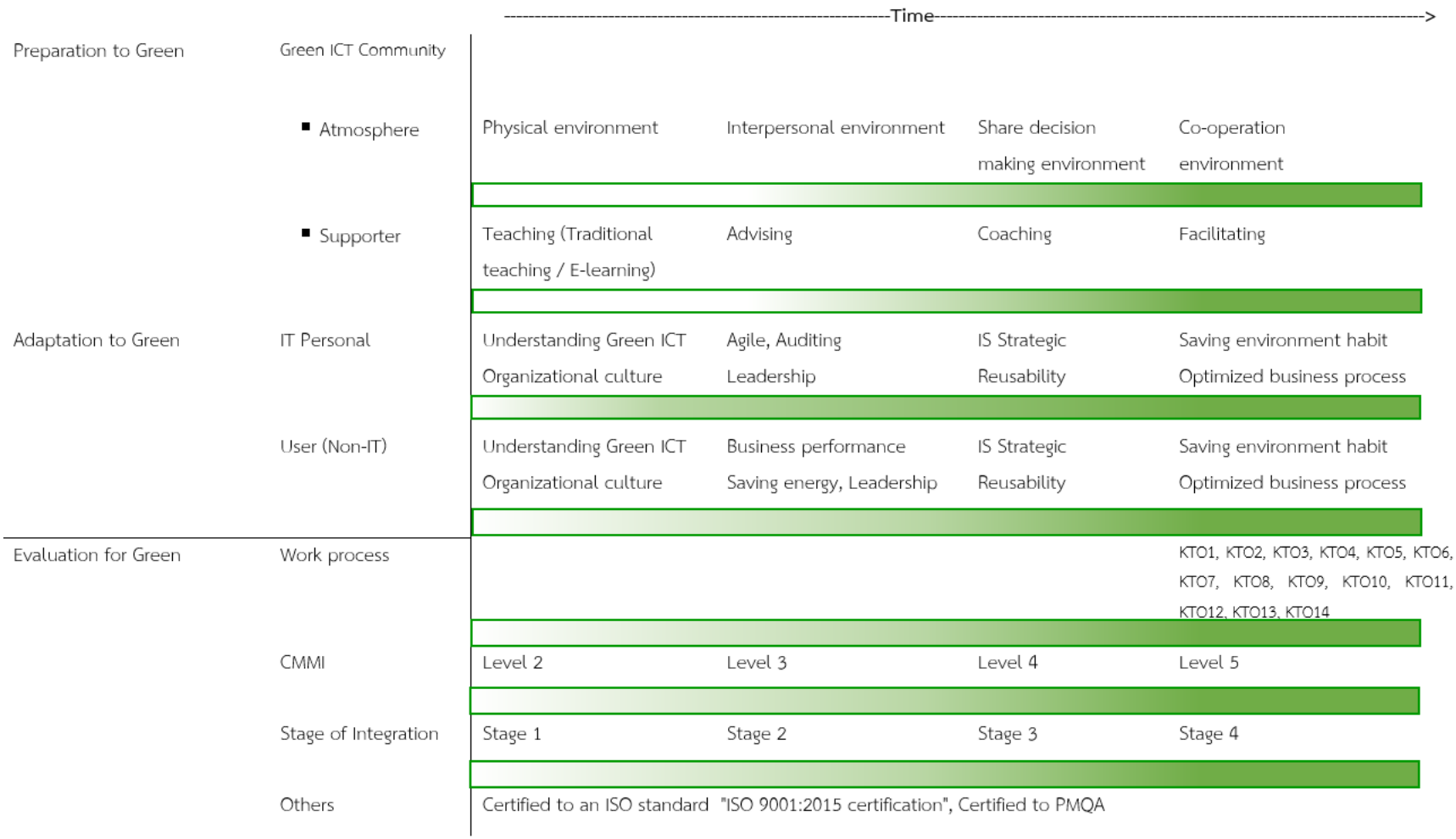
Appendix I

The First-drafted Version of Guideline

Time
Input
GreenICT Community
Atmosphere
Physical environment
Interpersonal environment
Share decision making environment
Co-operation environment
Supporter
Teaching (Traditional teaching / E-learning)
Advising
Coaching
Facilitating
e-Learning for IT Personal
Understanding Green ICT
Agile
Auditing
Saving energy
Reusability
Saving environment habit
Optimized business process
e-Learning for User (Non-IT)
Understanding Green ICT
Saving energy
Reusability
Saving environment habit
Optimized business process
Output
KTO1, KTO2, KTO3, KTO4, KTO5, KTO6, KTO7, KTO8, KTO9, KTO10, KTO11, KTO12, KTO13, KTO14
CMMI
Level 2
Level 3
Level 4
Level 5
Stage of Integration
Stage 1
Stage 2
Stage 3
Stage 4
Others
Certified to an ISO standard เช่น "ISO 9001:2015 certification", Certified to PMQA

Appendix J

The Improved Version of Guideline


Time
Preparation to Green
Green ICT Community
Atmosphere
Physical environment
Interpersonal environment
Share decision making environment
Co-operation environment
Supporter
Teaching (Traditional teaching / E-learning)
Advising
Coaching
Facilitating
Adaptation to Green
IT Personal
Understanding Green ICT
Organizational culture
Agile, Auditing
Leadership
IS Strategic
Reusability
Saving environment habit
Optimized business process
User (Non-IT)
Understanding Green ICT
Organizational culture
Business performance
Saving energy, Leadership
IS Strategic
Reusability
Saving environment habit
Optimized business process
Evaluation for Green
Work process
KTO1, KTO2, KTO3, KTO4, KTO5, KTO6, KTO7, KTO8, KTO9, KTO10, KTO11, KTO12, KTO13, KTO14
CMMI
Level 2
Level 3
Level 4
Level 5
Stage of Integration
Stage 1
Stage 2
Stage 3
Stage 4
Others
Certified to an ISO standard "ISO 9001:2015 certification", Certified to PMQA

Appendix K

The Consent Forms and Permission Letters to Participants for Verifying Guideline

Consent for participation in research interview for verifying Green ICT guideline

Dear all participants,

I am writing to request permission to interview you in order to validate my Green ICT guideline. I am a Ph.D. candidate in at National Institute of Development Administration (NIDA). My dissertation title is "The Development of Awareness on Green ICT through The Implication of Self-Directed Learning"

After developing guideline, you are, hereby, invited to attend face-to-face, semi-structured interview which six interview questions were attached via this consent form. The purpose of this interview is to make guideline trustworthy. Therefore, your suggestion will be worth for the study. If you are willing to attend in the interview, please read the consent form and kindly sign below.

……

I agree to voluntarily participate in an interview by Ms. Kultida Malison. I certify that:

1. I have been given sufficient information about this research study and I understand my role. The purpose of my participation as an interviewee in this study and the future management of my data has been explained to me and is clear.

2. Participation involves being interviewed by the researcher and her data transcriber; the questions comprised of six items. I allow the researcher to take notes during the interview. I also may allow the recording of the interview and subsequent dialogue by audio tape. It is clear to me that in case I do not want the interview and dialogue to be taped, I am fully entitled to withdraw from participation.

3. I have the right not to answer questions and if I feel uncomfortable in any way during the interview session, I have the right to withdraw from the interview.

4. I have been given the explicit guarantee that the researcher will not identify me by name or function in any reports using information obtained from this interview, and that my confidentiality as a participant in this study will remain secure.

5. I have read and understood the points and statements of this form. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

6. I have been given a copy of this consent form co-signed by the interviewer.

Signature of research participant *Date*

_____ _____

(_____)

Signature of researcher *Date*

_____ _____

(_____)

Research topic: The Development of Awareness on Green ICT through The Implication of Self-Directed Learning	
Name of interviewee: Organization:	
Date of interview:	Time:
Research questions:	
1. Do you agree with this guideline?	
2. Is it possible to employ this guideline to your organization?	
3. Do you agree with input and output process?	
4. Are learning environment proposing in this guideline sufficient or appropriate to make organization become Green ICT?	
5. Are learning curriculums or topics proposing in the guideline helpful for organization become Green ICT?	
6. Do you agree with using color bar to present timeline of increasing awareness process?	

Appendix L

The Resume of Transcriber

Curriculum Vitae

Ms. Piyaporn Boonchuayrod
Department of Languages, Faculty of Liberal Arts
Rajamangala University of Technology Tawan-Ok,
Charkrabongse Bhuvanath Campus
Vibhavadi Rangsit Road, Dindang, Bangkok
Mobile number: 082-4621954
E-mail: piyaporn1983j@gmail.com

ACADEMIC ACHIEVEMENT

2015 – 2019: Doctor of Philosophy (Language and Communication), National Institute of Development Administration (NIDA)

2010 – 2012: Master of Arts (Language and Communication), National Institute of Development Administration (NIDA)

2004 – 2007: Bachelor of Arts (English for International Communication), Rajamangala University of TechnologyTawan-Ok, Charkrabongse Bhuvanath Campus

ACADEMIC EXPERIENCE

20012 – present: Lecturer in Department of Languages, Rajamangala University of Technology Tawan-Ok, Charkrabongse Bhuvanath Campus

2008 – 2012: Invited lecturer in Department of Languages, Rajamangala University of Technology Tawan-Ok, Charkrabongse Bhuvanath Campus

2007: Tutor at Sun Set Academy

RESEARCH INTERESTS

- Demotivation in EFL, ESL
- Problem-based Learning
- Critical Pedagogy

SKILL

Computer Skill: Microsoft Office

Language: Good at Speaking, Reading and Writing English

Appendix M

Multiple Regression Result Dimension 1

Regression

Notes

Output Created		25-MAR-2018 21:30:32
Comments		
Input	Data	C:\Users\Kul\Desktop\Dissertation Questionnaire\20171009_Dissertation.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	279
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT FAC1_2 /METHOD=STEPWISE FAC1_1 FAC2_1 FAC3_1 FAC4_1 FAC5_1.
Resources	Processor Time	00:00:00.05
	Elapsed Time	00:00:00.07
	Memory Required	13840 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	REGR factor score 2 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	REGR factor score 5 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	REGR factor score 1 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4	REGR factor score 4 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: REGR factor score 1 for analysis 2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.286[a]	.082	.078	.96003821
2	.311[b]	.097	.090	.95369914
3	.334[c]	.111	.102	.94786826
4	.354[d]	.125	.112	.94214050

a. Predictors: (Constant), REGR factor score 2 for analysis 1

b. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1

c. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 1 for analysis 1

d. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 1 for analysis 1, REGR factor score 4 for analysis 1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.696	1	22.696	24.625	.000[b]
	Residual	255.304	277	.922		
	Total	278.000	278			
2	Regression	26.966	2	13.483	14.824	.000[c]
	Residual	251.034	276	.910		
	Total	278.000	278			
3	Regression	30.925	3	10.308	11.473	.000[d]
	Residual	247.075	275	.898		
	Total	278.000	278			
4	Regression	34.790	4	8.697	9.799	.000[e]
	Residual	243.210	274	.888		
	Total	278.000	278			

a. Dependent Variable: REGR factor score 1 for analysis 2

b. Predictors: (Constant), REGR factor score 2 for analysis 1

c. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1

d. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 1 for analysis 1

e. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 1 for analysis 1, REGR factor score 4 for analysis 1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.306E-16	.057		.000	1.000
	REGR factor score 2 for analysis 1	.286	.058	.286	4.962	.000
2	(Constant)	1.300E-16	.057		.000	1.000
	REGR factor score 2 for analysis 1	.286	.057	.286	4.995	.000
	REGR factor score 5 for analysis 1	.124	.057	.124	2.167	.031
3	(Constant)	1.463E-16	.057		.000	1.000
	REGR factor score 2 for analysis 1	.286	.057	.286	5.026	.000
	REGR factor score 5 for analysis 1	.124	.057	.124	2.180	.030
	REGR factor score 1 for analysis 1	.119	.057	.119	2.099	.037
4	(Constant)	1.582E-16	.056		.000	1.000
	REGR factor score 2 for analysis 1	.286	.057	.286	5.057	.000
	REGR factor score 5 for analysis 1	.124	.057	.124	2.193	.029
	REGR factor score 1 for analysis 1	.119	.057	.119	2.112	.036
	REGR factor score 4 for analysis 1	.118	.057	.118	2.087	.038

a. Dependent Variable: REGR factor score 1 for analysis 2

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	REGR factor score 1 for analysis 1	.119[b]	2.085	.038	.125	1.000
	REGR factor score 3 for analysis 1	-.012[b]	-.207	.836	-.012	1.000
	REGR factor score 4 for analysis 1	.118[b]	2.060	.040	.123	1.000
	REGR factor score 5 for analysis 1	.124[b]	2.167	.031	.129	1.000
2	REGR factor score 1 for analysis 1	.119[c]	2.099	.037	.126	1.000
	REGR factor score 3 for analysis 1	-.012[c]	-.208	.835	-.013	1.000
	REGR factor score 4 for analysis 1	.118[c]	2.074	.039	.124	1.000
3	REGR factor score 3 for analysis 1	-.012[d]	-.210	.834	-.013	1.000
	REGR factor score 4 for analysis 1	.118[d]	2.087	.038	.125	1.000
4	REGR factor score 3 for analysis 1	-.012[e]	-.211	.833	-.013	1.000

a. Dependent Variable: REGR factor score 1 for analysis 2

b. Predictors in the Model: (Constant), REGR factor score 2 for analysis 1

c. Predictors in the Model: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1

d. Predictors in the Model: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 1 for analysis 1

e. Predictors in the Model: (Constant), REGR factor score 2 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 1 for analysis 1, REGR factor score 4 for analysis 1

Appendix N

Multiple Regression Result Dimension 2

Regression

Notes

Output Created		25-MAR-2018 21:31:30
Comments		
Input	Data	C:\Users\Kul\Desktop\Dissertation Questionnaire\20171009_Dissertation.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	279
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT FAC2_2 /METHOD=STEPWISE FAC1_1 FAC2_1 FAC3_1 FAC4_1 FAC5_1.
Resources	Processor Time	00:00:00.08
	Elapsed Time	00:00:00.14
	Memory Required	13840 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	REGR factor score 1 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	REGR factor score 3 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: REGR factor score 2 for analysis 2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.255[a]	.065	.062	.96864872
2	.301[b]	.091	.084	.95706824

a. Predictors: (Constant), REGR factor score 1 for analysis 1

b. Predictors: (Constant), REGR factor score 1 for analysis 1, REGR factor score 3 for analysis 1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.096	1	18.096	19.287	.000[b]
	Residual	259.904	277	.938		
	Total	278.000	278			
2	Regression	25.190	2	12.595	13.750	.000[c]
	Residual	252.810	276	.916		
	Total	278.000	278			

a. Dependent Variable: REGR factor score 2 for analysis 2

b. Predictors: (Constant), REGR factor score 1 for analysis 1

c. Predictors: (Constant), REGR factor score 1 for analysis 1, REGR factor score 3 for analysis 1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.854E-17	.058		.000	1.000
	REGR factor score 1 for analysis 1	.255	.058	.255	4.392	.000
2	(Constant)	1.007E-16	.057		.000	1.000
	REGR factor score 1 for analysis 1	.255	.057	.255	4.445	.000
	REGR factor score 3 for analysis 1	.160	.057	.160	2.783	.006

a. Dependent Variable: REGR factor score 2 for analysis 2

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	REGR factor score 2 for analysis 1	-.007[b]	-.117	.907	-.007	1.000
	REGR factor score 3 for analysis 1	.160[b]	2.783	.006	.165	1.000
	REGR factor score 4 for analysis 1	.061[b]	1.045	.297	.063	1.000
	REGR factor score 5 for analysis 1	-.021[b]	-.362	.718	-.022	1.000
2	REGR factor score 2 for analysis 1	-.007[c]	-.118	.906	-.007	1.000
	REGR factor score 4 for analysis 1	.061[c]	1.058	.291	.064	1.000
	REGR factor score 5 for analysis 1	-.021[c]	-.366	.715	-.022	1.000

a. Dependent Variable: REGR factor score 2 for analysis 2

b. Predictors in the Model: (Constant), REGR factor score 1 for analysis 1

c. Predictors in the Model: (Constant), REGR factor score 1 for analysis 1, REGR factor score 3 for analysis 1

Appendix O

Multiple Regression Result Dimension 3

Regression

Notes

Output Created		25-MAR-2018 21:32:33
Comments		
Input	Data	C:\Users\Kul\Desktop\Dissertation Questionnaire\20171009_Dissertation.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	279
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT FAC3_2 /METHOD=STEPWISE FAC1_1 FAC2_1 FAC3_1 FAC4_1 FAC5_1.
Resources	Processor Time	00:00:00.13
	Elapsed Time	00:00:00.17
	Memory Required	13840 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	REGR factor score 4 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	REGR factor score 3 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	REGR factor score 2 for analysis 1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: REGR factor score 3 for analysis 2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.091	.088	.95499679
2	.365[b]	.133	.127	.93428831
3	.384[c]	.147	.138	.92843804

a. Predictors: (Constant), REGR factor score 4 for analysis 1

b. Predictors: (Constant), REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1

c. Predictors: (Constant), REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.371	1	25.371	27.818	.000[b]
	Residual	252.629	277	.912		
	Total	278.000	278			
2	Regression	37.081	2	18.541	21.240	.000[c]
	Residual	240.919	276	.873		
	Total	278.000	278			
3	Regression	40.951	3	13.650	15.836	.000[d]
	Residual	237.049	275	.862		
	Total	278.000	278			

a. Dependent Variable: REGR factor score 3 for analysis 2

b. Predictors: (Constant), REGR factor score 4 for analysis 1

c. Predictors: (Constant), REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1

d. Predictors: (Constant), REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.258E-16	.057		.000	1.000
	REGR factor score 4 for analysis 1	.302	.057	.302	5.274	.000
2	(Constant)	-2.102E-16	.056		.000	1.000
	REGR factor score 4 for analysis 1	.302	.056	.302	5.391	.000
	REGR factor score 3 for analysis 1	.205	.056	.205	3.663	.000
3	(Constant)	-2.271E-16	.056		.000	1.000
	REGR factor score 4 for analysis 1	.302	.056	.302	5.425	.000
	REGR factor score 3 for analysis 1	.205	.056	.205	3.686	.000
	REGR factor score 2 for analysis 1	.118	.056	.118	2.119	.035

a. Dependent Variable: REGR factor score 3 for analysis 2

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	REGR factor score 1 for analysis 1	.079[b]	1.384	.167	.083	1.000
	REGR factor score 2 for analysis 1	.118[b]	2.072	.039	.124	1.000
	REGR factor score 3 for analysis 1	.205[b]	3.663	.000	.215	1.000
	REGR factor score 5 for analysis 1	.070[b]	1.232	.219	.074	1.000
2	REGR factor score 1 for analysis 1	.079[c]	1.415	.158	.085	1.000
	REGR factor score 2 for analysis 1	.118[c]	2.119	.035	.127	1.000
	REGR factor score 5 for analysis 1	.070[c]	1.259	.209	.076	1.000
3	REGR factor score 1 for analysis 1	.079[d]	1.424	.156	.086	1.000
	REGR factor score 5 for analysis 1	.070[d]	1.267	.206	.076	1.000

a. Dependent Variable: REGR factor score 3 for analysis 2

b. Predictors in the Model: (Constant), REGR factor score 4 for analysis 1

c. Predictors in the Model: (Constant), REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1

d. Predictors in the Model: (Constant), REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1

BIOGRAPHY

NAME	Kultida Malison
ACADEMIC BACKGROUND	Bachelor' s Degree with a major in Computer Science, Faculty of Science, Naresuan University, Phitsanulok, Thailand in 2006 Master' s Degree in Applied Statistics at National Institute of Development Administration (NIDA), Bangkok, Thailand in 2009
EXPERIENCES	Lecturer, Department of Information System, Faculty of Business Administration and Information Technology, Rajamangala University of Technology Tawan-ok, Chakrabongse Bhuvanath Campus, Bangkok, Thailand