Factors Explaining Post Harvest Practices Adoption among Fruit Farmers in Johor

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Abstract. Nowadays, postharvest practices play an important role in the development of fruit production. Thus, this research investigates the relationship between effort expectations, performance expectations, social influence, facilitating conditions, and attitudes towards postharvest practices adoption among fruit farmers in Johor. The Unified Theory of Acceptance and Use of Technology (UTAUT) and Theory of Planned Behaviour (TPB) were utilized to explain the purpose of this study. This study has employed a cross-sectional study with a survey method via self-administered questionnaire. A total of 150 fruit farmers in Johor were chosen by a simple random sampling technique. The data collected were analysed by using descriptive analysis and Spearman's correlation. The analysis indicated that there was a positive significant relationship between performance expectations, effort expectancy, social influence, facilitating conditions, and attitude towards postharvest practices adoption among fruit farmers in Johor. This study will be significant for farmers in order to help them increase the yield by reducing the postharvest losses and for other researchers to understand the level of postharvest technology acceptance.

1. Introduction

The agriculture sector has contributed 8.2 % or RM96 billion to the National Gross Domestic Product (GDP) [1]. Malaysia fruits industry is one of the important sources that contributed to the agriculture development due to its high market potential. Malaysia has varieties of main fruits production such as star fruit, papaya, jackfruit, durian, sweet lime, mango, mangosteen, pineapple, watermelon, banana, rambutan, salak and dragon fruits. In 2018, Malaysia per capita consumption of fruits was at 62.18 kg and the self-sufficiency ratio of fruits was 80.24%, respectively. Although, Malaysia has produced 1.6 million metric tons of fruits, the country still needs to import 585 million metric tons in 2018 [2]. It shows that fruit production in Malaysia are still insufficient, even to the local demand. Thus, under National Agro Food Policy, Malaysia is eager to emphasize on expanding food production to ensure food supplies are sufficient, with better quality.

Post-harvest losses have been considered as a global issue and reducing the post-harvest losses has been an important aspect of food production, along with poverty alleviation, and improvements to

nutrition [3]. Postharvest losses are a measurable qualitative and quantitative food loss in line with the supply chain, which starts from the time of harvest until the time of consumption or other end-use[4]. It can occur because of food waste or inadvertent losses along the way. The quantitative food loss has occurred because of the reduction in weight due to some factors for example spillage, consumption by pest and physical changes in moisture content, temperature, and chemical deviations [5]. The fruit losses in Malaysia has increased to 353,165 metric ton in 2013 from 324,520 metric ton in 2011 [6]. Moreover, around 20 to 60% of post-harvest losses of fruits and vegetables have been recorded in Malaysia especially at farm, wholesalers and at the retailer's stages. Contribution of postharvest losses depends on many factors such as inappropriate postharvest handling practices, lack of knowledge and skill [7] and improper treatment methods during harvesting, marketing, transporting and storage [8]. However, postharvest practices and technology can be used to reduce fruit loss after harvesting and before the consumption [9] together with appropriate postharvest handling practices and treatment methods that can maintain or prolong the shelf life of harvested fruits [10].

Previous studies only focused on the factors that can increase profit and reduce postharvest losses but literatures on factor that influence the implementation of postharvest technology and handling practices are still lacking [11]. There have been several theoretical models employed to explain technology acceptance and use. Previously, many researchers used the Unified Theory of Acceptance and Use of Technology (UTAUT) [12] and Theory Planned Behaviour TPB [13] to explain the technology acceptance. However, it is only focusing generally on agricultural. Even though UTAUT is the most capable theory of predicting technology acceptance [14], however there are some arguments from previous study highlighting the weakness of UTAUT which is the elimination of external variables, which may affect technology adoption [15]. Other research gap is similar with the few studies using complete UTAUT model [16]. Supported by Venkatesh et al. [12], previous studies have generally not applied to the complete UTAUT model. Therefore, this study aims to evaluate the relationship between effort expectations, performance expectations, social influence, facilitating conditions, and attitudes towards postharvest practices adoption among fruit farmers in Johor. This study will help to promote a better post-harvest technology and practices adoption and to plan a strategic direction for fruit industry in Malaysia and to reduce the fruit post-harvest losses that has been drafted in the MalaysiaNational Agro Food Policy.

2. Literature Review

2.1 Post-harvest Practices

The concept of post-harvest can be described as activities after harvesting, which include sorting, grading, washing, curing, waxing, pre-cooling, packaging, transportation as well as marketing. Post-harvest practices and technologies are important to maintain and prolong the shelf life of harvested fruits [10] and reduce postharvest losses [3]. Inadequate postharvest handling and non-adoption of postharvest technologies can cause 50-70% losses during the post-harvest handling [17]. A few empirical study also has proven that post-harvest losses can also occur due to inappropriate postharvest handling practices, lack of knowledge [7] and inappropriate treatment methods during harvesting, marketing, transporting and storage [8]. Thus, adoption of post-harvest practices are important to maintain and prolong the shelf life of harvested fruits. Nevertheless, practices and technologies adoption in agriculture, especially among farmers, are still low [18].

2.2 Post-harvest Practices Adoption

Technology or practices adoption is the integration of new technology into an existing practice and is usually proceeded by a period of 'trying' and some degree of adaptation [19]. Thus, technology and practices adopted by farmers are important in order to reduce postharvest losses. Adoption refers to the level of use of a given technology in any time period [20]. Theories like Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) have been widely used to examine technology adoption behaviour [21, 22, 23] with a different set of variables and a distinct

explanation of practices or technology adoption behaviour. One of the factors that are explaining adoption under UTAUT is performance expectancy that refers to the degree of using methods or technology which will provide benefits to users in performing certain activities [24]. Because the farmers have only gained the knowledge and information to increase revenue or have a pleasant feeling with the system, they will be willing to use it repeatedly. As agreed by Nejadrezaei et al. [25], there is a positive sign of performance expectancy to users' behaviour. In contrast, the study by Kahenya et al. [26] indicated that improved efficiency has a low positive correlation with the use of information communication.

Effort expectancy is the degree of ease associated with the individual use of postharvest practices [24]. Effort expectancy in information technology for farmers will have a positive impact on behavioural intention, especially when their education is generally low [27]. Kahenya et al. [26] were consistent with results that, effort expectancy have a high positive correlation with the use of information communication. Nejadrezaei et al. [25] also agreed that effort expectancy was significant with users' behaviour.

Social influence refers to an individual's belief that they must use a particular technology [24]. Taufiq [11] has found that the main reasons most farmers in Malaysia have rejected post-harvest practice because of the lack of government incentives. Thus, social influence is essential to influence behavioural intention and decision to use post-harvest technologies. Besides, most farmers also refuse to implement the appropriate postharvest practices due to the lack of financial incentives from the government [28] even though they knew the importance of that technology. Termezai et al. [29] have agreed that fish cracker's entrepreneur refused to use fish cracker processing technology due to lack of financial support.

Facilitating conditions refers to the level of individual believe in how technical infrastructure exists can support them to use the system at any time necessary [24]. Attitude and infrastructure were found as the main factors that contributed to post-harvest losses of fruits and vegetables [30]. Facilitating conditions in technology will have a positive impact on the user behaviour. The study indicated that facilitating condition had a significant effect on faculty member's use of the internet [31]. Wu [32] also reviewed that unfavourable facilitating conditions have an impact on user's behaviour. A research finding by Kahenya et al. [26], also point towards facilitating conditions which have been found to have a high positive correlation with information communication use among Agricultural Extension.

Attitude is referred to as positive or negative performance evaluation of the individual in a particular behaviour [33]. Attitude has a significant positive relationship between intention to engage in on-farm food safety practices in Iran [34]. The previous study also agreed that there was a positive and significant correlation between attitude towards organic farming practices [35, 36].

3. Methodology

3.1 Research design and sample

A quantitative research design was used for this study in order to gather information from the respondents. This study was conducted in Johor, Malaysia, which is the state that has a higher number of fruit farmers in Malaysia [2]. In order to assess the reliability of the study, a pilot test was implemented among 30 fruit farmers in Johor. Moreover, 150 fruit farmers were selected as the respondents for this study using simple random sampling. List name of fruit farmers was provided by the Department of Agriculture Johor and Malaysia Pineapple Board as the sample framework. Structured interview and administrative questionnaire technique were employed as data collecting technique based on the objective of the study. The instruments used were comprised of seven sections, namely as demographic profile, post-harvest practices adoption, effort expectations, performance expectations, social influence and facilitating conditions and attitude. All items were measured using Likert Scale ranging from 1 to 5 which represents strongly disagree to strongly agree.

3.2Research framework and data analysis

In gaining better understanding of post-harvest practices adoption, the research framework (Figure 1) was constructed based on UTAUT [12] and TBP [13]. Both theories were adapted to identify the relationship between factors performance expectations, effort expectations, facilitating conditions and attitude with post-harvest practices adoption among fruit farmers in Johor. The data collected was analysed by using descriptive analysis and correlation analysis using SPSS Software Version 21.0.

The descriptive analysis was used to summarize the socio-demographic information into a simpler summary to make it easier to understand and measure. The Spearman's correlation analysis was used to evaluate the relationship between five key independent variable which are performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude towards postharvest practices adoption among fruit farmers in Johor.

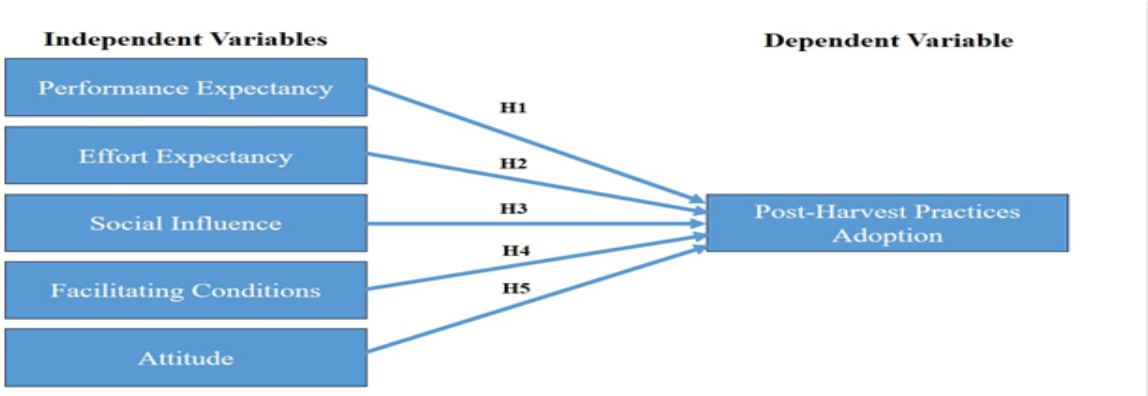

Figure 1. The research framework (Adapted from Venkatesh et al. [12] & Ajzen, [13])

4. Result and Discussion

4.1 Demographic Profile

Table 1 indicates the demographic profile of respondents which consists of gender, race, religion, age, marital status, size farming, education level and experiences in fruit farming. Majority of respondents were male with 83.3% and female with 16.7%. Besides that, most respondents are Malay and Islam with 71.3% and the others are Chinese, and their religion is Buddhism, with 28.7%. Majority of respondents in this study are aged 41 to 50 years old with 24%, followed by 31 to 40 years old with 21.3%, 51 to 60 years old with 20.7%, 61 to 70 years old with 18.7%, above than 71 years old with 8% and 21 to 30 years old with 7.3%. From the result, it can be described that most respondents are married with 95.3% and the others are single with 4.7%. Besides, majority of respondents have 6 to 10 acres farm with 48.7%, followed by below than 5 acres with 33.3%, more than 21 acres with 6.7%, and 11 to 15 acres with 6% and 16 to 20 acres with 5.3%. For education level, about 46.7% of respondents have obtained SPM, 20.7% of respondents never been to school, 12.7% of respondents have UPSR, 8% of respondents have a certificate, 6% of respondents have Diploma, 3.3% of respondents have a degree, and 2.7% of respondents have PMR. In the aspect of experiences in the fruit industry, about 38% of respondents have had 6 to 10 years, 22% of respondents have had below than 5 years, 16% of respondents have had 11 to 15 years, 14.7% of respondents have had more than 21 years and 9.3% of respondents have had 16 to 20 years. Based on the result, it can be concluded that majority of respondents participating in this study are male, Malay, Islam, age from 41 to 50 years old, married, have 6 to 10 acres size of farming are, have only SPM for education level and have had 6 to 10 years of experience in fruit industry.

Table 1. Demographic Profile of Respondents

Variables	Frequency	Percentages (%)
Gender		
Male	125	83.3
Female	25	16.7
Race		
Malay	107	71.3
Chinese	43	28.7
Religion		
Islam	107	71.3
Buddhism	43	28.7
Age		
21-30 years old	11	7.3
31-40 years old	32	21.3
41-50 years old	36	24.0
51-60 years old	31	20.7
61-70 years old	28	18.7
>71 years old	12	8.0
Marital Status		
Single	7	4.7
Married	143	95.3
Size Farming		
<5 acre	50	33.3
6-10 acre	73	48.7
11-15 acre	9	6.0
16-20 acre	8	5.3
>21 acre	10	6.7
Education Level		
Not school	31	20.7
UPSR	19	12.7
PMR	4	2.7
SPM	70	46.7
Certificate	12	8.0
Diploma	9	6.0
Degree	5	3.3
Experiences in Fruit Industry		
<5 years	33	22.0
6-10 years	57	38.0
11-15 years	24	16.0
16-20 years	14	9.3
>21 years	22	14.7

4.2 The Spearman's Correlation

The relationship between performance expectations, effort expectations, social influence, facilitating conditions, and attitude and postharvest practices adoption among fruit farmers in Johor were evaluated using Spearman's correlation after the result of normality test has shown the non-normal distribution with value below than 0.5 by using One-Sample Kolmogorov-Smirnov test. The Spearman's correlation was applied to measures the strength and direction of the association between two variables. Other than that, the rule of thumb for interpreting the size of a correlation coefficient [37] was used to estimates the strength of the relationship between the relative movements of two variables. Table 2 shows the effort

expectations, performance expectations, social influence, facilitating conditions, and attitude, which have a significant positive relationship with post-harvest practices adoption among fruit farmers in Johor.

The result of the correlation coefficient between performance expectations and post-harvest practices adoption shows low positive correlation at 0.3.11 value. Consistent with Kahenya et al. [26] shows that improved efficiency has a low positive correlation with the use of information communication. However, it is in contrast with the previous finding that there was positively significant with performance expectancy and users' behaviour [27, 25]. Performance expectation is an indicator of post-harvest adoption because to adopt post-harvest practices, fruit farmers need **to** gain the knowledge and information with an an enjoyable feeling with the system. Moreover, the relationship between effort expectations and post-harvest practices adoption also shows a low positive correlation at 0.390 value. Chiemeke and Evwiekpaefe [27] also reviewed that effort expectancy in information technology for farmers have a positive impact on behavioural intention, especially when their education is generally low. Agreed by Kahenya et al. [26], effort expectancy has a high positive correlation with the use of information communication. Social influence can be the most significant predictor of post-harvest adoption. Nevertheless, social influence and post-harvest practices adoption only show little if any correlation with 0.214 value, which is in contrast with Kahenya et al. [26], who mentioned that social influence is found to have a high positive correlation with the use of information communication technologies. Result of relationship facilitating conditions with post-harvest practices adoption also shows little if any correlation with 0.288 value. A research finding by Abdollahzadeh et al. [38] has found there was a positive correlation facilitating conditions with biological control practices. Supported by the previous study, unfavourable facilitating conditions have affected users' behaviour [32]. This study also found that attitude and post-harvest practices adoption has indicated little if any correlation with 0.224 value. Prajapati and Sharma [39] stated that organic farming has positively correlated with attitude. Supported by Adnan et al. [40] also agreed that attitude has a positive association with farmer intention towards technology adoption.

Table 2. Result of the relationship between performance expectations, effort expectations, social influence, facilitating conditions, and attitude and postharvest practices adoption among fruit farmers in Johor

			Post-harvest Practices Adoption	Performance Expectancy	Effort Expectancy	Social Influence	Facilitating Conditions	Attitude
Spearman's rho	Post-harvest Practices Adoption	Correlation Coefficient	1.000	.311**	.390**	.214**	.288**	.224**
		Sig. (2-tailed)	.	.000	.000	.009	.000	.006
		N	150	150	150	150	150	150
	Performance Expectancy	Correlation Coefficient	.311**	1.000	.310**	.112	.203*	.357**
		Sig. (2-tailed)	.000	.	.000	.173	.013	.000
		N	150	150	150	150	150	150
	Effort Expectancy	Correlation Coefficient	.390**	.310**	1.000	.427**	.364**	.319**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000
		N	150	150	150	150	150	150
	Social Influence	Correlation Coefficient	.214**	.112	.427**	1.000	.545**	.343**
		Sig. (2-tailed)	.009	.173	.000	.	.000	.000
		N	150	150	150	150	150	150

	Facilitating Conditions	Correlation Coefficient	.288**	.203*	.364**	.545**	1.000	.359**
		Sig. (2-tailed)	.000	.013	.000	.000	.	.000
		N	150	150	150	150	150	150
	Attitude	Correlation Coefficient	.224**	.357**	.319**	.343**	.359**	1.000
		Sig. (2-tailed)	.006	.000	.000	.000	.000	.
		N	150	150	150	150	150	150

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed)

5. Conclusion

The main purpose of this study is to discover the relationship between the independent variables which are performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude towards post-harvest practices adoption among fruit farmers in Johor. A survey was done in Johor for 150 respondents by distributing the questionnaires using a simple random sampling technique. Correlation analysis was executed to find out the results of the study. Although this study has achieved its main objectives, the study still has several limitations. This study only focuses on respondents who are involved in post-harvest practices on fruit. Thus, the sample groups will not be a representative of all types of fruits crop. Hence, the results and outcome cannot be generalized into any other types of fruit, such as seasonal or non-seasonal fruit.

This study only focuses on the combination of variables from UTAUT and TPB to examine the post-harvest practices adoption. However, there are many adoption theories which can be discussed for upcoming research in future in order to achieve the sustainability and green growth of agriculture. Besides, the results also may have been influenced by demographic factors such as populations, strata and socioeconomics. Other than that, the researchers should have a good connection with the government agency like Federal Agricultural Marketing Authority (FAMA) or Department of Agriculture (DOA) to ease them in data search and approaching the target group.

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