AGRICULTURAL INTERNET OF THINGS (IOT) ACCEPTANCE BY FARMERS IN KELANTAN.

By

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DECLARATION

I hereby declare that the work embodied in this Report is the result of the original research and has not been submitted for a higher degree to any universities or institutions.

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I certify that the Report of this final year project entitled "Agricultural Internet of Things (IoT) Acceptance by Farmers in Kelantan." by Muhammad Firas Hamizan bin Hassan, matric number F15A0088 has been examined and all the correction recommended by examiners have been done for the degree of Bachelor of Applied Science (Agrotechnology) with Honours, Faculty of Agro-Based Industry, Universiti Malaysia Kelantan.

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Agricultural Internet of Things (IoT) Acceptance by Farmers in Kelantan.

ABSTRACT

In order to sustain the generation of humankind, agriculture play the most important role, that acts as source of food. The Internet of Things (IoT) technology, are one of the new emerging technology, in agriculture. IoT, is the future of our agriculture sector. In Malaysia, the application of IoT technology is still new and at only selected place, for example Cyberjaya. We are still in preparing stage, to adopt the new technology. Farmer in Malaysia need to be aware of this new technology, therefore, this is the purpose of this research, to study the behavioral intention to use IoT technology by farmer in Kelantan. In order to achieve the purpose of this research, a conceptual framework was proposed with the combination of Technology Acceptance Model (TAM) by using perceived ease of use and perceived usefulness and Theory of Planned Behavior by using subjective norms. The result shows after analysis of data, state that, the most influential factor that influence farmer to use the IoT technology are perceived ease of use and perceived usefulness. While for the Chi-square analysis shows that there is significance relationship between subjective norm, perceived ease of use, and perceived usefulness towards the behavioral intention for farmer to apply the IoT technology.

Keywords: Internet of Things (IoT), behavioral intention, conceptual frameworks, perceived ease of use, perceived usefulness.

Penerimaan Teknologi 'Internet of Things (IoT)' oleh Para Petani di Kelantan.

ABSTRAK

Sektor pertanian memainkan peranan penting yang bertindak sebagai sumber makanan. Menjelang tahun 2050, dijangka total populasi manusia akan mencecah sebanyak 9 bilion, dan penghasilan makanan dunia harus meningkat naik sebanyak 60%. 'Internet of Things' (IoT), merupakan teknologi baru dalam sektor pertanian dunia dan IoT merupakan masa depan bagi kita. Malaysia, masih baru dengan teknologi ini dan masih dalam peringkat percubaan, hanya lokasi terpilih sahaja yang mengaplikasikan IoT secara menyeluruh, seperti di Cyberjaya. Para petani di Malaysia harus sedar akan teknologi ini. Itulah yang menjadi tujuan bagi penyelidikan ini, untuk mengkaji aras penerimaan para petani di Kelantan, dalam isu teknologi IoT. Untuk meneruskan kajian ini, sebuah model kajian baru yang menggabungkan Technology Acceptance Model (TAM) dengan menggunakan perspektif kemanfaatan dan perspektif kemudahan pemakaian dan Theory of Planned Behavior (TPB) dengan menggunakan norma subjektif telah di rangka. Hasil daripada analisis data menunjukkan yang perspektif kemanfaatan dan perspektif kemudahan pemakaian, merupakan factor yang mempengaruhi para petani dalam memilih untuk mengaplikasikan teknologi IoT. Sementara untuk, analisis Chi-square, menunjukkan bahawa perspektif kemanfaatan, perspektif kemudahan pemakaian dan norma subjektif mempunyai kepentingan secara langsung ke atas niat tujuan para petani di Kelantan untuk mengaplikasikan teknologi IoT.

Kata kunci: Internet of Things (IoT), niat tujuan, konsep rangka kerja, perspektif kemanfaatan, perspektif kemudahan pemakaian.

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IoT	Internet of Things
SPSS	Social Package for the Social Science
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter discussed the new emerging technology, which is Internet of Things (IoT). This chapter contain background of study, research problems, research question, research objectives, scope of study and significance of study.

1.1 Background of Study

Agriculture is not only about crop production as mainstream thinking holds. Agriculture is the creation of sustenance and fibre from the world's territory and water. A city, stock, market, bank and university cannot be built and sustain without the development of

agriculture. Agriculture is the main factor of civilization and any stable economy needed (Allan, 1999).

In this new era, Internet of Things (IoT) is develop as a new technology. People and objects are connected by the internet in IoT. In addition, IoT already considered widely because of development innovative applications. The quality of our lives are advanced with this new paradigm. It has enormous influence on supply chain management, location tracking, agriculture, real time financial analysis, energy efficiency, remote monitoring, maintenance and business process management. Researcher and industrialists all around the world have been attracted by this IoT. Developments in IoT scenario allow people to save loads of dollars in business improvements and mark our lives enhanced. Although IoT success attract researcher attention but still it has many potential issues and challenges (Joshitta & Arockiam, 2016).

Improvement of agriculture in modern society needed to apply IoT. It is important to reduce costs, improve efficiency and to achieve intelligent in agriculture. Progress of IoT in recent years have been made in data collection and transmission, and intelligent processing (Qu & Tao, 2014).

Nowadays data collection for crop performance is not as efficient as it should be. The crop studies are often undertaken in remote and distributed locations, which usually manually collected. But, the disadvantages when the data is collected manually, the result will be very low because it does not consider earlier conditions. With the help of IoT technologies, farmer will get specific data and improve their efficiency in farming (Jayaraman, Yavari, Georgakopoulos, Morshed, & Zaslavsky, 2016).

Organic farming technology is one of the examples in sustainable farming technology. Sustainable farming technology is defined as using traditional method with the aid of original farming knowledge, and at the same time implement selected modern technologies to improve variety into the farming system (Razali, Noor, Ahmad, & Shahbodin, 2017).

Attitude to apply, is the most causing factor in determine the intention to adopt precision agriculture technologies. While perceived ease of use and perceived usefulness, are crucial in changing users' attitude towards the technology (Rezaei-Moghaddam & Salehi, 2010).

Inclination in the level of acceptance of new technology usually affected by social factors. For example, a farmer who never applied smart agriculture system, will tend to apply it when the surrounding farmers apply and shows an advantages (Mohr, Harrison, Wilson, Baghurst, & Syrette, 2007).

To put in a nutshell, performance expectancy and social influence are the major factor that affect the acceptance of sustainable farming technology. If only sustainable farming technology can decrease task uncertainty on their farming activity and can increase their work performance, they will accept it (Razali et al., 2017).

1.2 Problem Statement

In northern Bangladesh, several technologies and practices are available for smallholder farmers to enable them better adapt to the effects of climate change. It however appears these technologies and practices have not been comprehensively documented in the climate change and technology adoption literatures. Technologies necessary

to mitigate with climate shock in agriculture encompass a wide range of activities involve in agricultural practices that will need to be evaluated and prioritized (Farid, Tanny, & Sarma, 2015).

When the rural farmers lack access to knowledge and information that would help them achieve maximum agricultural yield; they not only grope in the dark but are also forced to move to the urban centres in search of white-collar jobs, may be as the only option for survival. The above dangerous situation should not be allowed or encouraged because of its negative, social and economic consequences (D & Oliver, 2015).

The emerging of IoT, benefits us to collect real-time information about every physical activity. Ranging from the temperature of equipment to the performance of a fleet of wind turbines. Deliver information in real time is the capability of IoT sensors (Haight, 2015).

In agriculture, many things can be applied such as product processing, planting crops, and environment monitoring. Improvement of agriculture in modern society, IoT is important to reduce costs, improve efficiency and to achieve intelligent in agriculture (Qu & Tao, 2014).

Sustainable farming technology has been introduced before IoT. Sustainable farming technology is defined as using traditional method with the aid of original farming knowledge, and at the same time implement selected modern technologies (Razali et al., 2017).

Farmer will accept the sustainable farming technology if only the technology will help the farmer to make gains and decrease task uncertainty, increase their work performance in their farming activity, and when it is considered as a part of their social norms. (Razali et al., 2017).

1.3 Research Question

1.3.1 Does a relationship exists between demographic factor and behaviour intention of farmer towards the application of IoT?

1.3.2 Does farmer intention to apply IoT have relationship with their subjective norm, perceived ease of use and perceived usefulness?

1.3.3 What is the most influential factor in determining the behaviour intention of farmer in Kelantan to use the IoT technology?

1.4 Objectives

In order to study the behavioural intention of farmer in Kelantan to use the IoT technology, the objectives of this research are as follows:

1. To study the relationship between demographic factor (awareness about IoT concept) and behavioural intention of farmers towards the application of IoT?
2. To study the relationship between subjective norm, perceived usefulness, and perceived ease of use toward intention to use IoT.
3. To determine the most influential factor of intention to use IoT.

1.5 Limitations of research

Several limitations have been identified throughout this research. First, the population or respondents chosen were collected only among the farmers in Kelantan area. Therefore, the data collected are only based from the same demographic groups although this research was conducted in four districts in the same state. As a result, the attempting of the findings onto a wider population nationwide should be done with caution.

The second limitation is that this research was only conducted among those farmers involve in agriculture sector, while the application of IoT are wider. Those who are involve in husbandry sector should be considered as respondents in future studies about IoT.

Lastly, the presence of prejudice response from respondents can be expected as respondents with different background may respond to the questions differently. The honesty of respondents in answering the questions during the survey may be taken for granted by some of the respondents, which could also lead to the presence of bias in this study.

1.6 Scope of Study

This study is focussing on the behavioural intention of farmers in Kelantan about the application of IoT technology in farming activity. This research been done in Kelantan and the places chosen for this research are Jeli, Kemahang, Machang, Bachok and Kota Bharu. This study mainly focuses on farmer who are involved in agriculture sector. Moreover, this research also focusses on a new conceptual research framework with the combination of Technology Acceptance Model (TAM) and Theory of Planned Behaviour (TPB).

1.7 Significance of Study

This research study is to discover a new conceptual research framework with the combination of Technology Acceptance Model (TAM) and Theory of Planned Behaviour (TPB) in determining the acceptance of new technology by farmers in Kelantan. Besides to determine the most major factor that influence farmer to accept new technology, for example, perceived usefulness, perceived ease of

use, subjective norms and intention to use IoT. From this study, the new conceptual research framework can be used by other researcher, if they want to study the acceptance of new technology in targeted area. In addition, by this study, indirectly introduce to our farmer about the new technology in agriculture, IoT. This will gain their interest to discover and learn more about the technology, before the technology will be widely use in Malaysia. While for the government, this study will provide data about our farmer, whether they are ready or not to accept the technology

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The goal of this chapter is to attain more insight on the new emerging technology, which is, Internet of Things, the future of our agriculture. This chapter also discusses the review of studies and empirical findings that are important in the theoretical development and conceptual framework to achieve the objectives of this study.

2.1 Farming Before the Emerging of New Technologies in Agriculture.

Horticulture has changed drastically in the course of recent years. It has prevailing with regards to lessening sustenance costs,

nourishing an expanding populace, discharging work from the homestead and giving an ever more noteworthy decision of sustenance during the time to purchasers. Innovation has had a noteworthy impact in these advancements, and is likewise tending to today, in an incorporated way, natural and social concerns (OECD, 2001).

Before the emerging of IOT technologies, traditionally, agriculture sector has been caught with a lot of risk. There are plenty of factors, from rainfall forecasts and improper irrigation to faulty planting or either harvesting methods and poor soil quality, which was the declination factor in overall productivity (Amin & Li, 2014).

One of the precedents in sustainable farming technology is organic farming technology. organic farming technology is characterized as utilizing conventional method and unique cultivating information as at the same time actualizing chosen modern technologies to improve assorted variety into the farming system (Bhatta et al., 2009). It is likewise as an option in contrast to regular horticulture that can support horticultural advancement (Lankton et al., 2015; Khalil et al., 2011).

Further enhancement for natural cultivating innovation or on the other hand natural generation framework is important in the future (Garcia, 2014).

Production of food must be inclined until 60% by 2050, in order to be able to feed the growing population, that are expected to reach 9 billion. Increase in crop productivity is crucially needed (Jayaraman et al., 2016).

2.2 Farmer Acceptance Towards New Technology in Agriculture.

The Malaysian vegetable sector has encountered a low appropriation rate of reasonable horticultural practices. In addition, infer just a couple of agriculturists have received it (Tey et al. 2012). There is low awareness about this practical cultivating innovation among Malaysian (Darus, Norazlina Mohd, Ahmad Rozelan Yunus, 2017).

Agriculturists will acknowledge maintainable cultivating innovation when they can make gain and decrease assignment

vulnerability on their cultivating exercises. They will likewise acknowledge it when the innovation can build their work execution (Darus, Norazlina Mohd, Ahmad Rozelan Yunus, 2017).

The choice of utilization of innovations is reliant on how farmer see of innovation (Chi & Yamada, 2002). Innovation can be achieved agriculturists through innovation exchange. Innovation exchange alludes to the general procedure of moving data and aptitudes from data or on the other hand learning 'generators, for example, inquire about research centers and colleges to customers, for example, ranchers (Valera et al. 1987).

2.3 IoT Technology.

Selection of another innovation still intrigued field in IS. Innovation reception characterized as "the phase in which an innovation is chosen for use by an individual or an association" (Carr, 1999). The Internet of Things (IoT) permits gadgets interconnected any items whenever, anyplace on the planet that made an assaulted change in all parts of our life. Development of

Internet of Things gives broad administrations in all parts, for example, assembling, human services, and instruction. IoT advances are basically evolving the manner by which individuals cooperate and see innovation. The field of the Internet of Things is still in the earliest stages stage (Vos, 2015).

Internet of Things (IoT) characterized as "the systems administration of physical questions using implanted sensors, actuators, and different gadgets that can gather or transmit data about the articles" (McKinsey, 2014). These articles are anything, for example, a Person or any physical gadget can exchange information over the system. IoT alludes to the interconnections of the physical universe of things with the virtual universe of the Internet, the innovation stages, notwithstanding the measures normally used to empower interconnection (Mazhelis et al., 2012).

The IoT depicts objects that can convey by means of the web (Uckelmann et al.,2011). Having heaps of things associated will completely change us and the IoT advances can possibly change the world, similarly as the web did (Schlick et al., 2013). For instance, clients may profit by IoT advances utilized in savvy refrigerators

that self-governing screen the utilization of nourishment and drinks and re-arrange merchandise (Sundmaeker et al., 2010).

To tackle problems like hunger and food insecurity and ensure the well-being of human, smart farming practices are important to foster its growth and development (Agrawal, Prieto, Ramos, & Corchado, 2016). Nowadays, internet connectivity cost is decreasing and the connection are widely available all around the world (Joshitta & Arockiam, 2016).

IoT is a system of connected physical objects that are available through the internet. It is used to connect physical devices, vehicles, buildings and other item with electronics, software, and sensors for example, which enable these objects to collect data and exchange data. IoT is what mean by smart farming (Gupta, 2017).

2.4 Agriculture with the Help of IoT Technology

The "always connected" system is what our society is moving towards recently. Intense growth of technologies brings

changes in the life style of human beings. One of the most recent technologies is IoT. By IoT, variety of objects are connected by the internet. IoT are defined as "a dynamic global network infrastructure with self-configuring capabilities" by researcher and innovations team, based on standard and interoperable communication protocols where physical and virtual things have their identities such as physical attributes (Vijayalakshmi & Arockiam, 2016).

Smart farming techniques are introduced to farmers as long as they can reduce costs, facilitate traceability and increase security. Many smart farming other than IoT, require large investments but not in IoT (Agrawal et al., 2016).

IoT can be applied in planting vegetables, and also storage and distribution, directly improving the management of traceability from the original to the ending (Qu & Tao, 2014).

Accuracy Farming: Precision cultivating is a way to deal with cultivate the executives that utilizes IoT and data and correspondence (ICT) advancements to improve returns what's more, guarantee the safeguarding of assets. Exact cultivating involves the acquiring of ongoing information on the states of products, soil, and air. This methodology goes for guaranteeing

gainfulness and maintainability while securing nature (Malavade & Akulwar, n.d.).

The need to improve the productivity of water system forms and limit water misfortunes is on the ascent. There is an expanding mindfulness on the preservation of existing water assets by utilizing maintainable and productive water system frameworks. IoT-based brilliant water system estimates different parameters, for example, moistness, soil dampness, temperature, and light force to ascertain the exact prerequisites for water. It has been demonstrated that such system can add to higher water system proficiency (Rajakumar, Sankari, Shunmugapriya, & Maheswari, 2018).

2.5 Theoretical Frameworks.

2.5.1 Technology Acceptance Model (TAM)

TAM was introduced by Fred Davis in 1986. Adapt from the Theory of Reasonable Action, TAM is specific for modelling users'

acceptance of information or technologies (Lai, 2017). The final version of TAM was formed by Venkatesh and Davis in 1996 as show in figure 2.1. After, perceived usefulness and perceived ease of use were found to have a direct influence on behaviour intention (Lai, 2017).

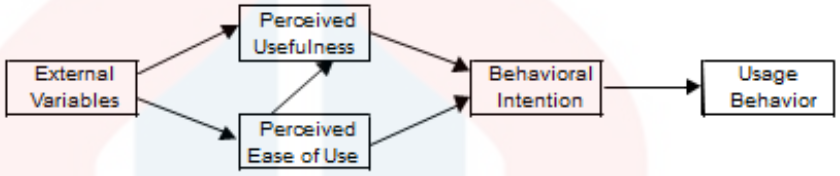

Figure 2.1: Adapted from Final version of Technology Acceptance Model (TAM) (Source: Venkatesh and Davis, 1996).

Perceived usefulness (PU) was characterized as how much an individual trust that utilizing a specific framework could upgrade his or her activity execution (Davis, 1989). It is the degree to which an individual trust that utilizing the framework upgrades his/her execution. Inside the authoritative setting, a framework that is high in seen helpfulness is one that the client accepts will have a positive use-execution relationship (Yusliza et al, 2009).

Perceived usefulness is the point at which an individual use the innovation existed to finish, oversee, and illuminate the errand given by their manager (Izzati, Redzuan, Razali, & Muslim, 2016). Along these lines it additionally alludes to client's perceptions as for the aftereffect of the experience (Davis; 1993).

Perceived ease of use is characterized as "how much an individual trust that utilizing a specific framework would be free of exertion" (Davis, 1989). Perceived ease of use measures client appraisals of usability and simplicity of learning. Perceived ease of use, along these lines, manages client inspiration that depends on the evaluation of the characteristic part of utilizing the IT, for example, its interface and the procedure engaged with utilizing it (David Gefen et al, 2000).

Behaviour is control by his aim which in this way managed by one's frame of mind towards conduct and emotional standard about the conduct (Lai, 2017).

2.5.2 Theory of Planned Behaviour (TPB).

TPB were developed by Ajzen (1991) as shown in Figure 2.2. The attitude and subjective norms factors are the same as Theory of Reasonable Action. While the perceived behaviour control which users perceive that may limit their behaviour (Lai, 2017).

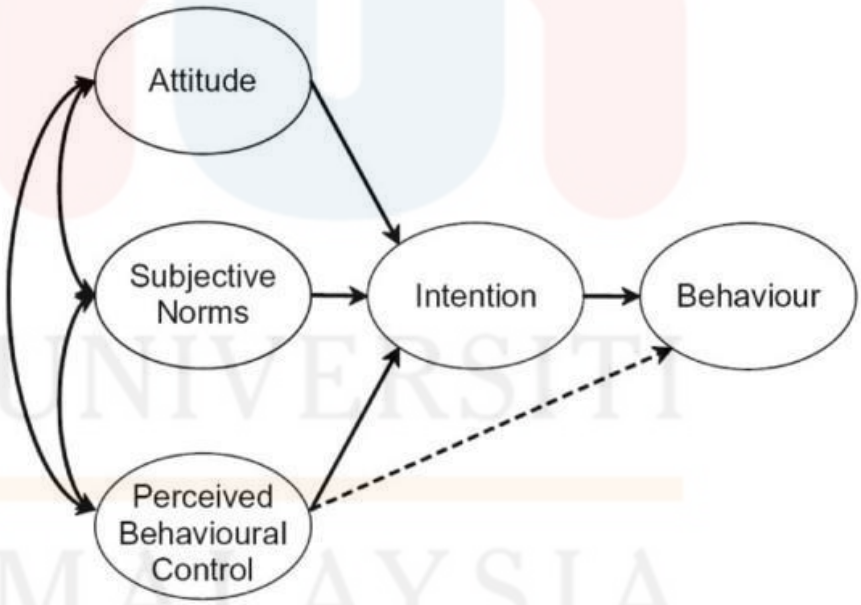

Figure 2.2: The Theory of Planned Behavior (Ajzen, 1991).

Mathieson (1991) and Yi, Jackson, Park, and Probst (2006) contended that human and social components could assume a part in the reception of innovation utilizing TPB show. In this manner, the TAM could be reached out with develops from the TPB to consolidate the social factors that could clarify innovation appropriation. In any case, the TPB in Chau and Hu (2002) noticed that social standard and conduct expectation to utilize finding was negative and did not bolster that social standard would impact conduct aim. Shih and Fang (2004) likewise inspected the reception of web keeping money by methods for the TPB and in addition Decomposed TPB and found that it was in accordance with the discoveries of Venkatesh and Davis (2000) that subjective standard was probably going to impact behavioural goal to use in a compulsory domain, while the impact could be immaterial in a deliberate situation. Since, this investigation is intentional, along these lines the Shih and Fang (2004) study won't make a difference in the novel innovation of single stage E-instalment System (PC Lai, 2017).

Subjective norms are a person's view of the social strain to perform or not to play out the objective conduct (Ajzen, 1991; Francis et al., 2004). It can likewise be characterized as the person's

impression of other individuals' perspectives and considerations on the proposed conduct. These observations can assume a compelling job and put weight on a person to play out a specific conduct, for example, come back to work. This implies subjective norms of an individual rely upon his or her recognition about the contemplation of critical others on their performed conduct (Brouwer et al., 2009; Vermeulen et al., 2011).

CHAPTER 3

METHODOLOGY

3.0 Introduction

For this study, there are several ways that will be use in order to conduct the research and to achieve the objective for example, questionnaire, site selection, research sampling, research procedure, data analysis and sampling.

This chapter describes the methodology used in order to achieve the objectives of this research. There will be four section in this chapter. The first section will describe about the conceptual framework and the model used. While in second and third sections, will be the types of data and the design of the questionnaire. Lastly, the final section covers the methods of analysis used in this study.

3.1 Conceptual Framework

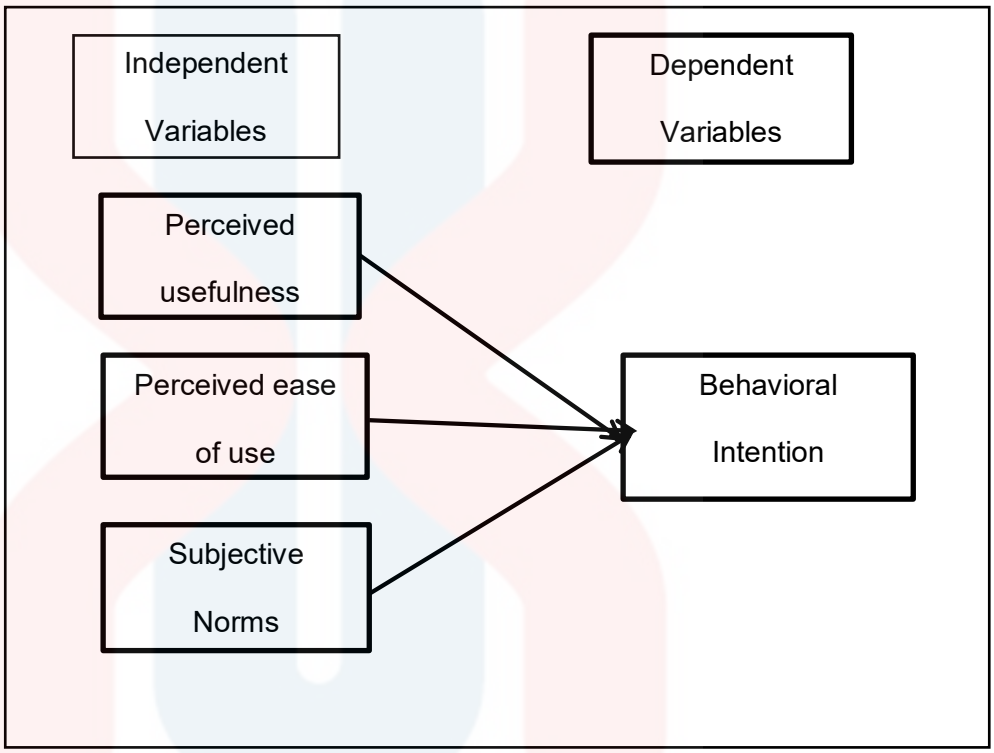

Figure 3.1: diagram of research framework

3.2 Data Collection

3.2.1 Study Site Description

Figure 3.2: Map of Kelantan state

Source: Official Portal of MCMC Taman Desa Kemumin, Padang Tembak

Kelantan was chosen as the site for this research because of its agriculture activities and potential. Specifically, the survey was conducted in five districts in Kelantan; Jeli, Kemahang, Machang, Bachok, and Kota Bharu.

3.2.2 Sampling Techniques

Gatherings picked by convenience sampling are helpful for self-choice, authoritative choice, time of the class, number of the long periods of presentation and numerous other contaminating impacts. At times, the distinction in the synthesis of the two gatherings is grave to the point that undermines the general legitimacy of the exploration. However, much of the time these deficiencies either stay unnoticed by scientists or are basically winked at as though something normal has occurred (Farrokhi, 2012).

This study will be convenience sampling technique to gather data. Convenience sampling is a non-probability sampling

technique where subjects are selected because of their convenient accessibility and proximity to the researcher.

The respondents are chosen since they are most straightforward to enlist for the research and the researcher did not consider choosing subjects that are illustrative of the whole populace.

3.2.3 The Instrument.

For this study, survey by using structured questionnaire was conducted. The entire questionnaire is using Likert scale design. Likert scale design offered the respondents five pre-coded responses. Firstly, in the Likert scale, define what will be measuring because later the definition as an instruction to the people who are going to create or generate the initial set of candidate items for your scale. Next, set of potential scale items will be creating and rating the items. The items usually will be rating with a scale:

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

Next step is selecting the items; compute the inter-correlations between all pair of items and lastly the respondents are ready to answer the questionnaire by using Likert scale by rating the scale given. The survey methods are conducting because it will make easier to collect the data from the respondents based on their acceptance on IoT technologies.

The questionnaire prepared will be consisting of the whole range of sections listed below:

I Section A: Demographic Information

II Section B: Perceived Usefulness of IoT Towards Agriculture Sector in Kelantan

III Section C: Perceived Ease of Use of IoT Towards Agriculture Sector in Kelantan

IV Section D: Subjective Norms That Influence Farmer to Apply IoT Technology

V Section E: Behavioural Intention Towards IoT in Kelantan Agriculture Sector

3.2.4 Pilot Study

A pilot study was conducted in this research, in order to make sure that the questionnaire was reliable, valid and easy to be answered by respondents. A sample size of 30 was used to measure the overall viability of the survey questionnaire. 30 respondents were interviewed out of the population of farmers in Jeli.

SPSS, Statistical Package for Social Science was used in this study to analyses the data collected. As the pilot study was done and the result for Cronbach's Alpha of reliability statistic is shown in Table 3.1.

The result showed for the variable of perceived usefulness of IoT towards agriculture sector in Kelantan and perceived ease of use of IoT towards agriculture sector in Kelantan are 0.663 and

0.602 respectively. While for the other two variables, namely the subjective norm that influence farmer to apply IoT technology and behavioural intention towards IoT in Kelantan agriculture sector are 0.585 and 0.653 respectively.

Therefore, all the variable for this research are acceptable. Generally, the Cronbach's Alpha below 0.5 are interpreted as poor, below 0.7 are acceptable, and above 0.8 are good (Mohtar et al., 2014). By this result, it can be concluding that the research framework proposed are relevant for this study.

Table 3.1 Reliability Statistic

Variables	**Cronbach's Alpha**	**Items**
Perceived Usefulness of IoT	0.663	4
Perceived Ease of Use of IoT	0.602	4
Subjective Norms	0.585	4
Behavioral Intention	0.653	3

3.3 Data Processing and Data Analysis Technique

The data gathered from the survey had been checked and proved for their precision. Data cleaning would be completed by observing the recurrence and descriptive statistic and in addition the coding and information passage. The survey data would be cleaned for achievable irregularities and blunders and would be balanced for missing information and exceptions.

3.3.1 Descriptive Analysis.

The descriptive analysis was the change of raw data in the shape that would make it straightforward and easy to translate. Descriptive statistic includes the estimations of mean on the nominal data that accomplished from research. Nominal data alludes to data, which are ordered in demographic and socioeconomic aspects. This test would bolster the comparison between the factors.

3.3.2 Reliability Analysis

Reliability analysis was run to affirm whether things were steady to quantify the factors. The method of reliability analysis examines some usually utilized proportions of scale dependability and furthermore gives data on the connections between individual things of that scale. The most prominent method for testing a scale's dependability is Cronbach's Alpha coefficient. Cronbach's Alpha is utilized to appraise the change's extent that is precise or steady in a lot of test scores. It could go between 0.00 - 1.00 and its esteem varies dependent on the quantity of things of scale and between thing joins. The reliability analysis is higher when the blunders caused are lower (Vicol and Zait, 2014).

3.3.3 Chi-square Analysis.

The Chi Square test is a statistical test usually used to differentiate observed data with expected data according to the specific hypotheses. The null hypothesis indicates there was no

significance difference between expected and observed result. It cannot be calculated if the expected value for any category is below than 5 (Independent Research Project: Biology 110 laboratory). This test is used to study the relationship between demographic factor and independent variables which is perceived ease of use, perceived usefulness and subjective norms towards behaviour intention of farmer to apply IoT.

3.3.4 Regression Analysis

Regression analysis is a lot of measurable procedures for evaluating the connections among factors. It incorporates numerous procedures for demonstrating and breaking down a few factors, when the emphasis is on the connection between a dependent variable and at least one independent variable (or 'indicators'). All the more explicitly, relapse examination causes one to see how the regular estimation of the reliant variable (or 'paradigm variable') changes when any of the free factors is differed, while the other autonomous factors are held settled.

3.4 Chapter Summary

This section explained on research design of the study that was conducted. The type of analysis that would be chosen to run were list and explained. The four methods of analyses namely descriptive analysis, reliability analysis, chi-square analysis and regression analysis would be utilized to achieve the objectives of this research.

CHAPTER 4

RESULT AND DISCUSSION

4.0 Introduction

In this chapter, the result and discussion of the findings were discussed. Convenience sampling method was used in this study where 110 questionnaires were distributed among the farmers in targeted area are Jeli, Kemahang, Machang, Bachok, and Kota Bharu, Kelantan. The analysis of data was done based on the objective of the study which cover the demographic of respondent, subjective norm, perceived usefulness, perceived ease of use and intention to apply IoT technology. Descriptive analysis of respondent, reliability test, chi-square test and regression analysis were discussed in the result of data analysis.

The data in this study was collected through self-answered questionnaire that consist of a few sections such as demographic

information, perceived usefulness, perceived ease of use, subjective norm and intention of farmer in Kelantan to apply IoT technology.

4.1 Descriptive Analysis Result

4.1.1 Socio-Demographic Profile of Respondents

The first sections in questionnaire is demographic background. Questions such as gender, race, education level, awareness about IoT concept were asked. Table 4.1 shows the data of demographic information.

In the data, it shows that the questionnaire was answered by 77.3% males (85 respondents), and 22.7% females (25 respondents) from total respondents, which is 110. There are 78.2% Malay (86 respondents), 12.7% Chinese (14 respondents), and the remaining 9.1% are Indian (10 respondents).

For educational level, most of the respondents are from secondary school background with 53.6% (59 respondents) followed by Diploma/STPM, 18.2% (20 respondents) and primary

school, 15.5% (17 respondents). There are 7.3% respondents from degree background and 5.5% respondents from post-graduate/PhD background.

While for awareness about IoT concept, 40.9% respondents know about the IoT but cannot explain it. Followed by 27.3% respondents who never heard about the IoT, and 20% respondents who are used to it. The remaining 11.8% respondents know very well about the IoT.

Table 4.1 Demographic Information of Respondents

Variables	Frequency	Percentage (%)
Gender		
Male	85	77.3
Female	25	22.7
Race		
Malay	86	78.2
Chinese	14	12.7
Indian	10	9.1
Education Level		
Primary school	17	15.5
Secondary school	59	53.6
Diploma/STPM	20	18.2
Degree	8	7.3
Post-graduate/PhD	6	5.5
Awareness about IoT concept		
Know very well about IoT	13	11.8
Use to IoT	22	20.00
Know, but cannot explain	45	40.9
Never heard about IoT	30	27.3

4.1.2 Perceived Usefulness of IoT Towards Agriculture Sector in Kelantan

Perceived usefulness (PU) was characterized as how much an individual trust that utilizing a specific framework could upgrade his or her activity execution (Davis, 1989). It is the degree to which an individual trust that utilizing the framework upgrades his/her execution. Inside the authoritative setting, a framework that is high in seen helpfulness is one that the client accepts will have a positive use-execution relationship (Yusliza et al, 2009).

The descriptive analysis was used to study the perceived usefulness of IoT towards agriculture sector in Kelantan. The result from data analysis was presented in Table 4.2.

Based from the analysis, the statement "*The IoT Technology Can Improve My Quality of Work*", the mean score is 3.61, in between neither agreed or disagreed and agreed with the statement. Majority were agreed with it, with total of 75 respondents. While 19 were neither agreed or disagreed, followed by 8 respondents who disagreed with the statement. The remaining eight respondents, four were strongly disagreed, and another four are strongly agreed.

Next, "*The IoT Technology Makes It Easier to do My Job*", the mean score is 3.66. Two respondents are strongly disagreed with the statement, 11 respondents are disagreed, 23 respondents are neither agreed or disagreed, 61 respondents are agreed with the statement and the remaining 13 respondents are strongly agreed with it.

While for the third question, the mean score is 3.96. 40 respondents strongly agreed with the statement, "*The IoT Technology Can Increase My Productivity*". 39 respondents are agreed, 21 respondents were neither agreed or disagreed, seven respondents are disagreed, and another three respondents are strongly disagreed with the statement.

"*The IoT Technology Gives Me Greater Control Over My Job*", the mean score is 3.81. 71 respondents agreed with this statement, while 15 respondents were strongly agreed, 15 respondents are neither agreed or disagreed, six respondents are disagreed, and the last three respondents were strongly disagreed.

Table 4.2 Descriptive analysis of perceived usefulness of IoT Towards Agriculture Sector in Kelantan

No	Statement	Respondents 1* 2* 3* 4* 5*	Mean	Standard Deviation
1	The IoT Technology Can Improve My Quality of Work.	4 8 19 78 4	3.61	0.83
2	The IoT Technology Makes It Easier to do My Job.	2 11 23 61 13	3.66	0.88
3	The IoT Technology Can Increase My Productivity.	3 7 21 39 40	3.96	1.03
4	The IoT Technology Gives Me Greater Control Over My Job.	3 6 15 71 15	3.81	0.84

4.1.3 Perceived Ease of Use of IoT Towards Agriculture Sector in Kelantan

Perceived ease of use is characterized as "how much an individual trust that utilizing a specific framework would be free of exertion" (Davis, 1989). Perceived ease of use measures client appraisals of usability and simplicity of learning. Perceived ease of use, along these lines, manages client inspiration that depends on the evaluation of the characteristic part of utilizing the IT, for example, its interface and the procedure engaged with utilizing it (David Gefen et al, 2000).

Based from the analysis, the statement "*The IoT Technology is Easy to Use*", the mean score is 3.61. Majority agreed with it, with total of 74 respondents. While 21 were neither agreed or disagreed, followed by seven respondents who disagreed with the statement. The remaining eight respondents, one were strongly disagreed, and another seven are strongly agreed.

By going through the questionnaire, "*To Learn using IoT are Easy*", the mean score is 3.66. 3 respondents are strongly disagreed with the statement, six respondents disagreed, 19 respondents are

neither agreed or disagreed, 55 respondents are agreed with the statement and the remaining 27 respondents are strongly agreed with it.

26 respondents strongly agreed with the statement, "*It Is Easy to Expert in Using IoT Technology*". 57 respondents are agreed, 21 respondents are neither agreed or disagreed, six respondents disagreed, and there is no respondents who strongly disagreed with the statement. The mean score for this question is 3.96.

"*Upgrading to IoT Technology at Our Farm Are Easy*", the mean score is 3.81. 73 respondents are agreed with this statement, while 15 respondents are strongly agreed, 10 respondents are neither agreed or disagreed, seven respondents are disagreed, and the last five respondents are strongly disagreed.

Table 4.3 Descriptive analysis of Perceived Ease of Use of IoT Towards Agriculture Sector in Kelantan

No	Statement	Respondents 1* 2* 3* 4* 5*	Mean	Standard Deviation
1	The IoT Technology is Easy to Use.	1 7 21 74 7	3.61	0.83
2	To Learn using IoT are Easy.	3 6 19 55 27	3.66	0.88
3	It Is Easy to Expert in Using IoT Technology.	0 6 21 57 26	3.96	1.03
4	Upgrading to IoT Technology at Our Farm Are Easy.	5 7 10 73 15	3.81	0.84

4.1.4 Subjective Norm that Influence Farmer to Apply IoT Technology

Subjective norms are a person's view of the social strain to perform or not to play out the objective conduct (Ajzen, 1991; Francis et al., 2004). It can likewise be characterized as the person's impression of other individuals' perspectives and considerations on the proposed conduct. These observations can assume a compelling job and put weight on a person to play out a specific conduct, for example, come back to work. This implies subjective norms of an individual rely upon his or her recognition about the contemplation of critical others on their performed conduct (Brouwer et al., 2009; Vermeulen et al., 2011).

Based from the analysis, the statement "*I will use IoT if agriculture officer recommends it to me*", the mean score is 3.61 majority agreed with it, with total of 81 respondents. While three were neither agreed or disagreed, followed by one respondent who disagreed with the statement. The remaining 25 respondents were strongly agreed.

Next, "*I will use IoT if my friend recommends it to me*", the mean score is 3.66. Five respondents are disagreed with the statement, 25 respondents were neither agreed or disagreed, 62 respondents agreed with the statement and the remaining 18 respondents were strongly agreed with it.

36 respondents strongly agreed with the statement, "*I will use IoT if people who are important to me recommends it*". 53 respondents agreed, 14 respondents were neither agreed or disagreed, and seven respondents disagreed with the statement. The mean score is 3.96.

"*I will use IoT if the technology goes viral*", the mean score is 3.81. 76 respondents agreed with this statement, while 11 respondents were strongly agreed, 18 respondents were neither agreed or disagreed, four respondents disagreed, and the last one respondent was strongly disagreed.

Table 4.4 Descriptive analysis of Subjective Norm that Influence Farmer to Apply IoT Technology

No	Statement	Respondents 1* 2* 3* 4* 5*	Mean	Standard Deviation
1	I will use IoT if agriculture officer recommends it to me.	0 1 3 81 25	3.61	0.83
2	I will use IoT if my friend recommends it to me.	0 5 25 62 18	3.66	0.88
3	I will use IoT if people who are important to me recommends it.	0 7 14 53 36	3.96	1.03
4	I will use IoT if the technology goes viral'.	1 4 18 76 11	3.81	0.84

4.1.5 Behavioral Intention Towards IoT in Kelantan Agriculture Sector

Behavior is control by his aim which in this way managed by one's frame of mind towards conduct and emotional standard about the conduct (Lai, 2017).

Based from the analysis, the statement "*I intend to frequently use the IoT technology, to ease my work*", the mean score is 3.61. Majority agreed with it, with total of 93 respondents. While 11 were neither agreed or disagreed, followed by one respondent who disagreed with the statement. The remaining five respondents were strongly agreed.

For the second statement, "*I intend to apply the IoT technology on my farm*", the mean score is 3.66. One respondent disagreed with the statement, 13 respondents were neither agreed or disagreed, 64 respondents agreed with the statement and the remaining 32 respondents were strongly agreed with it.

14 respondents strongly agreed with the statement, "*I intend to continue using the IoT technology, to perform my job*". 79 respondents are agreed, 15 respondents are neither agreed or

disagreed, and another twp respondents were strongly disagreed. The mean score is 3.96.

Table 4.5 Descriptive analysis of Behavioral Intention Towards IoT in Kelantan Agriculture Sector

No	Statement	Respondents 1* 2* 3* 4* 5*	Mean	Standard Deviation
1	I intend to frequently use the IoT technology, to ease my work.	0 1 11 93 5	3.61	0.83
2	I intend to apply the IoT technology on my farm.	0 1 13 64 32	3.66	0.88
3	I intend to continue using the IoT technology, to perform my job.	2 0 15 79 14	3.96	1.03

4.2 Chi-square Test

The chi-square independence test is a procedure for testing if two categorical variables are related in some population. The chi-square was used to test whether the hypothesis should be accepted or rejected according to the result from p-value. The null hypothesis is rejected when the significant reading shows below 0.05.

In this research, Chi-square analysis was applied to analyses the significant difference between the variable.

By referring to the first objective, to study the relationship between demographic factor (awareness about IoT concept) and behavioural intention of farmers towards the application of IoT, the data analysis is shown in Table 4.6.

Table 4.6: the relationship between demographic factor and behavioural intention

Behavioural Intention of Farmers towards the Application of IoT	Awareness About IoT Concept Chi-square Analysis
I intend to frequently use the IoT technology, to ease my work.	0.657
I intend to apply the IoT technology on my farm.	0.001
I intend to continue using the IoT technology, to perform my job.	0.022

Therefore, there is significance value for the behavioural intention of farmer to use IoT towards demographic factor. The value is only significance for the question two, "I intend to apply the IoT technology on my farm", and the third question, "I intend to continue using the IoT technology, to perform my job.

For question two, the value of Chi-square analysis is 0.001. While for the third question, the value is 0.022. To conclude, there is relationship between awareness about IoT concept and the intention of farmer to use IoT technology.

Table 4.7: Chi-square test of the relationship between subjective norm and perceived ease of use toward perceived usefulness

		Perceived Ease of Use of IoT Towards Agriculture Sector in Kelantan	Subjective Norm that Influence Farmer to Apply IoT Technology
Perceived Usefulness of IoT Towards Agriculture Sector in Kelantan	Chi-square test value	0.00	0.00

The value of chi-square test for the relationship between perceived ease of use of IoT towards agriculture sector in Kelantan and perceived usefulness of IoT towards agriculture sector in Kelantan, are 0.00 and it is significant because the value is below

from 0.05. This shows that, farmer tend to apply the IoT when, IoT technology is easy to use and can improve their quality of work.

While for the relationship between subjective norm that influence farmer to apply IoT technology and perceived usefulness of IoT towards agriculture sector in Kelantan are also significance. For this, shows that they will use IoT technology when agriculture officer recommends it to them, and the technology can make their job easier.

For the second objective, to study the relationship between subjective norm, perceived usefulness, and perceived ease of use toward intention to use IoT, the data analysis is shown in table 4.8.

Table 4.8 Chi-square test of the relationship between Subjective Norm, Perceived Ease of Use, and Perceived Usefulness towards Behavioural Intention.

		Subjective Norm	Perceived Ease of Use	Perceived Usefulness
Behavioural Intention	Chi-square test value	0.00	0.00	0.01

The chi-square test value for the relationship between subjective norm that influence farmer to apply IoT technology and behavioural intention towards IoT in Kelantan agriculture sector are 0.00, which are significance. Which means, farmers intend to frequently use the IoT technology when agriculture officer recommends it to them.

While for the relationship of perceived ease of use of IoT towards agriculture sector in Kelantan towards behavioural intention towards the application of IoT is also significance. Farmers

intend to apply the IoT technology on their farm when the technology is easy to use.

There is also significance relationship between perceived usefulness and behavioural intention of farmer to use the IoT technology, and the value is 0.001. This shows that, farmer intend to continue using the IoT technology when the technology can increase their productivity.

4.3 Regression Analysis

Regression analysis is an incredible measurable strategy that enables you to look at the connection between at least two factors of interest. As we refer to the third objective of the research, to investigate the most influential factor of intention to use IoT, we can conclude that, perceived usefulness of IoT towards agriculture sector in Kelantan and perceived ease of use of IoT towards agriculture sector in Kelantan are the most influential factor that promote the application of IoT by farmer in Kelantan. The value is presented in table 4.9.

Table 4.9 Regression analysis of the most influential factor.

	perceived usefulness	perceived ease of use	Subjective Norm
Sig value	0.001	0.026	0.887

From the result obtained, by conducting a survey on farmer in Kelantan, mostly of the respondents are male and Malay, this was due to the location of survey, which located in Kelantan. The highest number of respondents in education level are at secondary school, which is 59 respondents.

In addition, we can conclude that almost all farmer knows about IoT concept, but cannot explain it briefly, total about 45 respondents and its hold the majority number.

Both of the three objectives of the research were achieved as the data undergo analysis, for example chi-square test and regression analysis.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.0 Introduction

This concluding chapter will discuss about the summary of the hypothesis testing and draws conclusions based on the findings. The main finding, limitation of research, and recommendation for future research are also discussed.

5.1 Main Findings

There are three objectives proposed in this study. First, to study the relationship between demographic factor (awareness about IoT concept) and behavioural intention of farmers towards the application of IoT. There is significance value for the behavioral intention of farmer to use IoT towards demographic factor. The

value is only significance for the question two, “I intend to apply the IoT technology on my farm”, and the third question, “I intend to continue using the IoT technology, to perform my job.

Second, to study the relationship between subjective norm, perceived usefulness, and perceived ease of use toward intention to use IoT, the chi-square test value for the relationship between subjective norm, perceived ease of use and perceived usefulness that influence farmer to apply IoT technology are 0.00, which are significance.

Third objectives are to investigate the most influential factor of intention to use IoT. We can conclude that, perceived usefulness and perceived ease of use are the most influential factor that promote the application of IoT by farmer in Kelantan.

As mention in Chapter 4, all the objectives were successfully achieved. To conclude, the most influential factor that influence the farmer to apply IoT are perceived ease of use and perceived usefulness.

5.3 Recommendations for future research.

IoT technology is a new emerging technology in Malaysia, this is our future in agriculture sector, in order to alert those farmers in Malaysia, and indirectly to obtain data on how they will accept this new technology, future research need to be wider, data should be collected all around the Malaysia.

In addition, must include those who are involve in husbandry, because, IoT were not only the future of our agriculture sector, but also in husbandry sector, and generally the future of our country, Malaysia.

Last but not least, to avoid bias from respondents while answering the questionnaire due to their background, keep your question short and clear.

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APPENDIX A (SURVEY INSTRUMENT**)**

FAKULTI INDUSTRI ASAS TANI

UNIVERSITI MALAYSIA KELANTAN

Tuan/Puan,

PENERIMAAN TEKNOLOGI INTERNET OF THINGS (IoT) DALAM SEKTOR PERTANIAN OLEH PETANI DI SEKITAR MALAYSIA.

Umum mempercayai bahawa teknologi IoT ini adalah masa depan, menyedari kepentingan dan potensi IoT, kajian ini amat berminat untuk, mengetahui sejauh mana penerimaan dan kesediaan petani di Malaysia untuk menerima dan mengaplikasikan teknologi ini, dan bagaimana pengaruh sosial, perspektif kemanfaatan dan juga perspektif kemudahan pemakaian mempengaruhi petani di Malaysia untuk menggunakan IoT.

Kerjasama daripada pihak Tuan/Puan, adalah dimohon untuk membekalkan maklumat penting bagi menjayakan kajian ini. Kesemua maklumat yang diberikan adalah sulit dan akan digunakan untuk tujuan akademik semata-mata.

Sekian, terima kasih.

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BAHAGIAN A – <u>MAKLUMAT DEMOGRAFIK.</u>

Sila tandakan (x), di ruangan yang sesuai.

1. Jantina

( ) Lelaki

( ) Perempuan

2. Kaum

( ) Melayu

( ) Cina

( ) India

Lain-lain (nyatakan): _____

3. Pendidikan tertinggi

( ) Sekolah rendah

( ) Sekolah menengah

( ) Diploma/STPM

( ) Ijazah

( ) Ijazah lanjutan

4. Nyatakan tahap kesedaran anda mengenai konsep IoT?

( ) Sangat biasa dengan IoT

( ) Biasa dengan IoT

( ) Pernah dengar tapi tidak dapat menjelaskannya

( ) Tidak pernah mendengar konsep tersebut

BAHAGIAN B

B1: MANFAAT DAN FAEDAH IoT DALAM SEKTOR PERTANIAN

Sila tandakan (x), di ruangan yang sesuai.

1	2	3	4	5
Sangat tidak bersetuju	**Tidak bersetuju**	**Tidak pasti**	**Setuju**	**Sangat bersetuju**

No	Statement	1	2	3	4	5
7	Teknologi IoT meningkatkan kualiti kerja saya.					
8	Teknologi IoT memudahkan kerja saya.					
9	Teknologi IoT meningkatkan hasil kerja saya.					
10	Saya boleh mengawal kerja saya dengan lebih baik menggunakan IoT.					

B2: KEMUDAHAN PENGGUNAAN IoT DALAM SEKTOR PERTANIAN

Sila tandakan (x), di ruangan yang sesuai.

1	2	3	4	5
Sangat tidak bersetuju	**Tidak bersetuju**	**Tidak pasti**	**Setuju**	**Sangat bersetuju**

No	Statement	1	2	3	4	5
11	Teknologi IoT adalah mudah untuk digunakan.					
12	Teknologi IoT adalah mudah untuk dipelajari.					
13	Mudah untuk menjadi mahir menggunakan teknologi IoT					
14	Menaik taraf teknologi sedia ada kepada teknologi IoT di ladang adalah mudah.					

B3: PENGARUH SOSIAL TERHADAP TAHAP PENGGUNAAN IoT DALAM SEKTOR PERTANIAN

Sila tandakan (x), di ruangan yang sesuai.

1	2	3	4	5
Sangat tidak bersetuju	**Tidak bersetuju**	**Tidak pasti**	**Setuju**	**Sangat bersetuju**

No	Statement	1	2	3	4	5
15	Saya akan menggunakan IoT sekiranya pegawai pertanian merasakan saya patut menggunakannya.					
16	Saya akan menggunakan IoT sekiranya rakan merasakan saya patut menggunakannya.					
17	Saya akan menggunakan IoT sekiranya orang yang penting buat saya merasakan saya patut menggunakannnya.					
18	Saya akan menggunakan IoT sekiranya ianya menjadi viral					

BAHAGIAN C: NIAT TUJUAN TERHADAP IoT DALAM SEKTOR PERTANIAN DI MALAYSIA.

Sila tandakan (x), di ruangan yang sesuai.

1	2	3	4	5
Sangat tidak bersetuju	**Tidak bersetuju**	**Tidak pasti**	**Setuju**	**Sangat bersetuju**

No	Statement	1	2	3	4	5
19	Saya becadang untuk kerap menggunakan teknologi IoT, bagi memudahkan kerja saya.					
20	Saya bercadang untuk mengaplikasikan IoT di ladang saya.					
21	Saya bercadang untuk meneruskan penggunaan teknologi IoT, dalam menjalankan kerja saya.					

TERIMA KASIH UNTUK KERJASAMA ANDA!