UNIVERSITI
MALAYSIA
KELANTAN

Postharvest Technology Acceptance at the Handling and Storage Level among Fruit Vegetable Farmers in East Coast Economic Region (ECER)

Maizatul Vanisha Binti Masril

F15A0076

A report submitted in fulfillment of the requirements for the degree of Bachelor of Applied Science (Agrotechnology) with Honours

Faculty of Agro Based Industry

UNIVERSITI MALAYSIA KELANTAN

2019

DECLARATION

I hereby declare that the work embodied in this report is the result of the original research except citations and summaries of each of which I have already described the source and has not been submitted for a higher degree to any universities or institutions.

_____

Signature

Student name : Maizatul Vanisha Binti Masril

Matric number : F15A0076

Date :

Approved by:

_____

Signature

Supervisor name : Tengku Halimatun Sa'adiah Binti T Abu Bakar

Date :

ACKNOWLEDGEMENT

Alhamdulillah. First of all, I would like to giving my appreciation to my supervisor, Puan Tengku Halimatun Sa'adiah Binti T Abu Bakar for her help and supervising me with her fully concern and commitment to my final year project. With her help, I able to complete my final year project with smoothly and fully understanding. Other than that, deep gratitude also for my co-supervisor, Puan Munirah Binti Mahshar. They always giving me their best so that I would understand, always learn more and completing my study on time. Without their supportive and easily approaches attitude, it will be hard for me to complete my study.

Other than that, I would like to appreciate the help from Jabatan Pertanian Jeli, Terengganu and Cameron Highland for their assistance for the informations that help me in my project. The information shared by the Agriculture Officer do help us to allocate the farmers. Besides that, a special gratitude are for my family, especially my father, Masril and mother, Evayulia and siblings, Maizatul Haniza and Syeid Naquyuddin. Their support and encouragement are my source of strength so that I would never giving up until I able to complete this project.

To all respondents that involved in the survey, I would like to thank them for help me with spending some of their time and allowing me conducts my survey in their place and share their perspective in my project. Without them, there are no ways I can get all the information needed to complete my project efficiently. Lastly, I am also grateful for the moral support, help and knowledge shared by my fellow friends, Syahril Alimin, Nurul Nadia, Nurafza Aiman, Nur Syahirah, and Siti Nor Fatihah. Without them, I wouldn't able to complete this project smoothly and successfully. Their continuous support are truly appreciated and wouldn't never forgotten.

TABLE OF CONTENT

LISTS OF TABLE

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
ECER	East Coast Economic Region
FAMA	Federal Agricultural Marketing Authority
FAO	Food and Agriculture Organization
MARDI	Malaysian Agricultural Research and Development Institute
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SPSS	Statistical Package for the Social Sciences
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour

LISTS OF SYMBOLS

M	Mean
SD	Standard Deviation
α	Value of significance level

Penerimaan Teknologi Lepas Tuai Dalam Tahap Pemprosesan Dan Penyimpanan Oleh Petani Sayuran Buah Di Kawasan Ekonomi Pantai Timur (ECER)

ABSTRAK

Teknologi lepas tuai bukan sahaja boleh membantu meningkatkan hasil tanaman petani, malah pendapatan negara. Terdapat pelbagai teknologi lepas tuai yang sudah diperkenalkan kepada petani termasuk kepada petani sayuran buah di ECER. Namun begitu, peratusan kerugian lepas tuai masih lagi tinggi dan meningkat setiap tahun. Walaupun kemunculan teknologi baharu amatlah dihargai, fenomena penolakan penggunaan teknologi masih belum dikaji dan dipelajari. Tujuan kajian ini adalah untuk mengenalpasti tahap penerimaan teknologi lepas tuai dalam tahap pengendalian dan penyimpanan. Dalam kajian ini, soal selidik berstruktur direka berdasarkan kombinasi Model TAM dan TPB. Kaedah persampelan rawak telah digunakan dan 105 petani sayuran buah telah terlibat untuk menjawab soal selidik dalam kajian ini. Data yang telah dikumpul dimasukkan dan dianalisis dengan menggunakan SPSS versi 21.0. Analisis yang digunakan ialah Statistik deskriptif, Ujian Normal, Kolerasi Spearman dan Ujian kebolehpercayaan. Pembolehubah bebas dalam kajian ini adalah tanggapan kegunaan, tanggapan kemudahan penggunaan dan sikap sementara pembolehubah bergantung adalah penerimaan teknologi lepas tuai. Dalam kajian ini menunjukkan bahawa petani sayuran buah menerima teknologi lepas tuai tetapi tidak menggunakan dan mengaplikasikannya disebabkan korelasinya yang penting tapi boleh diabaikan. Kajian ini akan penting bagi penyelidik dan petani untuk memahami faktor penerimaan teknologi lepas tuai selain untuk membantu mengurangkan kerugian lepas tuai.

Kata Kunci: Teknologi Lepas Tuai, Tanggapan Kegunaan, Tanggapan Kemudahan Penggunaan, Sikap, Penerimaan, TAM

Postharvest technology acceptance in handling and storage level by fruit vegetable farmers in East Coast Economic Region ECER

ABSTRACT

Postharvest technology can help not only the yield of a farmers and also the productivity of a country. There are lots of postharvest technology that already being introduce to the farmer including the fruit vegetables farmers in East Coast Economic Region (ECER). But, the percentage of postharvest losses are still high and increasing each year. Although the phenomenon of new postharvest technology acceptance has been well appreciated, the increasingly characteristics phenomenon of the technology rejection are yet to be understand and studied. This research objectives are to identify postharvest technology acceptance towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER. A structured questionnaire was designed based on combinations of Technology Model Acceptance (TAM) and Theory of Planned Behavior model in this study. A purposive sampling technique was adapted and 105 fruit vegetables in ECER was involved in this study to answer the questionnaire. The data collected were entered and analysed using SPSS version 21.0. The analysis used was Descriptive statistics, Normality Test, Spearman's Correlation and Reliability test. The independent variable in this study are perceived usefulness, perceived ease of use, and attitude while the dependant variables is postharvest technology acceptance in processing and storage level on fruit vegetables farmers in ECER. From this study, the results indicate that fruit vegetable farmers in ECER accept the postharvest technology but do not use and apply it as the correlations is significant but negligible. This study will be important researchers and farmers to understand the factors of postharvest technology acceptance besides in order to help reducing the postharvest losses.

Keywords: Postharvest technology, Perceived Usefulness, Perceived Ease of Use, Attitude, Acceptance, TAM

CHAPTER 1

INTRODUCTION

In this chapter, the background of study of the postharvest systems in vegetables farming especially in Malaysia was covered including the activity in postharvest, total production and postharvest losses by the farming industry, postharvest technology, and low acceptance of postharvest technology in Malaysia. This chapter have also covered the research questions, research objectives, problems statements, scope of study and significant of study.

1.1 Background of study

Postharvest activity are process of handle the produce from the moment that they was harvest until the produce come to the consumers as the end products. The postharvest system defined as "the delivery of a crop from the time and place of harvest to consumption place in time, with minimum loss, maximum efficiency and maximum return for all involved" (Spurgeon, 1976). Postharvest handling are the final stage to produce high-quality produce. (Aziera, Norsida, Nolila, 2013). Appropriate production practices, careful harvesting and proper packaging , storage and transport all influence to good produce quality (Wilson, Boyette & Estes, 1995).

Suzzana (2016) had stated that the study by Malaysian Agricultural Research and Development Institute (MARDI) and Food and Agriculture Organization (FAO) shows

1.4 million tonnes of vegetables was produced in 2014 in Malaysia. From this production, 20% of the products was losses in postharvest level. The postharvest losses are happened in the production, field handling, postharvest handling and distribution. This data shows that losses in production are largely occur in postharvest handling phase with the percentage of 20% to 50%.

Postharvest technology main role are to develop ways which help the deterioration of the produce can be reduce as much as possible during the period between the harvest until the end products and to ensure that the produce highest market can be achieved (Wills, McGlasson, Graham & Joyce, 2007) . Postharvest technology can help in many ways if they are fully utilized. According to Malaysian Agricultural Research and Development Institute (MARDI) director-general Datuk Dr Sharif Haron, "By using technology in harvesting, farmers can improve farm activities. To achieve this objectives, the farmers should change their attitude and by going through courses and training, they can increase their knowledge and awareness" (Suzzana, 2016)

The fruit and vegetables losses may happened at three level which is at farms, wholesalers and retailers. 70% from this production are locally consumed and another 30% of production will be exported to countries especially Singapore, Hong Kong, United Arab Emirates and the Maldives (Suzanna, 2016). Over the period, there are much alternative in order to improve and reduce the losses. Unfortunately, post-harvest losses are still relatively high which can achieve from 5% to 30% of losses. This prove that postharvest technology are still low among the farmers. Based on study done by Truong (2008), the low rate acceptance of postharvest technology are due to several factors such as weak perceptions of technology, low education of farmers, low resources and fund, limited knowledge of workers and geographical conditions.

In this study, the level of postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in east coast economic region (ECER) was identified. The combination theory of Technology Acceptance Model (TAM) and theory of Planned Behaviour (TPB) was used in order to identify the level of perceived usefulness, perceived ease of use and attitudes towards postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER.

1.2 Research Questions

1. What are the level of postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in East Coast Economic Region (ECER)?
2. What are the level of perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER?
3. There is any relationship between specific between perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER?

1.3 Research Objectives

1. To identify the level of postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.

2. To identify the level of perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.

3. To analyse the relationship between specific between perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.

1.4 Problems Statement

Information from the Department of Agriculture Malaysia (2017) shows that the total production of vegetables is 1,290,488 metric ton in Malaysia and the most higher production are come from ECER with the percentage 75% (979,348 metric ton). However, based on Mahmud and Mohamed (2017) 20% of the production had been calculated as the postharvest losses (Table 1.1). This mean that the losses that the country faced can feed almost 140 million people.

Moreover, other issues had been identified that technology and practice acceptance in agriculture especially among farmers has always been low (Dhraief, Bedhiaf-Romdhania, Dhehibib, Oueslati-Zlaouia, Jebali, & Ben, 2018). Abdullah and Samah (2013) also shows that technology acceptance among farmers will effected by farmers' perceptions, levels of education, knowledge and physical conditions. Food pipelines (Figure 1.1) shows the phase that contribute the most of losses factors in the supply chain which include pre-processing, transportation, storage, handling and packaging and marketing (Bourne, 1977;Mahmud &Mohamed,2017). According to Kader, (2005) solutions to existing problems in the postharvest handling system is require

use of available information and application of available technologies at the appropriate scale rather than conducting new research, or developing new technologies.

The study conducted by Tarabay et al (2018) in their study on reduction of food losses in Lebanese apple through good harvesting and postharvest practices shows that there is a highly significant reduction in the percent of total damages was observed during storage when good harvesting and handling practices and pre-storage sorting were applied. Unfortunately, perishable produce are usually being marketed immediately after harvesting without primary processing and adequate packaging due to the absence of farm storage facility and proper pack or packing station (Atanda, Pessu, Agoda, and Isong, 2016). However in this studies, there is lacking data that showing the technology acceptance in the storage and handling phase by fruit vegetables farmers specifically.

Thus, in this study, the relationship between specific between perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER will be identify.

Table 1.1: Estimated postharvest losses of fruits and vegetables in Malaysia.

	2013	2014	2015	2016	2017
Total production metric ton)	1,374,982	1,452,846	1,373,086	1,195,647	1,290,488
PH losses (metric tan)	274,996	290,569	274,617	239,129	237,855
Available food (metric ton)	1,099,985	1,162,277	1,098,469	956,517	951,421

(Source: Statistik Tanaman . Department of Agriculture, Malaysia, 2017)

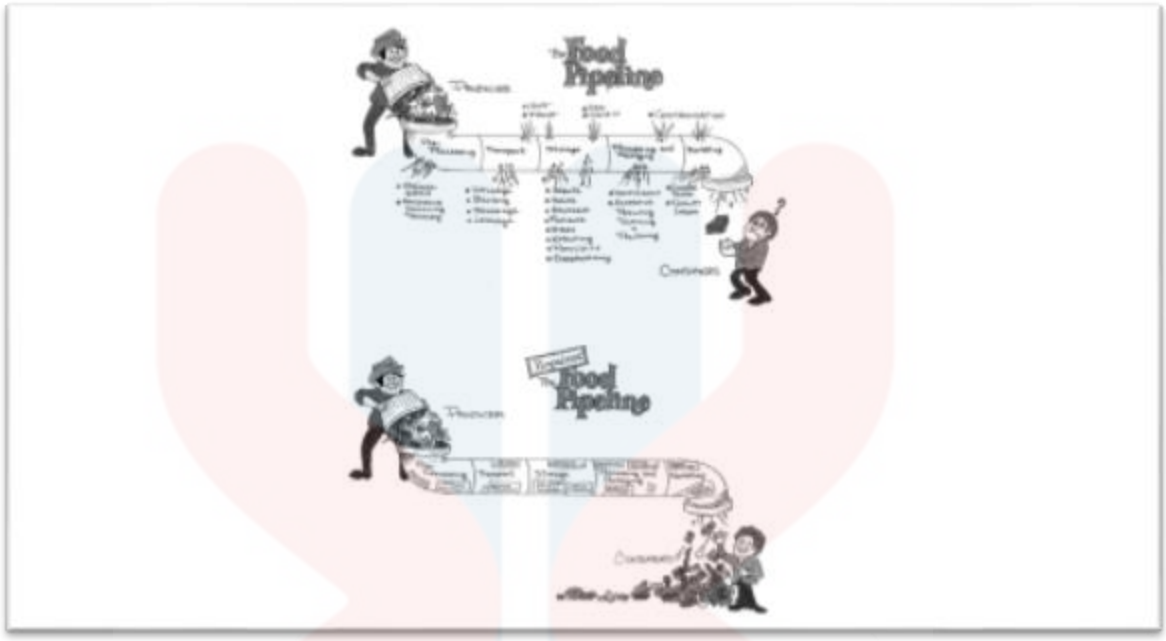

Figure 1.1 : The Food Pipelines.
(Source: Bourne, 1977; Mahmud and Mohamed, 2017)

1.5 Scope of Study

The scope of this study are focusing on the postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER. To identify the factors needed, the respondents was picked among the fruit vegetable farmers in ECER. A set of questionnaire was prepared before conducting the survey. The main focuses of this study are perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER.

1.6 Significant of Study

The research that was done are focusing of the factors of postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER. This study are important to know how individuals, communities and government involvement are influencing technology acceptance by the farmers in ECER.

By this study also, there is impacts of technology acceptance towards farmers and researchers. As for the farmers, this outcome of this study are important to convince them that by accepting the technology, the yield of the farms can be increase. Rather than stay with the conventional ways, by accepting the technology especially in the handling and storage level, the farmers can increase their income by reducing the lost, securing the safety and increasing the yield per year.

Other than that, this study also beneficial for the other researcher, to help them to understand the level of postharvest technology among the fruit vegetables farmers. This study could help them to identify the factors of adoption of technology available in agriculture industry. Thus, it will help other researchers in their further studies.

CHAPTER 2

LITERATURE REVIEW

This chapter has discuss about the review of this studies and empirical findings that are important in developing the theoretical and conceptual framework to obtain the objective of study.

2.1 Fruit Vegetables

Vegetables are defined as edible herbaceous plants or parts of plants that are eaten raw or cooked. This sources of foods is rich in vitamins and minerals, low in calorific value and neutralize the acid substances produced during digestion of high energy foods. Vegetables are grouped on olericulture, branch of a horticultural food crops. Olericulture is horticulture that deals with production, storage, handling and marketing of vegetables and has its origin when man started growing vegetables for consumption (Gopalakrishnan, 2007). Vegetables are grown as annual and perennials .Usually, vegetables are grown for their edible leaves, stem, flower buds, flowers, fruits and roots. In this research, fruit vegetables was chosen. Most vegetables are not botanically based. They are rather random by nature and commonly based on usage rather than plant morphology (Welbaum, 2015). Since vegetables is not considered as a botanical term, some vegetables botanically speaking are also fruits. In the botanical term, a fruit

describes a seeds together with adjacent parts contain in ripened ovary and eaten at maturity. Fruit vegetables is a food crops that really needs precise postharvest management this is because this is a perishable crops. According to Atanda, Pessu, Agoda and Isong, fresh horticulture is highly perishable with some estimates suggesting a postharvest losses of 30 to 50% in vegetables (2016). Due to high water content and high metabolic activities, vegetables are highly perishable. In many developing countries, the vegetables sector plays the important roles in order to overcome poverty and increasing the public income. However, this sector suffers greatly from the problem of high postharvest losses, resulting in significant declines in food quality and safety, competitiveness in the market, and profits earned by producers (Jabir Ali, 2012). Improved storage technologies could be useful strategies for preventing post-harvest losses (World Bank et al., 2011), and improving food security and household welfare (Parmar et al., 2017). Fruits vegetables are mostly categorize in the family Cucurbitaceae such as winter squash and bitter gourd. Followed the Solanaceae family, such as brinjal, tomato, and chilies and by Malvaceae family which is Okra. Fruit vegetables are classified based on their hardiness which most of them is tender and also parts used which is the fruit parts. They also shows several of same cultural requirement which they needs high irrigation rate as they needs high moisture level that makes them suitable to be planted in rainy seasons.

2.2 Postharvest Technology

Postharvest are refer as the last stage in agriculture to produce high-quality fresh produce (Aziera et al., 2013). The failure to control the mechanisms in the postharvest can lead to the postharvest losses. Wilson et al stated that suitable production practices, effective harvesting, and good packaging, storage and transport all lead to good produce

quality (Wilson, Boyette & Estes , 1995). The main importance of postharvest technology is to prevent the deterioration of the produce as much as possible between the period of harvest and use. This is to ensure that the maximum market value will be achieved. This requires a thorough understanding of the structure, composition, biochemistry and physiology of horticultural produce, as postharvest technologies will be mainly concerned with slowing down the rate of produce metabolism without inducing abnormal events (Wills, McGlasson, Graham and Joyce, 2007). Practices of postharvest technologies can reduce the quantitative and qualitative losses of fresh fruits and vegetables and also maintained the product quality up to final consumption. Attaining the hygienic agricultural produce should be focused on the varieties of higher postharvest longevity (Wasala et al., 2014). Vegetables quality are determined at harvest . This is because the produced are removed from the sources of carbohydrates, water and nutrient supply once they was harvested. This make no possibility to further improvement in the produces harvested. The best way is to reduce the rate of deterioration during the maturation, ripening and senescence of the produce. Thus, it is important to understand the pre-harvest and postharvest factors that influence the quality of harvested produce and subsequently, the consumers' decision to purchase the produce (Barman, Ahmad and Siddiqui, 2015).

2.2.1 Postharvest Losses

Postharvest losses is defined as weight of wholesome edible products (exclusive of moisture content) that is normally consumed by human and that has been separated from the medium and sited of its immediate growth and production by deliberate human action with intention of using it for human feeding but which for any reasons fails to be consumed by human (Sudheer and Indira, 2007). The fruit vegetables affected the quality,

quantity, the fruit's appearance and their market value will be reduced. All fresh commodities are high in water content and that makes them expose to desiccation and mechanical injury. Other than that, they are susceptible to attack by bacteria and fungi. The postharvest losses occurred during collection, sorting, packing, and transportation. These losses occurred at farm level due to lack of storage facilities and improper handling (Changule, Shelke & Mane, 2011). Fruit vegetables such tomato are not practiced storage neither at farm level nor at the trader level over a period of time (Changule, Shelke & Mane, 2011). Postharvest losses can be categorized into several type which is the quantitative losses which mean, a decline in the availability, utility, saleable weight. While the qualitative losses are defined as a decline in acceptability by the consumer (Ofelia & Elda, 1990). As been reported, the losses can exceed 50% of the production depending on the handling and distribution chain and the data are varies with different countries (Abd Shukor et al, 2003). Thus, it is important to practice the postharvest handling to minimize the postharvest losses. Other than that, there are economic loss which is reduction in monitory value as a result of physical losses and there is pilferage and other incidental loss of consumers appeal. Lastly, there is nutritive loss which includes loss in vitamins, mineral, sugar and etc (Sudheer and Indira, 2007). In order to increase production of vegetables, the reduction in postharvest losses is complementary. It is not necessary to increase the production of the fruit vegetables if the actions taken is by reduction of postharvest losses. Attention to the concept of the postharvest food loss reduction as a significant means to increase food availability was drawn by World Food Conference held in Rome in 1974. (Sudheer and Indira, 2007).

2.2.2 Handling Level in Postharvest

Postharvest handling is the stage of crop production immediately following harvest, including cooling, cleaning, sorting and packing. Once the crops is harvested from the parents, the quality of the crops are started to deteriorate. Postharvest treatment will determines the final quality of the crops. Whether it will be for fresh consumption or will be processed as a products. To keep the crops temperature low is one of most important goals of the postharvest handling. Other than that, it's also important to avoid moisture loss, slow down any unwanted chemical changes and avoiding any physical damage to delay spoilage. According to El-Ramady et al. (2013), high temperatures during postharvest storage are commonly associated with high transpiration rates and subsequent degradation of quality traits. The main aim of postharvest handling is believed to maintain the fresh state of commodities and the safety of those used and trade requirements (Bautista, Ofelia & Elda, 2012). The sanitation is the important part in order to reduce the possibility of the pathogens could be carried by the fresh produce. Regardless of the scale of harvest, whether it is from home garden or industrialised farm, the basic principles of postharvest handling for most crops are the same. The produce must be handle with care to avoid damage like cutting, crushing, and bruising. They also must be immediately cool and maintain in cool conditions, and cull. Example of problems happened in the processing level of postharvest that lead to the postharvest losses are inefficiency , excessive peeling, trimming and polishing and also the contamination. The function of packaging in processing level of postharvest is to protect the produce from the mechanical injury and contamination during market the produce. Other than that, it also prevent moisture loss, and help in chemical treatment and ethylene absorption (Kader and Rolle, 2004).

Fruit vegetables should receive the preliminary treatments in order to improve the appearance and to maintain the quality. The preparatory treatments that usually conducted by the farmers including the cleaning, disinfection, and waxing. The fruit vegetables that are planted in the farms will be usually sprayed by the pesticides or insecticides in the field. The usage of this chemicals can be too dangerous for the humans even in the small concentrations. Thus, before the produce is packed for direct selling to the consumers, or distribution to the middlemen, the fresh produce must be free from the chemicals residue. During the cleaning process, standard fruit or vegetables washing machine usually will be used. As for the packaging, the package must have sufficient mechanical strength to protect the content during handling, transport and stacking. They also must be free of chemical substances that could transfer to the produce and become toxic to man. Usually, the package must either exclude light or be transparent. Packages are classified as flexible sacks, wooden crates, cartons and plastic crates. Figure 2.1 shown the pipeline in the postharvest activity. Figure 1.1 adapted from Bourne (1977) illustrates the importance of reducing postharvest losses. When the food pipeline is repaired through appropriate postharvest technologies, more food will be made available for consumption by the consumers.

2.2.3 Storage Level of Postharvest

Fresh products' shelf life can be prolonged by keeping it at optimum storage temperature, relative humidity and environmental conditions, as well as by application of chemical preservatives (Lee and Kader, 2000). Most horticulture crops have a short shelf life, particularly crops grown in tropical and subtropical regions. Proper storage is thus required to prolong the marketing period. Many storage methods have been used on a

commercial scale, including air-cooled storage, refrigerated storage, controlled atmosphere storage and modified atmosphere storage. However, storage management is equally as important as the technique used. Since storage incurs cost, proper planning of suitable storage areas is needed, while the range of temperatures required and arrangement of produce, especially when it involves cross commodities, are equally important.

2.2.4 Concept of Technology Acceptance

Postharvest technology is including all actions and processing applied to a crop after harvest in order to preserve the maximum of its quantities and quality to provide food supplies and planting material (George, 1988). As for the technology adoption, Loevinsohn et al., (2013) defines adoption as the integration of a new technology into existing practice and is usually proceeded by a period of 'trying' and some degree of adaptation. Technology acceptance by the farmers are important in order to reduce postharvest losses. This is proved when in Association of Southeast Asian Nations (ASEAN) countries , improper handling and packaging , low-level technology , lack of essential equipment and facilities at the packaging area and lack of trained personnel are commonly contribute to post harvest losses (Abd Shukor et al , 2003). Adoption is in two categories; rate of adoption and intensity of adoption. The former is the relative speed with which farmers adopt an innovation, has as one of its pillars, the element of 'time'. On the other hand, intensity of adoption refers to the level of use of a given technology in any time period (Bonabana Wabbi, 2002). The farmers are also not available to find the equipment in their market and even if the equipment are available, the farmers couldn't afford it. Only the big producer can afford this expensive equipment. Other than

that, the machines are too heavy, and created mobility problems because it make it harder to transfer the machines from field to field (Truong, 2008)

2.3 Theoretical Framework

The theory applied in this study is the combination of theory of Technology Acceptance Model (TAM) and theory of Planned Behaviour (TPB). Researchers have extended the TAM and added constructs like trust, perceived playfulness, cognitive absorption, product involvement and perceived enjoyment. Luarn and Lin (2005) extended the model by adding perceived credibility in a mobile banking context. Abad (2010) have states that, "other researchers extended the TAM model to include additional variables that can be attributed to the many variances in computer technology usage" (as cited in Mamdouh, 2013). The concept of this theory are explained in this part.

2.3.1 Technology Acceptance Model (TAM)

Postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER was determined by using the combination theory of Technology Acceptance Model (TAM) and theory of Planned Behaviour (TPB). TAM are develop by Davis in 1989. TAM has been widely studied and verified by different studies that examine the individual technology acceptance behaviour in different information systems constructs (Priyanka, 2012). Theory of Reasoned Action, developed by Fishbein & Ajzen (1975, 1980) were expanded into this model. Perceived usefulness and perceived ease of use are the key constructs of the TAM.

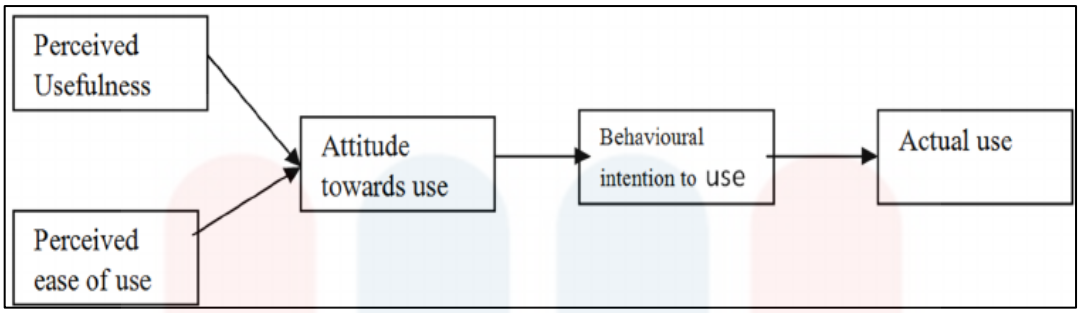

Figure 2.1: The Technology Acceptance Model (TAM)
Source: Davis (1989)

2.3.2 Theory of Planned Behaviour (TPB)

Theory of Planned Behaviour (TPB) is initially developed by Fishbein and Ajzen (1980) as reasoned action theory and proposed that human action depends directly on an individual's intention. In this model, the intention is also generally influenced by individual attitudes and social norms. Ajzen (1991) further introduced the variable of perceived behavioral control (PBC) to complete previous behavioural frameworks and developed the TPB model (Zhou, Romero and Qian, 2016). In the model, intention implies individual readiness to perform a given behaviour (Ajzen, 2002) and is recognized as the motivation which is necessary for engagement in a particular behaviour. Attitude is an individual's positive or negative evaluation of the performance of a particular behaviour (Ajzen and Fishbein, 1981). A person, who believes that valuable positive outcomes would result from performing the behaviour, will have a positive attitude toward such behaviour.

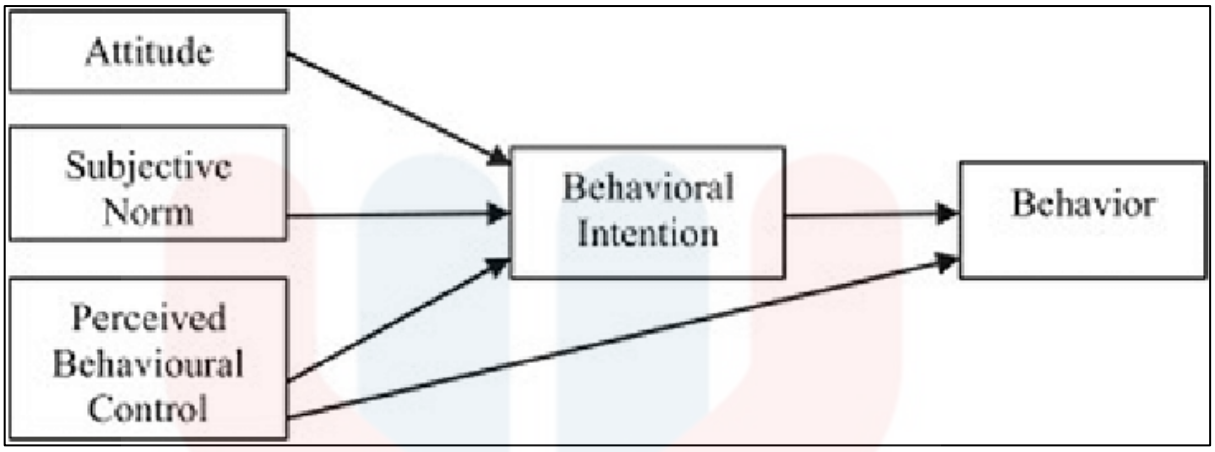

Figure 2.2: The Theory of Planned Behaviour (TPB)
Source: Ajzen (1991).

2.3.3 Perceived Usefulness

According to TAM, perceived ease of use refers to the level to which that make a person that using a particular technology would effortless (Ali et al, 2014). Perceived usefulness is refers to the degree to which a man trusts that utilizing a specific system would upgrade his employment performance (Redzuan, Razali, Muslim, and Razali, 2016). With regard to fruit vegetables plantation. The perceived usefulness defines as the prospective user's subjective probability that using a specific application system will enhance the job or life performance (Davis, 1989). A study by Berhanu, Mehretu, and Ephraim (2016) further proves this point in their study in Ethiopian Agriculture Education and Research whereby a this study revealed that Perceived Usefulness (PU) had significant positive effect on internet use. For those that attempts to design or implement successful systems, perceived usefulness should not being ignored as it has strong correlation with the user's acceptance (Davis, 1989).

2.3.4 Perceived Ease of Use

Davis (1989) defines perceived ease of use as a degree of person believes that using a particular system would be free from efforts such as easy to learn, clear and understandable and easy to remember and also to practices (Davis ,1989). Perceived ease of use is defined as the level to which a farmers considers that using postharvest technology would be free of effort. Effort is described as a finite resource that an individual can exert to the many activities for which he or she is responsible to conduct (Radner & Rothschild, 1975). All else being equal, the users are more likely to be accepting the application perceived to be easier to use. In this issues, fruit vegetable farmers believe that postharvest technology are easy to apply and easy to learn. According to Farhana (2017) perceived ease of use establish an important factor affecting the MORTEX technology acceptance among rubber smallholder in RISDA.

2.3.5 Attitude

Attitude towards behaviours can be define as positive and negative evaluation of an individual of performing a certain behaviour (Kim, Chun and Song, 2009). Attitude in postharvest technology acceptance can be defined as the perception of the fruit vegetables farmers. Their belief about the benefits and drawbacks of the new technology and about their intention to buy the technology. Studies by Davis (1989) stated that attitude serves at best a partial mediator as a partial and vague construct. While Yang and Yoo (2004) argues this statement and stated that attitude can be used a tool to improve user's acceptance of new technology as it is malleable factor that can be influenced through motivation, capability, experiences and education. In the study conducted by Bahaman,

Jeffrey Hayrol and Jegak (2010) stated that majority of the respondents found to have a high positive attitude towards contract farming. Attitude play a direct effect towards perceived usefulness, perceived ease of use on behavioural intention for cases of strong attitude group (Kim, Chun and Song, 2009).

2.4 The effect of Perceived Usefulness, Perceived Ease of Use and Attitude towards the technology acceptance.

2.4.1 The effect of Perceived usefulness towards technology acceptance.

Davis (1989) has stated that perceived usefulness as "the prospective user's subjective likelihood that utilizing a particular application system will expand their employment execution inside of hierarchical connection. Thus, in this study when the fruit vegetables farmers think that it's simple to utilize any technology in their farming, they will consider the technology will be helpful. Behaviour intention to use technology is influenced by perceived usefulness and perceived ease of use. Since behaviour intention based on cognitive choice, in this study, a potential postharvest technology user can either respond favourably or unfavourably towards engaging in postharvest technology. The study done by Aluisio, Maurizio and Katia (2017) to observe the adoption of Integrated Production by common bean growers' in the Brazilian Central Region shows that higher intention to adopt Integrated Production does not depend on the respondents' perception of usefulness of Integrated Production system. Actually, PU does not have a direct effect on intention, but an indirect effect by attitude. It means that other attitudinal factors besides those considered on perceived usefulness are important to make growers adopt Integrated Production.

2.4.2 The effect of Perceived Ease of Use towards technology acceptance.

Perceived Ease of use measures user assessments of ease of use and ease of learning. Based the study to observe Information and communication technology (ICT) acceptance in Ethiopian Agriculture Education and Research among staff and students by Berhanu, Mehretu, and Ephraim (2016), Perceived Ease of Use do not significantly affect Internet usage in teaching and research related activities. Users may believe that technology is useful, they may be, but at the same time, perceive it to be too difficult to use, and that the benefits of usage do not justify the amount of effort needed to use the technology (Davison and Tatnall, 2003; Augusto, 2010; Kwak, 2011).

2.4.3 The effect of Attitude towards technology acceptance.

According to the Logical action theory of Fishbein and Ajzens (1975), person's behaviour is follower of intention or plan that affected on their attitudes are formed due to the normative influences. Attitude is an individual's positive or negative evaluation of the performance of a particular behaviour (Ajzen and Fishbein, 1980). Supported by Rohollah, Sepideh and Ali (2018) in factors affecting farmers' intention to engage in on-farm food safety practices, attitude has a statistically significant positive relationship with the intention to engage in on-farm food safety practices in Iran practices. A person, who believes that valuable positive outcomes would result from performing the behaviour, will have a positive attitude toward such behaviour. In this study, the attitudes of the farmers towards the postharvest technology will determine their behavioural intention to the technology itself.

CHAPTER 3

METHODOLOGY

This part are discuss the procedure that used in this study. The way how the research was conducted and what was the method that used in the research will be briefly explain in this chapter. The research design is the first part of this discussion while research framework are the second part. Other than that, the instrumentation, population, sampling and data preparation procedure will be place under the third part of this research.

3.1 Research Design

In order to gather the information from the respondent, quantitative research design was used. The independent variables for this study are perceived usefulness, perceived ease of use and the attitude while dependant variable are postharvest technology acceptance in handling and storage level by farmers in East Coast Economic Region (ECER). Data was analysed by using SPSS 21.0 to perform data entry and analysis about demographic profile, independent and dependence variables.

3.2 Research Framework

The research framework was prepared to identify the postharvest technology acceptance in handling and storage level by farmers in ECER. The dependant variable is postharvest technology acceptance in handling and storage level by farmers in ECER. The independent variable is are perceived usefulness, perceived ease of use and the attitude. The independent variables are be determined by on the combination of TAM (Technology Acceptance Model) and TPB (Theory of Planned Behaviour).

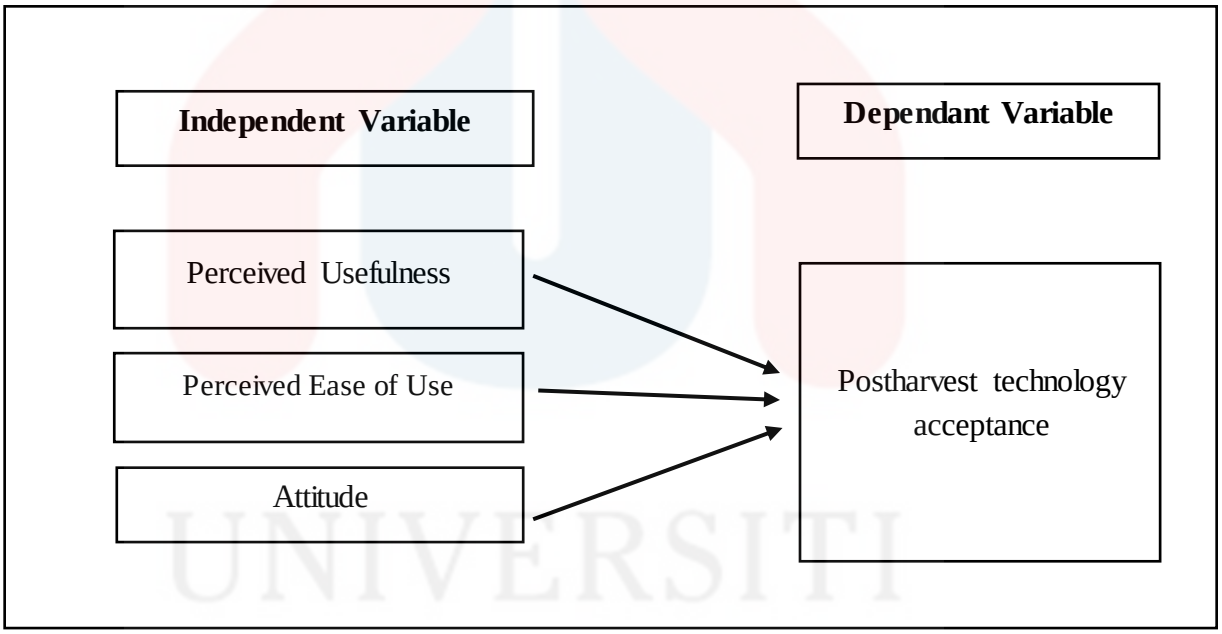

Figure 3.1: Research Framework (Adapted from Davis, 1989 and Ajzen, 1991)

3.3 Instrumentation

Questionnaires was distributed to the respondent among the fruit vegetables farmers in ECER and only the completed questionnaire was taken into the analysis. The questionnaire that was constructed are refer to the study by Ali et al., (2014) using the Technology Acceptance Model (TAM) and combination with Theory of Planned

Behaviour (TPB). The three aspects that influenced the postharvest technology acceptance in handling and storage level by farmers in ECER are perceived usefulness, perceived ease of use and attitudes. Demographic factors also included in the research such the gender, marital status, age, farm land area, educational level, selling method, farming area, income and usage of technology . Before the questionnaire distributed, a pilot test was conducted to get the reliability of the instrument. The questionnaire consists of several parts with desired data from the farmers. Demographic profile is in the Part A, while Part B, C and D are consists of the independent variables which is perceived usefulness, perceived ease of use and attitudes. While part E is postharvest technology acceptance. Responses was recorded on a 5 point Likert Scale representing as strongly disagree, disagree, slightly agree , agree, strongly agree with range 1 to 5 .

3.3.1 Part A: Demographic Profile

Nine question was asked in this part to study the bio of the fruit vegetables farmers. The questions in this part are including the gender, age, religion, farm land area, type of fruit vegetables planted and income. These questions was asked using the ended question.

3.3.2 Part B, C, D: Independent Variables

The question that was answered by the respondents in this sections are referred the previous studied that been done by Ali et al.,(2014). The item included in this part are the postharvest technology acceptance in handling and storage level by farmers in ECER.

Part B, C, and D contained the respond of the respondents in independent which is perceived usefulness, perceived ease of use and attitudes.

3.3.3 Part E: Dependant Variable

This part content the postharvest technology acceptance in handling and storage level by fruit vegetable farmers in ECER without any external influence, such as family and friends.

3.4 Population and Sample

Fruit vegetables farmers in ECER in four district including Kelantan, Pahang, and Terengganu were selected as the population and sample for this study. Research shown that Mahmudal, Golam, Chamhuri and Wahid (2012) have the population of 231,000 farmers in ECER in 2004. Due to the time and money constraint, only 105 questionnaire was distributed to fruit vegetables farmers that are in ECER. This due to they indicated that the number of sample around 90 respondents are enough to use (Krejcie & Morgan, 1970) .

Figure 3.2: The area of East-Coast Economic Region .
Source: ECER (2014)

3.4.1 Sample Size

In this study, 105 respondents among fruit vegetable farmers in ECER choose as the sample size. The sample in this study was determined by using Kline (2005) in order to measure the precision level and also confidence level of the result in the research paper. According to Roscoe (1975), the accurate sample size is must be more than 30 and below than 500. But the critical sample size is 200 by following Hoelter (1983). Besides, according to Sekaran (2003), accurate results fails to obtain if the sample size of a research is below 30 respondents. This is because too small number of sample size cannot represent the characteristics of the whole population. However, in the last research by Kline (2005), the minimum rate is less than 100. The medium rate is between 100 to 200 samples sizes while the maximum rate is more than 200 sample size. In order to gather data or to identify every single item, it is very difficult to involve many hundreds and thousand respondents in a sample size of a study. This is because the study could not

cover all districts due to resources, money and time constraints. Actually, enlarge the target respondent can lead to get more precise and accurate result. Therefore, table 3.1 by Kline (2005) has shown the category of sample size.

Table 3.1: Table of Sample Size

Sample size	**Description**
<100	Minimum rate of sample size
100 – 200	Medium rate of sample size
>200	Maximum rate of sample size

Source: Kline (2005)

3.4.2 Sampling Procedure

The respondents in this study was selected by using non-probability sampling. This technique was used as the samples are not known which individual in the population that was chosen. There also no lists of fruit vegetable farmers obtained from the Department of Agricultural as the information in confidential. The purposive sample were chosen as the respondents are the farmers in ECER, specifically, the fruit vegetables farmers which are used to the handling and storage level in postharvest in their farms. Compare to probability sampling, the non-probability sampling are easy to use and are reasonable to be conduct as it was not very costly and time-effective.

3.5 Data Preparation

Completed questionnaire was tested among 30 farmers in Kelantan to conduct a pilot test and the reliability test to obtain information of respondent. The reliability of the questionnaire was measured.

3.5.1 Pilot Study

To determine the reliability of the questionnaire, the pilot test was conducted among 30 farmers in Kelantan. Through the use of structure questionnaire, pre-test data used to collect from the respondents. The collected data was measured by using reliability test.

Usually, by looking at Cronbach's alpha, reliability coefficient ranges between 0 and 1, but no lower limit is actual exist for the coefficient. The internal consistency of the items in the scale are larger when Cronbach's alpha coefficient became closer to value 1.0. Based on George and Mallery (2003), they show that the rules of thumb are excellent it is >0.9, good if it is >0.8, acceptable if it is >0.7 questionable if it is 0.6, poor if it is >0.5 and unacceptable if it is <0.5. To ensure the value of Cronbach's alpha for each measurement tool exceeding 0.7, the unreliable items were deleted or restructured which was of a correct level. In addition, fruit vegetables farmers in the pilot test were exempted from the actual data collection.

3.5.2 Reliability test

According to Heffner (2016), the reliability test is consistency test, survey, observation or other measuring device. The procedure of reliability analysis analyses a number of commonly used measures of scale reliability and also provides information on the relationships between individual items of the scale. To measure the reliability of the questionnaire in this study, Cronbach's alpha was used. The variables were reliable if the response was stable after the test administration was repeated. It could be ranged between 0% – 1% and its value differs based on the number of the items of scale and inter-item links.

Table 3.2: Reliability test

Variables	Cronbach's Alpha	Number of items
Perceive usefulness	0.895	8
Perceive ease of use	0.809	6
Attitude	0.885	6
Postharvest technology acceptance in handling and storage level by farmers in ECER	0.884	8

3.6 Data Analysis

The information collected data was gathered to check and prove for their accuracy. Data analysis was carried out by checking the frequency and descriptive statistics for independent variables and correlative analysis for dependant variables as well as the

coding and data entry. The survey data would be cleaned for attainable inconsistencies and errors and would support the comparison between the variables.

3.6.1 Descriptive Analysis

The descriptive analysis is the analysis that was transformation of raw data in the form that easy to understand and interpret. Descriptive statistics include the measurements of mean on the nominal data that achieved from research. Nominal data refers to data, which categorized each individual basically in aspects of demographic and socioeconomic. This test would support the comparison between the variables.

3.6.2 Correlation Analysis

The aim of this analysis as to find the relationship between the three variables which influenced the Postharvest technology acceptance in handling and storage level by farmers in ECER. The hypothesis were formulated according to the literature review to recognize the relationship between the variables which influenced the postharvest technology acceptance.

3.7 Summary

In this chapter, the methodology of this study has briefly explained. In research design, the quantitative method were demonstrated by using SPSS 21.0. This use to analyse the data according to the study objectives. The research framework indicate the dependant variable which is postharvest technology acceptance at the handling and storage level on fruit vegetables farmers in ECER, and three independent variables which

is perceived usefulness, perceived ease of use and attitudes. In the instrumentation, each part of the variables starts from the demographic profile, postharvest technology acceptance among fruit vegetables farmers in ECER, perceived usefulness, perceived ease of use and attitudes. All items was measured by using Likert Scale that represent as strongly disagree , disagree , slightly agree , agree, strongly agree with the range of 1 to 5 .

Other than that, population and sample were explained the number of fruit vegetables farmers in ECER and the way that researcher used to determine the sample. On than that, the data preparation were explains about the pilot study that involved 30 respondents from Kelantan. After the reliability test conducted, the study was then studied on 105 respondents from ECER. Lastly, the data analysis will be shows on the analysis by researcher. Descriptive analysis and correlation analysis was used by researcher to analyses the data for the study.

CHAPTER 4

RESULT AND DISCUSSION

The results and discussion of this study was covered in this chapter. 105 fruit vegetables farmers in East Coast Economic Region (ECER) were survey randomized and the questionnaires were collected for further analysis. The analysis will discuss the objectives of the study based on socio-demographic, perceived usefulness, perceive ease of use towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.

4.1 Descriptive Analysis

The descriptive analysis was the analysis that easy to understand and interpret that was transformation of raw data in the form. This test would support the comparison between the variables.

4.1.1 Socio-Demographic Profile of Fruit Vegetables farmers in ECER

Descriptive was run to describe the fruit vegetables farmers in ECER socio demographic profile of the study. The demographic profile including gender, race, age,

marital status, education level, selling method, total income per month, and area of planting. Table 4.1 shows the socio-demographic profile of the fruit vegetables farmers in ECER.

In this study, most of the fruit vegetables farmers were males which are 69.6% as compare to females only 30.5%. The race of fruit vegetables farmers in ECER are consists of Malay with 90.5%, followed by Chinese 4.8%, Indian 3.8% and others with 1%. As for the range of fruit vegetables, the most age of fruit vegetables farmers is between under 30 years old with the percentage of 31.4%, followed by the age range of 31-40 years old with 30.5%, 41-50 years old with 14.3%, 13.3% of 51-60 and 10.5% for the age older than 60. For the marital status of fruit vegetables farmers, most of them is married with the percentage of 62.9% and 37.1% for the single status.

Educational level of fruit vegetables farmers will usually affect the behaviour and relate to the usability of the postharvest technology. As shown in Table 4.1 of this study, the highest respondent of level education is SPM which is 38.1%, followed by Degree with 21.9%, then Diploma with 18.1%, UPSR with 9.5%, PMR with 7% and Certificates with 5.7%. Other than that, total income per month of fruit vegetables farmers with the highest composition is under RM2,000 with 53.3%, followed by the income of RM2,001 – RM3,000 with 18.1% , income per month between more than RM5,000 with 15.2%, income per month between RM3,001 – RM4,000 with 10.5% and only 2.9% of income per month between RM4,001 to RM5,000.

Fruit vegetables farmers are between directly sell their produce to the consumers or sell it to the middleman. In this study, most of them are sell their produce to middlemen with 58.1% and another 41.9% are selling their produce directly. On other hand, most of

the fruit vegetables farmers have less than 1 acres of planting area with 47.6%, followed by area of planting of 2-5 acres with 39%, area of planting between 5-10 with 7.6%, and 5.7% of more than 10 acres of area of planting.

Table 4.1: Socio-Demographic profile of fruit vegetables farmers in ECER

Variables	Frequency	Percentage (%)	Mean	SD
Gender			1.30	0.462
Male	73	69.5		
Female	32	30.5		
Race			1.15	0.514
Malay	95	90.5		
Chinese	5	4.8		
Indian	4	3.8		
Other	1	1.0		
Age			2.40	1.335
<30	33	31.4		
31 – 40	32	30.5		
41 – 50	15	14.3		
51 – 60	14	13.3		
>60	11	10.5		
Status			1.62	0.485
Single	39	37.1		
Married	66	62.9		
Selling Method			1.14	0.495
Middleman	61	58.1		

Direct Selling	44	41.9		
Education			3.81	1.597
UPSR	10	9.5		
PMR	7	6.		
SPM	40	38.1		
SIJIL	6	5.7		
DIPLOMA	19	18.1		
IJAZAH	23	21.9		
Income			1.71	0.840
< RM2,000	56	53.3		
RM2,001 –	19	18.1		
RM3,000	11	10.5		
RM3,001 –	3	2.9		
RM4,000	16	15.2		
RM4,001 –				
RM5,000				
>RM5,000				
Farming area			1.71	0.840
< 1 acre	50	47.6		
2 acre – 4.9 acre	41	39		
5 acre – 9.9 acre	8	7.6		
> 10 acre	6	5.7		
Technology used			1.89	0.307
Yes	11	10.5		
No	94	89.5		

4.1.2 Level of Postharvest technology acceptance in handling and storage level by farmers in ECER

The descriptive analysis result for postharvest technology acceptance in handling and storage level is shown in Table 4.8. It is about 21.9% of fruit vegetables farmers who disagree with the statement "I do not know much about handling and storage technology" and 26.7% of fruit vegetables farmers who either disagree or agree with the statement. Followed by 34.3% of fruit vegetables farmers agree, 3.8% of fruit vegetables farmers strongly disagree and 13.3% of fruit vegetables farmers that strongly agree with the statement. It is show that fruit vegetables farmers know and concern with the technology to improve latex.

The results showed that 25.7% of fruit vegetables farmers disagree with statement "I perceived the handling and storage technology very complicated", 9.5% of fruit vegetables farmers strongly disagree and 28.6% agree with this statement, and another 7.6% of fruit vegetables farmers strongly agree with it. While another 28.6% of fruit vegetables farmers are either agree or disagree with this statement. This statement reveal that the fruit vegetables farmers doesn't believe that the handling and storage technology are complicated.

Response for disagree is the highest with 30.5% for the statement "I did not have time to know the latest handling and storage technology. Followed by 21.9% of fruit vegetables farmers who either disagree or agree with statement, 5.7% of fruit vegetables farmers strongly disagree, 20% of fruit vegetables farmers agree and 8.6% of fruit vegetables farmers strongly agree with statement. This shows that fruit vegetables farmers knows and also follow the latest postharvest technology in handling and storage level.

For the statement of "I perceived the handling and storage technology is not priority in improving my fruit vegetable's quality" has 27.6%% fruit vegetables farmers agree, 10.5% fruit vegetables farmers strongly agree, 21.9% fruit vegetables farmers either disagree or agree, 30.5% fruit vegetables farmers disagree and another 9.5% fruit vegetables farmers strongly disagree with this statement. Therefore, this shows the priority of accepting the postharvest technology at the handling and storage level.

It is shows that in Table 4.6, the statement "I think there is no interest in using handling and storage technology" has 19% fruit vegetables farmers agree followed by 7.6% fruit vegetables farmers strongly agree, 25.7% fruit vegetables farmers either disagree or agree, 30.5% fruit vegetables farmers disagree and another 17.1% fruit vegetables farmers strongly disagree with this statement. This statement show that most of fruit vegetables farmers interest to accepting the postharvest technology at the handling and storage level.

"I perceived the cost to use handling and storage technology is too high" is a statement with response 31.4% fruit vegetables farmers agree, 19% fruit vegetables farmers strongly agree, 30.5% fruit vegetables farmers either disagree or agree, 15.2% fruit vegetables farmers disagree and another 3.8% fruit vegetables farmers strongly disagree with this statement. This show that the cost of technology is not expensive and fruit vegetables farmers able to buy it.

Other statement which is "I am not exposed to the importance of handling and storage technology" has 28.6% fruit vegetables farmers agree, 19% fruit vegetables farmers strongly agree, 23.8% fruit vegetables farmers either disagree or agree, 24.8% fruit vegetables farmers disagree and another 3.8% fruit vegetables farmers strongly disagree with this statement. This shows how the fruit vegetables farmers are not exposed to the importance of handling and storage technology.

Last statement for postharvest technology acceptance at the handling and storage level is "Financial factor is the reason I didn't use the handling and storage technology" has the response 7.6% of fruit vegetables farmers disagree and 35.2% of fruit vegetables farmers agree with the statement. It is about 1.9% fruit vegetables farmers strongly disagree, 24.8% of fruit vegetables farmers either disagree or agree and 30.5% of fruit vegetables farmers strongly agree with the statement. Based on the responses, it is show that financial factor is reason the fruit vegetables farmers didn't accept the postharvest technology at handling and storage level.

As conclusion, level of postharvest technology acceptance at handling and storage level is Moderate. It is due to percentage is 61% moderate and the mean is 2.79. The mean score for this study was categorized into three categories which are low (1.00-2.33), moderate (2.34-3.67) and high (3.68-5.00). So the mean score for this level from the Table 4.7 is moderate. This result shows that the level of fruit vegetables farmers in ECER accept but not use. The farmers are actually know the function and usability of the postharvest technology at handling and storage level. According to Brinckerhoff (2010), not accept technology, not use technology but rather totally hold technology for mission. Research by Meuter (2003) said that adoption or rejection of technology is impacted by factors of the degree of individual technical anxiety and perceives risk associated with use of these services.

Table 4.2: Descriptive Analysis Postharvest technology acceptance in handling and storage level by farmers in ECER

Statement	Percentage (%)					Mean	Standard Deviation
	1*	2*	3*	4*	5*		
I do not know much about processing and storage technology	3.8	21.9	26.7	34.4	13.3	2.69	1.077
I perceived the processing and storagetechnology very complicated.	9.5	25.7	28.6	28.6	7.6	3.01	1.114
I did not have time to know the latest processing and storage technology	5.7	29.5	36.2	20.0	8.6	3.04	1.037
I perceived the processing and storage technology is not priority in improving my fruit vegetables's quality	9.5	30.5	21.9	27.6	10.5	3.01	1.181
I think there is no interest in using processing and storage technology	17.1	30.5	25.7	19	7.6	3.30	1.186
I perceived the cost to use processing and storage technology is too high.	3.8	15.2	30.5	31.4	19	2.53	1.084
I am not exposed to the importance of processing and storage technology .	3.8	24.8	23.8	28.6	19	2.66	1.159
Financial factor is the reason I didn't use the processing and storage technology .	1.9	7.6	24.8	35.2	30.5	2.15	1.007

1*(Strongly disagree) 2*(Disagree) 3*(Either agree and disagree) 4*(Agree) 5*(Strongly agree)

Table 4.3: Level of Postharvest technology acceptance in handling and storage level by farmers in ECER

Factor	Frequency	Percentage (%)	Mean	Standard deviation
Postharvest technology acceptance in handling and storage level by farmers in ECER			2.79	0.784
Low	25	23.8		
Moderate	64	61		
High	16	15.2		

4.1.3 Level of Perceived Usefulness

Descriptive analysis also used in order to describe fruit vegetables farmers in ECER's perceived usefulness. It is important to measure the perceived usefulness of fruit vegetables farmers in ECER towards postharvest technology acceptance in handling and storage level to accomplish the objective of this study. The analysis result of fruit vegetables farmers in ECER perceived usefulness towards postharvest technology acceptance in handling and storage level are presented in Table 4.2. The statement of "I perceived by using the handling and storage technology would increase the efficiency of my daily work" has 45% agree, 30.5 strongly agree, 23% either disagree or agree, 1% disagree and 1% strongly disagree with this statement. This statement illustrates that most of fruit vegetables farmers in ECER find the by using the handling and storage technology can increase the efficiency of their daily work.

"I perceived by using the handling and storage technology allow me to better manage my time" has 46.7% fruit vegetables farmers agree, 39% fruit vegetables farmers strongly agree, 12.4% fruit vegetables farmers either agree or disagree, 1% fruit vegetables farmers disagree and 1% fruit vegetable farmers strongly disagree. From this statement, majority of fruit vegetables farmers in ECER agree that handling and storage technology allow them to manage their time.

Statement of "I perceived by using the handling and storage technology would be useful for me as farmers" has 46% agree, 42.9% strongly agree, 8.6% either disagree or agree, 1% disagree and 1% strongly disagree with this statement. This statement indicates that handling and storage technology would be useful for them as fruit vegetable farmers.

"I perceived by using the handling and storage technology would increase the quality of fruit vegetables" is statement that 34.3% fruit vegetables farmers agree, 45.7% fruit vegetables farmers strongly agree, 9.5% fruit vegetables farmers either agree or disagree, 8.6% fruit vegetables farmers disagree and 1.9% fruit vegetable farmers strongly disagree with this statement. This shows that postharvest technology would increase the quality of fruit vegetables.

Other statement is I perceived by using the handling and storage technology would increase the shelf-life of fruit vegetables". This statements shows that 41% fruit vegetables farmers agree, 42.9% fruit vegetables farmers strongly agree, 9.5% fruit vegetables farmers either agree or disagree, 5.7% fruit vegetables farmers disagree and 1% fruit vegetable farmers strongly disagree with this statement. Fruit vegetables farmers in ECER agree that handling and storage technology would increase the shelf-life of fruit vegetables.

There are 43.8% of fruit vegetable farmers in ECER who agree with the statement "I perceived by using the handling and storage technology can increase my income". It

was followed by 39% fruit vegetables farmers strongly agree, 14.3% fruit vegetables farmers either agree or disagree, 1.9% fruit vegetables farmers disagree and 1% fruit vegetable farmers strongly disagree with this statement. Fruit vegetable farmers believe that postharvest technology could increase their income.

The statement of "I perceived by using the handling and storage technology would decrease the postharvest losses has 52.4% fruit vegetables farmers agree, 34.3% fruit vegetables farmers strongly agree, 9.5% fruit vegetables farmers either agree or disagree, 52.4% fruit vegetables farmers agree and 1.9% fruit vegetable farmers strongly disagree with this statement. By using the handling and storage technology can decrease the postharvest losses.

Lastly, statement of " I perceived by using the handling and storage technology can reduce the labour cost and number of employees" has 44.8% fruit vegetables farmers agree, 21% fruit vegetables farmers strongly agree, 23.8% fruit vegetables farmers either disagree or agree, 8.6% fruit vegetables farmers disagree and 1.9% fruit vegetables farmers strongly disagree with this statement. This statement indicates that handling and storage technology can reduce the labour cost and number of employees.

Based on the results in Table 4.3, 78.1% of fruit vegetable farmers in ECER have high level of perceived usefulness. Moreover, mean score for perceived usefulness are M=4.11, since the mean value was categorized as high mean value, it can be said that fruit vegetables in ECER are approximately agree to the perceived usefulness of fruit vegetables farmers in ECER towards postharvest technology acceptance (Table 4.3). This statement could be supported by Malek, Gatzweiler & Braun (2017), people more to turns into perceived usefulness towards to use agriculture technology. In conclusion, based on perceived usefulness towards postharvest technology acceptance at the handling and

storage level, the fruit vegetable farmers accept usefulness of postharvest technology acceptance at the handling and storage level.

Table 4.4: Descriptive Analysis Perceived Usefulness

Statement	Percentage (%)					Mean	Standard Deviation
	1*	2*	3*	4*	5*		
I perceived by using the handling and storage technology would increase the efficiency of my daily work	1	1	21.9	45.7	30.5	4.03	0.807
I perceived by using the handling and storage technology allow me to better manage my time	1	1	12.4	46.7	39	4.21	0.807
I perceived by using the handling and storage technology would be useful for me as farmers	1	1	8.6	46.7	42.9	4.29	0.771
I perceived by using the handling and storage technology would increase the quality of fruit vegetables	1.9	8.6	9.5	34.3	45.7	4.13	0.745
I perceived by using the handling and storage technology would increase the shelf-life of fruit vegetables	1	5.7	9.5	41	42.9	4.19	1.02
I perceived by using the handling and storage technology can increase my income	1	1.9	14.3	43.8	39	4.18	0.899
I perceived by using the handling and storage technology would decrease the postharvest losses	1.9	1.9	9.5	52.4	34.3	4.15	0.817
I perceived by using the handling and storage technology can reduce the labour cost and number of employees	1.9	8.6	23.8	44.8	21	3.74	0.951

1*(Strongly disagree) 2*(Disagree) 3*(Either agree and disagree) 4*(Agree) 5*(Strongly agree)

Table 4.5: Level of Perceived Usefulness

Factor	Frequency	Percentage (%)	Mean	Standard deviation
Perceived usefulness			4.11	0.622
Low	1	1		
Moderate	22	21		
High	82	78.1		

4.1.4 Level of Perceived Ease of Use

Perceived ease of use can have significant impact in the postharvest technology acceptance at the handling and storage level. Table 4.4 shows the results for descriptive statistic of the perceived ease of use towards postharvest technology acceptance at the handling and storage level. The statement "I perceived by using the handling and storage technology ease me to increase the production of fruit vegetables" has the response of 54.3% fruit vegetables farmers agree, 32.4% fruit vegetables farmers strongly agree, 10.5% fruit vegetables farmers either disagree or agree, 1% fruit vegetables farmers disagree and 1% fruit vegetables farmers strongly disagree with this statement. That statement shows the postharvest technology at the handling and storage level give ease for fruit vegetable farmers.

Statement of " I perceived by using the handling and storage technology ease to use and user-friendly" has of 49.5% fruit vegetables farmers agree, 20% fruit vegetables farmers strongly agree, 26.7% fruit vegetables farmers either disagree or agree, 1.9% fruit vegetables farmers disagree and 1.9% fruit vegetables farmers strongly disagree with this

statement. It shows that postharvest technology at the handling and storage level give ease to use and user-friendly for fruit vegetable farmers.

The statement of " I perceived by using the handling and storage technology easy to understand" shows that 49.5% fruit vegetables farmers agree, 12.4% fruit vegetables farmers strongly agree, 30.5% fruit vegetables farmers either disagree or agree, and 7.6% fruit vegetables farmers disagree with this statement. The results shows that postharvest technology at the handling and storage level give are easy to be understand.

About 42.9% of fruit vegetables farmers who agreed with the statement "I perceived by using the handling and storage technology easy to control. Followed by 16.2% of fruit vegetables farmers who were strongly agreed, 33.3% of fruit vegetables farmers either disagree or agree, and 7.6% of fruit vegetables farmers that are disagree with it. Postharvest technology at the handling and storage level is easy to control by fruit vegetables farmers in ECER.

" I perceived by using the handling and storage technology is easy in skilful" is a statement that 50% fruit vegetables farmers agree, 17.1% fruit vegetables farmers strongly agree, 29.5% fruit vegetables farmers either disagree or agree, 4.8% fruit vegetables farmers disagree and another 1% fruit vegetables farmers strongly disagree with this statement. This statement indicates that fruit vegetables can easily be skilful with postharvest technology at the handling and storage level.

Other statement which is " I perceived that I will use the handling and storage technology more often in future" has 54.3% fruit vegetables farmers agree, 23.8% fruit vegetables farmers strongly agree, 21% fruit vegetables farmers either disagree or agree and another 1% fruit vegetables farmers strongly disagree with this statement. This shows postharvest technology at the handling and storage level will be use more often in the future.

The result in Table 4.5 were explains the fruit vegetables farmers has a significant effect on the perceived ease of use of postharvest technology acceptance at the handling and storage level from statistical aspect. Mean score is explaining that effect of perceived ease of use are (M = 3.84, SD = 0.588) that was categorized as high mean value. So, it can be asserted those fruit vegetables farmers in ECER are approximately agree to the perceived ease of use towards postharvest technology at the handling and storage level. This results were supported by Nadarajah (2011) study which said that technology was simple and easy to use innovative technology can encourage manufacturer and farmers to adapt new technology and applications that enhance productivity. In this study, the variable of perceived ease of use shows there is a significant influence on postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER. Other than that, postharvest technology at the handling and storage level gives more ease of use to the fruit vegetables farmers.

Table 4.6: Descriptive Analysis Perceived Ease of Use

Statement	Percentage (%)					Mean	Standard Deviation
	1*	2*	3*	4*	5*		
I perceived by using the handling and storage technology ease me to increase the production of fruit vegetables	1	1.9	10.5	54.3	32.4	4.15	0.756
I perceived by using the handling and storage technology ease to use and user-friendly	1.9	1.9	26.7	49.5	20	3.83	0.833
I perceived by using the handling and storage technology easy to understand		7.6	30.5	49.5	12.4	3.67	0.792
I perceived by using the handling and storage technology easy to control		7.6	33.3	42.9	16.2	3.67	0.837
I perceived by using the handling and storage technology is easy in skilful	1	4.8	29.5	47.6	17.1	3.75	0.829
I perceived that I will use the handling and storage technology more often in future	1		21	54.3	23.8	4	0.733

1*(Strongly disagree) 2*(Disagree) 3*(Either agree and disagree) 4*(Agree) 5*(Strongly agree)

Table 4.7: Level of Perceived Ease of Use

Factor	Frequency	Percentage (%)	Mean	Standard deviation
Perceived Ease of use			3.84	0.588
Low	2	1.9		
Moderate	41	39		
High	62	59		

4.1.5 Level of Attitude

Another than that, descriptive analysis also used in order to describe fruit vegetables farmers in ECER's attitudes towards postharvest technology at the handling and storage level. In order to achieve the third objective of this study, it is important to measure the attitude of fruit vegetables farmers in ECER towards postharvest technology in handling and storage level. The analysis result of fruit vegetables farmers in ECER's attitude towards postharvest technology acceptance in handling and storage level are presented in Table 4.6. The statement "I feels up-to-date if I used any handling and storage technology" has the response of 45.7% fruit vegetables farmers agree, 16.2% fruit vegetables farmers strongly agree, 20% fruit vegetables farmers either disagree or agree, 14.3% fruit vegetables farmers disagree and 3.8% fruit vegetables farmers strongly disagree with this statement. That statement shows what farmers feels if they use the handling and storage technology.

Statement of "I'm more confident when using the handling and storage technology in producing my fruit vegetable" has of 46.7% fruit vegetables farmers agree,

25.7% fruit vegetables farmers strongly agree, 21.9% fruit vegetables farmers either disagree or agree, 4.8% fruit vegetables farmers disagree and 1% fruit vegetables farmers strongly disagree with this statement. It shows the fruit vegetables farmers high confident level towards the postharvest technology at the handling and storage level.

The statement of "I feels more comfortable to use the handling and storage technology compare to the traditional postharvest handling." shows that 50.5% fruit vegetables farmers agree, 19% fruit vegetables farmers strongly agree, 24.8% fruit vegetables farmers either disagree or agree, 3.8% fruit vegetables farmers disagree and 1.9% fruit vegetables farmers strongly disagree with this statement. The results shows the comfortability of fruit vegetables farmers when use postharvest technology at the handling and storage level compare to the traditional postharvest handling.

About 55.2% of fruit vegetables farmers who agreed with the statement "I will encourage the community around here to use the handling and storage technology". Followed by 21.9% of fruit vegetables farmers who were strongly agreed, 18.1% of fruit vegetables farmers either disagree or agree, 3.8% of fruit vegetables farmers that are disagree and 1% of fruit vegetables farmers who are strongly disagree with it. This shows how confident the fruit vegetables farmers in order to encourage their community to use the handling and storage technology

"I'm confident that handling and storage technology can increase the fruit vegetable's quality" is a statement that 44.8% fruit vegetables farmers agree, 34.3% fruit vegetables farmers strongly agree, 7.6% fruit vegetables farmers either disagree or agree, 11.4% fruit vegetables farmers disagree and another 1.9% fruit vegetables farmers strongly disagree with this statement. This statement indicates how confident fruit vegetables farmers that postharvest technology at the handling and storage level can increase the fruit vegetable's quality.

Other statement which is "I'm confident that handling and storage technology can increase the fruit vegetable's shelf-life" has 50.5% fruit vegetables farmers agree, 34.3% fruit vegetables farmers strongly agree, 9.5% fruit vegetables farmers either disagree or agree, 2.9% fruit vegetables farmers disagree and another 2.9% fruit vegetables farmers strongly disagree with this statement. This shows how confident fruit vegetables farmers that postharvest technology at the handling and storage level can increase the fruit vegetable's shelf-life.

The fruit vegetables farmers that has a significant effect on the attitude of postharvest technology acceptance at the handling and storage level from statistical aspect was explained in the result in Table 4.7. Mean score is explaining that effect of attitude are (M = 3.89, SD = 0.680) that was categorized as high mean value. So, it can be asserted those fruit vegetables farmers in ECER have high level of attitude towards postharvest technology at the handling and storage level. Observability and perceived usefulness of performance monitoring technologies influence attitudes and tendency to apply such technologies (Salehi, Rezaei-Moghaddam, and Hayati, 2010). Supported by Bahaman et al., (2010) shows that there is high level attitude in adopting contract farming study.

Table 4.8: Descriptive Analysis Attitude

Statement	Percentage (%)					Mean	Standard Deviation
	1*	2*	3*	4*	5*		
I feels up-to-date if I used any handling and storage technology	3.8	14.3	20	45.7	16.2	3.56	1.046
I'm more confident when using the handling and storage technology in producing my fruit vegetable	1	4.8	21.9	46.7	25.7	3.91	0.867
I feels more comfortable to use the handling and storage technology compare to the traditional postharvest handling	1.9	3.8	24.8	50.5	19	3.81	0.855
I will encourage the community around here to use the handling and storage technology	1	3.8	18.1	55.2	21.9	3.93	0.798
I'm confident that handling and storage technology can increase the fruit vegetable's quality	1.9	11.4	7.6	44.8	34.3	3.98	1.028
I'm confident that handling and storage technology can increase the fruit vegetable's shelf-life	2.9	2.9	9.5	50.5	34.3	4.15	0.863

1*(Strongly disagree) 2*(Disagree) 3*(Either agree and disagree) 4*(Agree) 5*(Strongly agree)

Table 4.9: Level of Attitude

Factor	Frequency	Percentage (%)	Mean	Standard deviation
Attitude			3.89	0.680
Low	3	2.9		
Moderate	34	32.4		
High	68	64.8		

4.2 Normality test

To determine if the sample or any group of data fits as standard normal distribution, normality test is used. In this is a statistical process, the value of significant must be >0.05 to achieve the normality of distribution. If the value of significant is >0.05, thus Pearson Correlation will be used. Meanwhile, if the value of significant is <0.05, Spearman Correlation will be use. According to the table 4.10, the significant value are 0.000 which is <0.05. Thus Spearman correlation was applied in this study.

Table 4.10: One-Sample Kolmogorov-Smirnov Test

		Perceived Usefulness	Perceived Ease of Use	Attitude	Acceptance
N		105	105	105	105
Normal Parameters[a,b]	Mean	2.7714	2.5714	2.6190	1.9143
	Std. Deviation	.44413	.53452	.54386	.62194
Most Extreme Differences	Absolute	.478	.379	.406	.317
	Positive	.303	.267	.242	.293
	Negative	-.478	-.379	-.406	-.317

Kolmogorov-Smirnov Z	4.893	3.885	4.158	3.245
Asymp. Sig. (2-tailed)	.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

4.3 Spearman Correlations

Spearman correlation analysis was used to compute the statistical significance of the cross-tabulation table. In this study, Spearman correlation analysis as used in order to determine the relationship between perceived usefulness, perceived ease of use and attitude towards the postharvest technology acceptance at handling and storage level among fruit vegetables farmers in ECER.

The correlation coefficient would take a range in value between 1.0 and +1.0. The both sign (positive and negative) and its absolute value should be consider to interpret the correlation coefficient. Coefficient of 1.0 shows the perfect positive correlation while a -1.0 shows negative correlations. To interpret correlation coefficient, there are many rules of thumb used but all of them are domain specific. The rule of thumb for interpreting the size of a correlation coefficient from Hinkle, et al (2003) are shown in the table 4.10.

Table 4.11: Rule of Thumb for Interpreting the Size of a Correlation Coefficient (Hinkle et al.,2003)

Size of Correlation	Interpretation
0.90 to 1.% (-0.9 to -1.%)	Very high positive (negative) correlation
0.70 to 0.90 (-0.70 to -0.90)	High positive (negative) correlation
0.50 to 0.70 (-0.50 to 0.70)	Moderate positive (negative) correlation
0.30 to 0.50 (-0.30 to -0.50)	Low positive (negative) correlation
0.% to 0.30 (0.% to -0.30)	Negligible correlation

Table 4.12: Spearman's Correlation Analysis

			Perceived Usefulness	Perceived Ease of Use	Attitude	Acceptance
Spearman's rho	Perceived Usefulness	Correlation Coefficient	1.000	.273**	.425**	.179
		Sig. (2-tailed)	.	.005	.000	.068
		N	105	105	105	105
	Perceived Ease of Use	Correlation Coefficient	.273**	1.000	.436**	.060
		Sig. (2-tailed)	.005	.	.000	.546
		N	105	105	105	105
	Attitude	Correlation Coefficient	.425**	.436**	1.000	.011
		Sig. (2-tailed)	.000	.000	.	.908
		N	105	105	105	105

Postharvest Technology Acceptance	Correlation Coefficient	.179	.060	.011	1.000
	Sig. (2-tailed)	.068	.546	.908	.
	N	105	105	105	105

**Correlation is significant at the 0.01 level (2-tailed).

4.3.1 Relationship between Perceived Usefulness and Postharvest technology acceptance in handling and storage level by farmers in ECER.

Table 4.11 below was shows the results of Spearman correlation analysis which is applied to measure the relationship for all independent variables with dependent variable. The correlation between perceived usefulness and postharvest technology acceptance among fruit vegetables farmers in ECER is significant at the level of 0.179. Based on the table rule thumb, the interpretation of correlation for this relationship is negligible correlation. Which mean that they between have correlation or do not have correlation.

Perceived usefulness had consistently been a strong determinant of usage intention in previous studies (Venkatesh and Davis, 2000) and similar results were found in this study. In general, the results accepted objective 1 which predicted that perceives usefulness has relationship with postharvest technology acceptance among fruit vegetables farmers at handling and storage level by ECER.

4.3.2 Relationship between Perceived Ease of Use and Postharvest technology acceptance in handling and storage level by farmers in ECER.

Based the table 4.11, the result of correlation analysis for perceive ease of use is also significant at level of 0.060 and it is negligible correlation between perceive ease of use and postharvest technology acceptance among fruit vegetables farmers at handling and storage level by ECER. These results indicated that objective 2 has accepted which predicted perceive ease of use has relationship with postharvest technology acceptance among fruit vegetables farmers at handling and storage level by ECER.

Studies on TAM that led to the conclusion that perceived ease of use directly and indirectly influenced behavioural intention to use (Davis, 1989; Davis et al., 1992). As in this study, there is directly influence of perceived ease of use to the postharvest technology acceptance. But the relationship is only negligible correlation. This can be approve as the study by Hailu, Mammo and Ketemu (2016) stated that users may believe that technology is useful, they may be, but at the same time, perceive it to be to difficult to use, and that the benefits of usage do not justify the amount of effort need to use the technology. Thus, perceive ease of use not too much influencing the postharvest technology acceptance among the fruit vegetable farmers.

4.3.3 Relationship between Attitude and Postharvest technology acceptance in handling and storage level by farmers in ECER.

Lastly, based the table 4.11, the result of correlation analysis for attitude is also significant at level of 0.011 and it is negligible correlation between perceive attitude and postharvest technology acceptance among fruit vegetables farmers at handling and

storage level by ECER. These results indicated that objective 3 has accepted which predicted attitude has relationship with postharvest technology acceptance among fruit vegetables farmers at handling and storage level by ECER.

A positive attitude, positive subjective norm, and positive PBC, each leads to a higher intention to perform the behaviour (Fishbein and Ajzen, 1975). In the study by Adnan.N, Md Nordin.S and Rahman.I (2018) to observe adoption of Green Fertiliser Technology amongst Malaysian paddy farmers shows that positive attitude is the most important determinant for determining the farmers intention towards technology adoption. In this study, attitudes did shows as one of factors that lead to the postharvest technology among the farmers.

The conclusion from the correlation analysis of relationship between perceive usefulness, perceive ease of use and attitude towards postharvest technology acceptance among fruit vegetables farmers at handling and storage level by ECER is negligible correlation. The mean score of postharvest technology acceptance among fruit vegetables farmers at handling and storage level by ECER are moderate which 2.79. That show they are negligible correlate. This results may influenced by the area of farming. Many authors have studied farm size as one of important determinant of technology adoption. Farm size can affect and in turn be affected by the other factors influencing adoption (Lavison 2013). From this study, there is only 10.5% of farmers that actually using the postharvest technology and the farmers that have more than 10 acres are also the lowest with the 5.7% of the respondent. Farmers with large farm size are likely to adopt a new technology as they can afford to devote part of their land to try new technology unlike those with less farm size (Uaiene, Arndt & Masters, 2009). Sarcheshmeh, Bijani and Sadighi (2018) also agreed that there is positive and significant correlation with the behavior of adopting

nuclear technology in agricultural sector. This results shows that fruit vegetables farmers in ECER are accept the postharvest technology but they do not apply the technology.

CHAPTER 5

CONCLUSION

This chapter reviews the factors and determinants found in this study that influence the postharvest technology acceptance at handling and storage level among fruit vegetables farmers in ECER. The study was focusing the relationship of three factors which are perceived usefulness, perceived ease of use and attitude towards the postharvest technology acceptance at handling and storage level among fruit vegetables farmers in ECER. This chapter covers on the conclusion of the results of the research questions. Besides that, this chapter also discussed the recommendations of study.

5.1 Conclusion

In this study, there were three objectives which are 1; To identify the level of postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER 2; To identify the level of perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER 3; To analyse the relationship between specific between perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.

The questionnaires were distributed to 105 fruit vegetables farmers in ECER to determine postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER. In general, the findings shows that they were moderate in postharvest technology acceptance at the handling and storage level with the mean value of M= 2.79 however the fruit vegetables farmers in ECER agree with the perceived usefulness with mean value M=4.11, perceived ease of use with mean value M=3.84 and attitudes with the mean value M=3.89. As for the relationship of Perceived Usefulness, Perceived Ease of Use and Attitude towards the Postharvest Technology acceptance, all of the variables are significant at level of 0.179, 0.60 and 0.11 respectively.

Generally, the results indicate that the perceived usefulness, perceived ease of use and attitude were negligible which is the fruit vegetables farmers is accept technology but do not use and apply it. This results will help in investigating the technology acceptance among the fruit vegetables farmers in ECER. Based on the results of Spearman correlation, the fruit vegetables farmers accept the postharvest technology on the handling and storage level but they do not want to take risk with use of these technology.

5.2 Recommendations

As for the recommendations, based on this study, there is several recommendations for future research especially on agriculture technology acceptance. First and foremost, is to choose another multiple target groups from a population especially, the target group that may can increase their productivity by accepting the technology. By focusing on fruits farmers also important to observe their acceptance for technology in fruits production. The results may influenced by the demographic factors such as populations, strata and socioeconomics. Beside than, the researchers should have a good connection with the government agency like Federal Agricultural Marketing Authority (FAMA) or Agriculture Department to ease them in data search and approaching the target group. Third suggestion is to study another kinds of technology that to study the factors of technology acceptance. Lastly, in the future, the study can focus on postharvest technology in the others level such storage and processing as this level are also important to ensure the continuous of food security in Malaysia.

REFERENCES

Abad , M., Itxaso , D., & Markel, V. (2010). *Acceptance of Mobile Technology in Hedonic Scenarios.* Retrieved from http://ewic.bcs.org/upload/pdf/ewic_hci10_paper28.pdf.

Abd Shukor, A., M. Salleh, P., Pauziah, M., & A. Tarmizi , S. (2003). *Development of appropriate postharvest technologies for major vegetables crops of ASEAN; Perspectives of ASEAN cooperation in vegetable research and development* . Proceedings of the Forum on the ASEAN_AVRDC Regional Network on Vegetable Research and Development (AARNET).

Abdullah, F., & Samah, A. (2013). Factors impinging farmers' use of agriculture technology. *Asian Social Science*, 9(3), 120.

Adnan, N., Md Nordin, S., & Rahman, I. (2017). Adoption of green fertilizer technology among paddy farmers: A possible solution for Malaysian food security. *Land Use Policy, 63*, 38-52.

Alam, M., Morshed, G., Siwar, C., & Murad, M. (2012). Initiatives and Challenges of Agricultural Crop Sector in ECER Development Projects in Malaysia. *American-Eurasian Journal of Agricultural & Environmental Science. 12.* , 922-931.

Ali, S., M. Salleh, M., Abdullah, M., Mustafa, N., Latiff, Chang, P., & Suhana. (2014). ICT acceptance among Malaysian urbanites: A study of additional variables in user acceptance of the new media. *Malaysian Journal of Society and Space*, 86 - 96.

Aluisio , G., Maurizio, C., & Katia, L. (2017). A Technology Acceptance Model of common bean growers' intention to adopt Integrated Production in the Brazilian Central Region. *Journal of Land Management, Food and Environment Volume 68*, 131–143.

Atanda , S., Pessu, P., Agoda, S., Isong, I., & Ikotun, I. (2016). The concepts and problems of post-harvest food losses in perishable crops. In S. VD, *Post-harvest physiology and quality management of fruits and vegetables* (pp. 137 - 164). New York: Scitus Academics LLC.

Aziera , R., Norsida , M., Nolila , M., & Phoebe, D. (2013). Factors that influences the Implementation of Postharvest Handling Practices Among Fresh Vegetables Producers in Selected State in Malaysia. *Journal of International Food & Agribusiness Marketing*, 25:87-97.

Azjen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 179-211.

Bahaman , A., Jeffrey, L., Azril, H., & Jegak. (2010). Acceptance,Attitude and Knowledge towards Agriculture Economic Activity between rural and urban youth: The case of Contract farming. *Journal of Applied Sciences*, 10: 2310 - 2315.

Barman, K., Ahmad, M., & Siddiqui, M. (2015). Factors affecting the quality of fruits and vegetables: Recent Understanding. In M. Siddiqui, *Postharvest Biology ans Technology of horticultural crops* (pp. 1-50). USA: Apple Academic Press Inc.

Bautista, Ofelia , K., & Elda, B. (2012). Postharvest Research, Education and training in the Philiphines: The role of PHTRC from past to future. *Acta Horticulture*, 934:41- 45.

Berhanu, K., Mehretu, D., & Ephraim, A. (2017). Technology Acceptance Model (TAM) in Ethiopian Agriculture Education and Research. *Global Research Journal of Education*, 531-544.

Bonabana-Wabbi, J. (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Msc. Thesis Eastern Uganda.

Bourne, & Malcolm , C. (1977). Compression Rates In The Mouth. *Journal of Texture Studies*, 373-376.

Changule, R., Shelke, R., & Mane, B. (2011). Economic evaluation of post harvest losses in tomato in Latur district of Maharashtra State. *International Research Journal of Agricultural Economics and Statistics*, 2(1):38-41.

Davis, F. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information . *MIS Quarterly*, 319 - 339.

Dhraief, M., Bedhiaf-Romdhania, S., Dhehibib, B., Oueslati-Zlaouia, M., Jebali, O., & Ben Youssef, S. (2018). Factors Affecting the Adoption of Innovative Technologies by Livestock Farmers in Arid Area of Tunisia. *FARA Research Report.*, (Vol. 3, No. 5, p. 22).

DOA. (2017). *Vegetables and Cash Crops Statistic.* Malaysia.

Farhana. (2017). *MORTEX technology acceptance to imporve production of latex.* Kelantan: Universiti Malaysia Kelantan.

Fishbein , M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fishbein , M., & Ajzen, I. (1981). Attitudes and voting behavior: An application of the theory of reasoned action. *In G. M. Stephenson & J. M. Davis (Eds.), Progress in Applied Social Psychology* , (Vol. 1, pp. 253-313.

Fishbein, M., & Ajzen, 1. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. . *Reading, Mass; Don Mills, Ontario: Addison-Wesley Pub. Co.*

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. *11.0 update (4th ed.).* .

Gopalakrishnan.T.R. (2007). *Vegetable Crops.* Kerala Agricultural University: Sumit Pal Jain.

Hailu, M., Mammo, Y., & Ketema, M. (2016). Internet Acceptance and Use Model in Ethiopian Agriculture Education and Research: the case of two universities. *International Journal of Science and Technology Educational Research Vol. 7(4),* 35-48.

Heffer, T. (2016). The effects of social media use in undergraduate students. *Theses and Dissertations. 1440.*

Hoelter, J. (1983). The analysis of covariance structures: Goodness-of-fit indices. *Sociological Methods and Research, 11,* 325–344.

Jabir, A. (2012). Factors Influencing Adoption of Postharvest Practices in Vegetables. *International Journal of Vegetable Science,* 18: 29 - 40.

Kader, A., & Rolle, R. (2004). Criteria for the Selection of Appropriate Post-harvest Technologies: In the role of Post-harvest management in assuring the quality and safety of Horticultural Produc. *FAO Agricultural Services Bulletin,* 152, 43- 45.

Kim, Y., Chun, J., & Song, J. (2009). Investigating the role of attitude in technology acceptance from an attitude strength perspective. *International Journal of Information Management 29* , 67–77.

Kline, R. B. (2005). Methodology in the social sciences. Principles and practice of structural equation modeling (2nd ed.). *Guilford Press.*

Krejcie, R., & Morgan, D. (1970). Determining Sample Size for Research Activities. In Hill, R. (1998). "What Sample Size is 'Enough' in Internet Survey Research"? Interpersonal Computing and Technology: . *An electronic Journal for the 21st Century*.

Lai, P. (2017). The Literature Review Of Technology Adoption Models And Theories For The Novelty Technology . *Journal of Information Systems and Technology Management* , 21-38.

Lavison, R. (2013). Factors Influencing the Adoption of Organic Fertilizers in Vegetable Production in Accra,Msc Thesis, Accra Ghana.

Lee, S., & Kader, A. (2000). Preharvest and postharvest factors influencing vitamin C content of horticultural crops. *Postharvest Biology and Technology*, 207-220.

Loevinsohn , M., Sumberg , J., & Diagne , A. (2013). *Under What Circumstances and Conditions Does Adoption of Technology Result in Increased Agricultural Productivity?* University of London: EPPI Centre, Social Science Research Unit, Institute of Education.

Luarn,, P., & Lin, H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior*, 873-891.

Mahmud, T., & Mohamed , M. (2017). *Postharvest An Unsung Solution for Food Security*. Serdang: Universiti Putra Malaysia.

Malek, M., Gatzweiler, F., & Braun, J. (2017). Identifying technology innovations for marginalized smallholders-A conceptual approach. *Technology in Society Volume 49*, 48-56.

Mamdouh, Malek, Ayed, & Khaldoon. (2013). Factors Affecting University Student's Attitudes toward E-Commerce: Case of Mu'tah University. *International Journal of Marketing Studies*, 88-93.

Margaret , M., & Samuel , K. (2015). Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries . *Journal of Economics and Sustainable Development. Vol.6, No.5, 2015*.

Meuter , M., Bitner, M., Ostrom, A., & Brown, S. (2005). Choosing among alternative service delivery models: An investigation of customer trial of self service technologies. *Journal of Marketing, Vol. 69 (2)*, 61-83.

Ofelia, M. (1990). *Postharvest Technology for Southern Asian Perishable Crops*. Laguna : University of The Philippines Los Banos.

Priyanka Surendran. (2012). Technology Acceptance Model: A Survey of Literature. *International Journal of Business and Social Research (IJBSR)*, 175-178.

Radner, R., & Rothschild, M. (1975). On the Allocation tion of Effort. *Journal of Economic Theory (10)*, 358-376.

Redzuan, N. N., Ahmad Razali, N., Muslim, N., & Wan Hanafi, W. (2016). Studying Perceived Usefulness and Perceived Ease of Use of Electronic Human Resource Management (e-HRM) with Behavior Intention. *International Journal of Business Management (IJBM) Volume 1 Issue 2*.

Rohollah , R., Sepideh , M., & Ali , G. (2018). Factors affecting farmers' intention to engage in on-farm food safety practices in Iran: Extending the theory of planned behavior. *Journal of Rural Studies, 60*, 152-166.

Roscoe, J. T. (1975). Fundamental Research Statistics For The Behavioral Sciences. *Holt, Rinehart and Winston*.

Salehi, S., Rezaei-Moghaddam, K., & Hayati, H. (2010). Application of improved technology acceptance model to predict agricultural experts' environmental behavioral intention and attitude. *Iran. Agric. Ext. Educ. J.*, 15-29.

Sarcheshmeh, E., Bijani, M., & Sadigh, H. (2018). Adoption behavior towards the use of nuclear technology in agriculture: A causal analysis. *Technology in Society*, 175-182.

Sekaran, U. (2003). Research Methods for Business. *A Skill-Building Approach. 4th Edition, John Wiley & Sons, New York*.

Siti Nurfarhana Zainol Abidin. (2018). Mortex Technology Acceptance to Improve the Latex Production Among RISDA Rubber Smallholder in Kelantan. Universiti Malaysia Kelantan.

Spurgeon, D. (1967). *Hidden harvest: a systems approach to postharvest technology.* Ottawa: International Development Research Centre.

Sudheer, K., & Indira, V. (2007). *Post harvest Technology of Horticultural crops.* New Delhi: New India Publishing Agency.

Suzanna, P. (2016, June 12). Retrieved from New Straits Time: https://www.nst.com.my/news/2016/06/151334/curbing-food-wastage-source

Syuhaidi, A., & Rosmiza, B. (2014). Technology Acceptance and Purchase Intention towards Movie Mobile Advertising among Youth in Malaysia. *Procedia - Social and Behavioral Sciences*, 558-567.

Tarabay, P., Chahine-Tsouvalakis, H., Tohmé Tawk, S., Nemer, N., & Habib, W. (2018). Reduction of food losses in Lebanese apple through good harvesting and. *Annals of Agricultural Sciences*.

Truong, T. (2008). Factor affecting Technology Adoption among the Rice Farmers in Mekong Delta through the Lens of tha local Authorial Managers. *An Analysis of Qualitative Data , Omonrice*, 16,107-112.

Uaiene, R., Arndt, C., & Masters, W. (2009). Determinants of Agricultural Technology Adoption in Mozambique. Discussion papers No. 67E .

Venkatesh, V., & Davis , F. (2000). A theoretical extension of the Technology Acceptance Model. *Management Science, Vol. 46* , 186-204.

Wasala, C., Dissanayake, C., Dharmasena, D., Gunawardena, C., & Dissanayake, T. (2014). Postharvest losses, current issues and demand for postharvest technologies for loss management in the main banana supply chains in Sri Lanka. *Journal of Post-Harvest Technology*, 2(1), 80-87.

Welbaum, G. (2015). *Vegetable Production and Practices.* Retrieved from https://www.cabi.org/Uploads/CABI/OpenResources/45346/Welbaum%20Ch1.pdf

Wills, R., McGlasson, W., Graham , D., & Joyce , D. (2007). *Postharvest: an introduction to the physiology and handling of fruit, vegetables and ornamental.* Sydney: University of New South Wales Press.

Wilson, L., Boyette, M., & Estet, E. (1995). Postharvest handling and cooling of fresh fruits, vegetables and flowers for small farms. 800-804.

Yang , H., & Yoo, Y. (2004). "It's all about attitude: revisiting the technology acceptance model. *Decision Support Systems (38:1)*, 19-31.

Yong, J., Jae, U., & Jaeki, S. (2009). Investigating The Role Of Attitude In Technology Acceptance From An Attitude Strength Perspective. *International Journal of Information Management*, 67-77.

Zhou, H., Romero, S., & Qin, X. (2016). An extension of the theory of planned behavior to predict pedestrians' violating crossing behavior using structural equation modeling. *Accident Analysis & Prevention Volume 95*, 417-424.

APPENDICES

POSTHARVEST TECHNOLOGY ACCEPTANCE AT THE PROCESSING AND STORAGE LEVEL ON FRUIT VEGETABLES FARMERS IN ECER.

PENERIMAAN TEKNOLOGI LEPAS TUAI DALAM TAHAP PEMPROSESAN DAN PENYIMPANAN OLEH PETANI SAYURAN BUAH DI ECER

Penyelidik:

1. **MAIZATUL VANISHA BINTI MASRIL**
2. **PUAN TENGKU HALIMATUN SA'ADIAH BINTI T. ABU BAKAR (SUPERVISOR)**

The objectives of the study are:

1. To identify the level of postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.
2. To identify the level of perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.
3. To analyse the relationship between specific between perceived usefulness, perceived ease of use and attitude towards postharvest technology acceptance at the handling and storage level among fruit vegetables farmers in ECER.

SECTION A/ SEKSYEN A: DEMOGRAPHIC RESPONDENT/ DEMOGRAFI RESPONDENT

Please answer all questions and (√) the appropriate answer.

Sila jawab semua soalan dan (√) pada jawapan yang sesuai.

1.	**Gender** / *Jantina*	( ) i. **Male** / *Lelaki* ( ) ii. **Female** / *Perempuan*
2	**Race** / *Bangsa*	( ) i. **Malay** / *Melayu* ( ) ii. **Chinese** / *Cina* ( ) iii. **Indian** / *India* ( ) iv. **Others** / *Lain-lain*
3.	**Age** / *Umur*	_____
4.	**Marital Status** / *Taraf Perkahwinan*	( ) i. **Single** / *Bujang* ( ) ii. **Married** / *Berkahwin* ( ) iii. **Others** / *Lain-lain*
5.	**Selling Method** / *Kaedah penjualan*	( ) i.**Middlemen** / *Orang tengah* ii. **Direct selling** / *Jualan* ( ) *langsung*
6.	**Education Level** / *Tahap Pendidikan*	( ) i. **UPSR** ( ) ii. **PMR/SRP** ( ) iii. **SPM** ( ) iv. **Sijil** / *Certification* ( ) v. **Diploma** / *Diploma* ( ) vi. **Ijazah** / *Degree*
7.	**Total Income Per Month**/ *Jumlah Pendapatan Sebulan*	RM _____
8.	**Area of planting**/ *Luas penanaman.*	_____ **Hectare** /*Hektar*
9.	**Types of fruit vegetables planted**/ *Jenis tanaman*	_____

For the question on **PART B,C,D and E** please read each item and **give your answer by circling the answer option that is appropriate** to the scale of 1 (strongly disagree) to 5 scale (strongly agree).

*Untuk soalan-soalan pada **BAHAGIAN B,C,D, and E** sila baca setiap item dan **beri jawapan anda dengan membulatkan pada pilihan jawapan yang bersesuaian** dengan mengikut skala 1 (sangat tidak bersetuju) hungga skala 5 (sangat setuju).*

Strongly disagree / Sangat tidak setuju	Disagree / Tidak setuju	Either disagree or agree Agree or Disagree / Tidak Setuju atau Setuju	Agree / Setuju	Strongly agree / Sangat setuju
1	2	3	4	5

PART B / *BAHAGIAN B* : **Perceived Usefulness** / *Tanggapan Kegunaan*

1.	**I perceived by using the processing and storage technology would increase the efficiency of my daily work.** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan meningkatkan kecekapan kerja harian saya*	1	2	3	4	5
2.	**I perceived by using the processing and storage technology allow me to better manage my time.** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan membolehkan saya menguruskan masa dengan baik.*	1	2	3	4	5
3.	**I perceived by using the processing and storage technology would be useful for me as farmers** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan berguna untuk saya sebagai petani.*	1	2	3	4	5
4.	**I perceived by using the processing and storage technology would increase the quality of fruit vegetables.** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan meningkatkan kualiti sayuran buah.*	1	2	3	4	5
5.	**I perceived by using the processing and storage technology would increase the shelf-life of fruit vegetables.** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan meningkatkan jangka hayat sayuran buah.*	1	2	3	4	5
6.	**I perceived by using the processing and storage technology can increase my income.**	1	2	3	4	5

	Saya beranggapan teknologi pemprosesan dan penyimpanan akan meningkatkan pendapatan saya.					
7.	**I perceived by using the processing and storage technology would decrease the postharvest losses.** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan mengurangkan kerugian lepas tuai*	1	2	3	4	5
8.	**I perceived by using the processing and storage technology can reduce the labour cost and no of employees** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan mengurangkan kos pekerja dan jumlah pekerja.*	1	2	3	4	5

PART C / *BAHAGIAN C :* **Perceived Ease Of Use /** *Tanggapan Kemudahan Penggunaan*

1.	**I perceived by using the processing and storage technology ease me to increase the production of fruit vegetables** *Saya beranggapan teknologi pemprosesan dan penyimpanan akan memudahkan saya meningkatkan penghasilan sayuran buah*	1	2	3	4	5
2.	**I perceived by using the processing and storage technology ease to use and user-friendly.** *Saya beranggapan teknologi pemprosesan dan penyimpanan senang digunakan dan mesra pengguna.*	1	2	3	4	5
3.	**I perceived by using the processing and storage technology easy to understand** *Saya beranggapan arahan teknologi pemprosesan dan penyimpanan mudah difahami.*	1	2	3	4	5
4.	**I perceived by using the processing and storage technology easy to control** *Saya beranggapan teknologi pemprosesan dan penyimpanan mudah dikendalikan.*	1	2	3	4	5
5.	**I perceived by using the processing and storage technology is easy in skillful** *Saya beranggapan mudah untuk mahir dalam menggunakan teknologi pemprosesan dan penyimpanan*	1	2	3	4	5
6.	**I perceived that I will use the processing and storage technology more often in future.** *Saya percaya saya akan menggunakan teknologi pemprosesan dan penyimpanan lebih kerap pada masa hadapan.*	1	2	3	4	5

PART D / *BAHAGIAN D :* **Attitude** */ Sikap*

1.	**I feels up-to-date if I used any processing and storage technology** *Saya rasa tidak ketinggalan jika menggunakan mana-* *mana teknologi pemprosesan dan penyimpanan sayuran buah*	1	2	3	4	5
2.	**I'm more confident when using the processing and storage technology in producing my fruit vegetable** *Saya rasa lebih yakin jika menggunakan teknologi* *pemprosesan dan penyimpanan dalam penghasilan* *sayuran buah*	1	2	3	4	5
3.	**I feels more comfortable to use the processing and storage technology compare to the traditional postharvest handling.** *Saya rasa lebih selesa menggunakan teknologi pemprosesan dan penyimpanan berbanding pengendalian lepas tuai tradisional.*	1	2	3	4	5
4.	**I will encourage the community around here to** **use the processing and storage technology** *Saya akan menggalakkan komuniti sekitar untuk menggunakan teknologi pemprosesan dan penyimpanan .*	1	2	3	4	5
5.	**I'm confident that processing and storage technology can increase the fruit vegetables's quality** *Saya yakin teknologi pemprosesan dan penyimpanan* *boleh meningkatkan kualiti sayuran buah.*	1	2	3	4	5
6.	**I'm confident that processing and storage technology can increase the fruit vegetables's shelf-life** *Saya yakin teknologi pemprosesan dan penyimpanan* *boleh meningkatkan jangka hayat sayuran buah.*	1	2	3	4	5

PART E / BAHAGIAN *E* : Acceptance

1.	**I do not know much about processing and storage technology** *Saya tidak begitu tahu mengenai teknologi pemprosesan dan penyimpanan.*	1	2	3	4	5
2	**I perceived the processing and storage technology very complicated.** *Saya beranggapan teknologi pemprosesan dan penyimpanan adalah sangat merumitkan.*	1	2	3	4	5
3	**I did not have time to know the latest processing and storage technology** *Saya tidak mempunyai masa untuk mengambil tahu teknologi pemprosesan dan penyimpanan.*	1	2	3	4	5
4	**I perceived the processing and storage technology is not priority in improving my fruit vegetables's quality** *Saya beranggapan teknologi pemprosesan dan penyimpanan bukanlah keutamaan dalam meningkatkan kualiti sayuran buah*	1	2	3	4	5
5	**I think there is no interest in using processing and storage technology** *Saya tidak berminat untuk menggunakan teknologi pemprosesan dan penyimpanan bagi hasil tanaman saya.*	1	2	3	4	5
6	**I perceived the cost to use processing and storage technology is too high.** *Saya beranggapan kos untuk menggunakan teknologi pemprosesan dan penyimpanan terlalu tinggi.*	1	2	3	4	5
7	**I am not exposed to the importance of processing and storage technology .** *Saya tidak didedahkan dengan kepentingan teknologi pemprosesan dan penyimpanan. Sayuran buah.*	1	2	3	4	5
7	**Financial factor is the reason I didn't use the processing and storage technology .** *Faktor kewangan menyebabkan saya menggunakan teknologi pemprosesan dan penyimpanan.*	1	2	3	4	5

APPENDICES

Figure A: The respondent from Cameron Highland that involved in answering the questionnaire

Figure B: The respondent from Terengganu that involved in answering the questionnaire

Figure C: The respondent from Kelantan that involved in answering the questionnaire