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### EXAMINING FACTORS THAT INFLUENCE HARUMANIS FARMERS' INTENTION TO USE SAFE PESTICIDES

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#### ABSTRACT

Harumanis demands delicate handling and farmers must know how to use safe pesticides. Therefore, the aim of this study is to examine factors influencing the use of safe pesticide among Harumanis farmers in Mata Ayer, Perlis. The Theory of Planned Behavior (TPB) was used to underpin this study. This study suggests that attitude, subjective norm, perceived behavioral control, knowledge and moral norm as the variables that influence the use of safe pesticides. Data were collected from 97 registered Harumanis farmers under Department of Agriculture (DOA) Malaysia through questionnaires. SmartPLS was used to test the hypotheses in this study. The results showed that attitude, moral norm and knowledge had positive effects on the intention to use safe pesticides. Moreover, subjective norm and perceived behavioral control exhibited insignificant effect on the dependent variable. The results provide helpful information to the stakeholders in the Harumanis industry, from which they could develop and improve appropriate strategies and provide essential assistance to the Harumanis farmers.

**Keywords:** Theory of Planned Behavior, Knowledge, Moral Norm, Harumanis Farmers, Perlis.

## INTRODUCTION

Harumanis has been widely acknowledged as an iconic fruit not only for the locals, but global as well. The uniqueness and prestige value of Harumanis allow it to be marketed to Japan where there is a stringent quality control by a specific authority involved in the quality inspection for export purpose (Department of Agriculture Malaysia, 2021c). Additionally, the delicate handling also increases the price of Harumanis due to increasing cost in the overall production of Harumanis (Badriasih et al., 2019; Faridah et al., 2010; Muhammad Hassan et al., 2019; Nurul Huda et al., 2009). Surprisingly, Perlis is the only location named for the export of Harumanis to the Japanese market. This is because Perlis has the right agro-ecology that delivers the premium quality of the fruit as compared to any other region in Malaysia (Department of Agriculture Malaysia, 2021c).

To meet the said quality, commercial farmers must closely follow the regulation underlined by the Department of Agriculture (DOA) during the production process to ensure that their produce is of high qualities (Department of Agriculture Malaysia, 2021c). Since DOA is the authorized body responsible for the penetration of Harumanis into the international market, Malaysian Good Agricultural Practice (MyGAP) has been introduced to ensure that each commercial farmer meets all requirements stated for the safety production of food (Department of Agriculture Malaysia, 2021c). Harumanis farmers in Perlis who plan to participate in internal commercialization must therefore, register with the DOA and follow all the procedures mentioned in the MyGAP scheme (Faridah et al., 2010; Muhammad Hassan et al., 2019).

Since March 2020, Malaysia has been facing the challenges of Covid 19 pandemic. This situation has affected the pre-harvest and post-harvest activities due to the limited movement order enforced by the government (Zhe, 2020). However, Malaysian government is committed in helping the agriculture sectors, particularly vegetables and fruits through the use of proper pesticides to ensure that the harvested crops are healthy (Malay Mail, 2020). For Harumanis farmers, the safety of pesticide is becoming more important as they need to conform with international market regulation (Musa et al., 2010). Thus, this study was conducted to examine the intention to use pesticides among commercial Harumanis farmers during the pandemic of Covid 19.

The Theory of Planned Behaviour (TPB) and intention have been analyzed in a variety of studies to clarify behaviors in a variety of settings, including the classroom (Opoku et al., 2020), banking (Kashif et al., 2017), green purchasing intention (Liu et al., 2020), online shopping (Yahya et al., 2020), purchase behaviour (Mushi, 2019) and the food sector (Kashif et al., 2017). (Thaivalappil et al., 2019). Aside from that, in other countries, several studies (Rezaei et al., 2019; Savari & Gharechae, 2020) used TPB in the agriculture field to support their findings especially in terms of the intention to use pesticides. However, in Malaysia, there is minimal and insufficient study on the assessment of TPB in agriculture setting especially on the intention to use pesticides among farmers. Thus, the gap will be filled by this study where the stated theory is applied in agriculture setting especially in Harumanis. For this study, five variables were tested along with three main TPB variables (attitude, subjective norms, perceived behavioral controls), namely knowledge and moral norm. The additional variables, moral norm and knowledge added in the context of Harumanis farmers as the extension of TPB were expected to increase the variance in explaining the intention to use pesticides among Harumanis farmers in Mata Ayer Perlis. This study had been conducted during the movement control order due to the Covid19 pandemic. Data were analyzed using SmartPLS.

## LITERATURE REVIEW

### Harumanis in Perlis

Harumanis is classified as an iconic local fruit due to its uniqueness, such as its fragrant, thick orange-yellowish flesh, fine texture and fiber, and of sweet taste (Bernama, 2017). However, mango experts claim that Harumanis can only be planted at several locations in Malaysia namely Arau (Perlis), MARDI Sintok (Kedah) and Kota Tinggi (Johor) (Muhammad Hassan et al., 2019). This is because Harumanis requires certain climate (a very hot and dry weather during the day; and a cold, windy condition at night) continuously for several months for the plant to produce healthy flowers (Bakhtiar, 2012; Bernama, 2017). Up to 2021, the area of Harumanis farms covers 1,575.00 hectares; and 1,334.62 hectares are actively producing Harumanis for commercial purposes. Approximately 3,336.00 metric tons of Harumanis are produced with a value of RM 66,720,000.00 per season (Department of Agriculture Malaysia, 2021b). Previous scholars also found that Perlis is the location that can produce the highest grade A fruit as compared to the other two locations (Muhammad Hassan et al., 2019). Hence, it is not surprising that the government had decided to register a trademark for the Harumanis from Perlis as 'Perlis Harumanis Mango' to differentiate this product from the production of other states (Bernama, 2021). Due to the quality and the uniqueness of this fruit, it does not only attract demand from Malaysia but also from other countries such as Japan (Faridah et al., 2010; Muhammad Hassan et al., 2019).

However, in order to export this fruit to the international market, Malaysia must ensure that it conforms with the quality guideline for fruits to be exported (Faridah et al., 2010). The fruit has to particularly conform with the strict regulations of plant health product or Phytosanitary Regulations (Department of Agriculture Malaysia, 2021c). Through the negotiation with the Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan, the Department of Agriculture Malaysia (DOA) has received a recognition to manage the regulations to ensure that the horticulture products including Harumanis variety fulfilled the requirements of Phytosanitary Regulations. Several criteria have been outlined to ensure the products conform with the regulation. One of the criteria clearly stated that, as at January 2021, only mangos from registered farms in Perlis were allowed to be exported to Japan. This report confirms that the DOA of the Perlis state must ensure that the monitoring of farmers is done. This is to guarantee that the procedure of producing Harumanis conforms with the Phytosanitary Regulations for international market. Table 1 highlights the requirements of Phytosanitary Regulations for the Harumanis variety.

It is undeniable that Perlis is becoming a very important location for Harumanis production, not only for local consumption but also for the international market. Similar to other fruits. Harumanis is also exposed to pest problem. Fruit flies are among the most common identified pests that attack mangoes (Badriasih et al., 2019; Nurul Huda et al., 2009). Fruit flies affect the quantity of the crop production, as well as the quality of the fruit itself (Badriasih et al., 2019). Besides that, pest species such as snout weevil (*Alcidodes sp.*) had also been found to affect the young stems and flower panicles of Harumanis; thus affecting the income of the farmers, especially the commercial farmers (Nurul Huda et al., 2009). In order to solve these issues, the use of pesticides to control pest is therefore unavoidable.

Since Harumanis farmers in Perlis are monitored by the DOA, the farmers must ensure that they received Malaysia Good Agriculture Practice (MyGAP) certificate. MyGAP is a comprehensive

certificate scheme for farming, aquaculture and livestock activities (Department of Agriculture Malaysia, 2021c). For the farming sector, MyGAP scheme is enforced under the Malaysian Standard (MS) MS 1784:2005 Crop Commodities – Good Agricultural Practice. One of the important elements stated in MS 1784:2005 is the procedure to use pesticides. In this practice, the farmers need to ensure that fruits exposed to pesticides must be given enough time after harvesting to ensure that they are safe to be eaten (Department of Agriculture Malaysia, 2021c).

**Table 1:** Phytosanitary Regulations Export to Japan for Harumanis Variety from Malaysia

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1. Phytosanitary Certificate from DOA Malaysia which has been endorsed by Inspection Officer from the Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan;
  2. Fruits must be sourced from farms registered with DOA Malaysia;
  3. As of 1st January 2021, only farms in Perlis are allowed to export Harumanis mango to Japan;
  4. The fruit is treated using VHT at core temperature of 46.5°C for 20 minutes at treatment centre registered with DOA Malaysia and approved by MAFF Japan.
  5. As of 1st January 2021, one premise is approved by MAFF Japan to treat and pack Harumanis mango to Japan:
 

Serdang Export Treatment Centre  
DOA Malaysia, Lot 5377  
Jalan Putra Permai  
Bandar Putra Permai  
43300 Seri Kembangan, Selangor
- 

*Source: Department of Agriculture Malaysia (2021c)*

## **Development of the Research Framework**

### *Intention to Use Pesticide*

Pesticide is one of the requirements for farmers to control pests. Fruits infected by pests are normally low in quality; and this impacts the productivity (Badriasih et al., 2019). Hence, the use of pesticides is unavoidable. However, it should be used according to the regulations and guided by the authorities such as Department of Agriculture (DOA) Malaysia (Department of Agriculture Malaysia, 2021a). The need to conform with the regulations of farming activities is becoming more important when the products are not only for local consumption but also for international markets. However, the production of products must be strictly monitored to ensure that the classification of the products remains, i.e. as a healthy product according to Phytosanitary Regulations (Department of Agriculture Malaysia, 2021c).

Previous study by Monfared et al. (2015) found that the use of pesticide is important as it is a policy introduced by authorities that manage farming regulations. Farmers can use pesticides in their farming activities, but they must have the awareness of how pesticides may impact the environment and humans. As such, commercial farmers must be aware of the regulations on pesticides so that the quality and quantity of the crops are optimized (Khan et al., 2021). Safe use of pesticides will benefit the farmers, consumers and environment (Wang et al., 2017). Until now, there are very few empirical

studies on the use of pesticides among farmers, including Harumanis in Malaysia. Since Harumanis is an important product not only to Perlis, but also Malaysia, we believe there is a call for us to conduct a study on factors influencing the intention to use pesticides among Harumanis farmers in Perlis.

### *Theory of Planned Behavior (TPB)*

Theory of Planned Behaviour had been used to underpin this study. The TPB suggests that behaviors originate from individual intention and perceived behavioral control. Intention, defined as “indicators of how hard people are willing to try to perform the behavior” (Ajzen, 1991, p. 181), and it relies on the influence of three main variables, namely attitude, subjective norm, and perceived behavioral control (PBC). Attitude refers as an individual’s evaluation, either the person favors or disfavors certain behaviors; subjective norm could be defined as the pressure perceived by individuals from their circles to influence their behaviors; and PBC is the personal evaluation of the possibilities of executing the behavior in certain situation (Ajzen, 1991).

TPB had been used in various studies such as explaining behaviours in various settings such teaching environment (Opoku et al., 2020), banking sectors (Kashif et al., 2017), green purchase intention (Liu et al., 2020) and food sector (Thaivalappil et al., 2019). Apart from that, several studies had also underpinned their studies using TPB in the agriculture (Rezaei et al., 2019; Savari & Gharechae, 2020) including the use of pesticide in farming activities (Bagheri, Bondori, et al., 2019; Khan et al., 2021; Monfared et al., 2015; Wang et al., 2017).

For this study, five variables had been tested along with three main TPB variables (attitude, subjective norms, perceived behavioral controls), namely knowledge and moral norm. The additional variables added as the extension of TPB are expected to increase the variance in explaining the intention to use pesticides among Harumanis farmers in Mata Ayer, Perlis.

### *Attitude*

Attitude is the first variable of TPB. Attitude influences how people make decision. There are many studies related to the attitude in the context of the use of pesticides among farmers (Bagheri, Bondori, et al., 2019; Bagheri, Emami, et al., 2019; Khan et al., 2021; Monfared et al., 2015). For example, a study by Abadi (2018) revealed that attitude is important towards the use of pesticides. This is because it is a part of the requirements for their farming activities to ensure the quality and the quantity of cucumber production in Iran. Also, a study by Bagheri, Emami, et al., (2019) showed a positive influence of attitude towards the use of pesticide safely among apple farmers in the same country. Similar result is also exhibited by other studies such as cotton farmers in Mutan (Khan et al., 2021) and cereal farmers in Iran (Bagheri, Bondori, et al., 2019). Hence, we conclude the hypothesis for this study as follows:

H1: Attitude has a positive effect on Harumanis farmers’ intention to use safe pesticides.

### *Subjective Norms*

Subjective norm is defined as the pressure perceived by individuals from their circles that influence their behaviors (Ajzen, 1991). Several studies about the environment (Razali et al., 2020) and agriculture that include the use of pesticide (Abadi, 2018; Bagheri, Bondori, et al., 2019) found that subjective norm has significant positive influences on behavior. However, scholars also found that subjective norm is significant and has negative relationship with behavior (Ekasari & Zaini, 2020).

Meanwhile, other evidence shows that subjective norm is not significant to behavior. Nonetheless, subjective norm appears to be significant with attitude as a mediator (Shin & Hancer, 2016). Therefore, subjective norm shows a mixed result based on research context. For this study, we had formulated the hypothesis for subjective norm as follows:

H2: Subjective norm has a positive effect on Harumanis farmers' intention to use safe pesticides.

#### *Perceived Behavioral Control (PBC)*

PBC is the personal evaluation of the possibilities of executing a behavior in certain situation (Ajzen, 1991). PBC does consistently have a significant positive relationship with behaviour based on past research's contexts; such as in food consumption (Ekasari & Zaini, 2020), environment such as waste separation behaviour (Razali et al., 2020), the use of eco-friendly reusable bag (Ekasari & Zaini, 2020), and agriculture sector such as the use of pesticides among farmers such as cereal (Bagheri, Emami, et al., 2019), cucumber (Abadi, 2018), and vegetables (Nguyn et al., 2018). Hence, our hypothesis is formulated as follows:

H3: PBC has a positive effect on Harumanis farmers' intention to use safe pesticides.

#### *Knowledge*

Besides moral norm, knowledge is another variable used by scholars as the extension of TPB. The research about knowledge in the use of pesticides was conducted using various design and data analysis methods; as examples, knowledge as the intervention in quasi-experimental (Maddah et al., 2020), comparative analysis (Khalid et al., 2020; Masruri et al., 2021) and modelling using hypothesis testing (Abadi, 2018; Nguyn et al., 2018). The results of these studies reveal that, knowledge has a huge impact on the behavior to use pesticides among farmers. A specific knowledge is important to ensure that the decisions of what need to be done in certain situation are based on specific context (Mohtashim Mehboob et al., 2019). However, when knowledge is used as the extended variable for TPB, mixed results were reported. For example, the study by Bagheri, Bondori, et al., (2019) found that knowledge has a significant influence on the intention to use pesticides. On the contrary, specific knowledge such as indigenous knowledge appears to be insignificant with the intention to use pesticide (Abadi, 2018). Hence, the hypothesis for this study is as follows:

H4: Knowledge has a positive effect on Harumanis farmers' intention to use safe pesticides.

#### *Moral Norms*

Moral norm refers to people's reaction towards moral responsibility where it influences how they behave to make decisions (Ajzen, 1991). Moral norm is one of the variables that is regularly used as an extended variable included in TPB. Most of the studies found that moral norm has positive influence on the intention or behaviour of the participants (Bagheri, Emami, et al., 2019; Ekasari & Zaini, 2020; Razali et al., 2020; Shin & Hancer, 2016). A study conducted by Razali et al., (2020) found that moral norm has the biggest impact on the behavior of waste separation among Malaysians. Thus, for this study, we propose the hypothesis as follows:

H5: Moral norm has a positive effect on Harumanis farmers' intention to use safe pesticides.

Based on the discussion above, this study aimed to investigate the relationship between TPB variables (attitude, subjective norm and PCB) and the intention to use pesticides among Harumanis farmers in

Mata Ayer, Perlis. The two additional variables included in the research framework were moral norm and knowledge. This study was conducted during the movement control order due to Covid19 in Malaysia using survey-based research design.

## METHODOLOGY

### Research Setting, Population and Sampling

This study was conducted at Mata Ayer, Perlis among Harumanis farmers. These farmers registered with the DOA and participated in the MyGAP scheme. The use of pesticides is becoming very important for Harumanis farmers in Perlis. This is because only the Harumanis mangos from Perlis meet the export requirements to the international market. In order to produce a high-quality product, the maintenance of the trees is essential to Harumanis. These registered farmers are classified as commercial farmers for Harumanis. Mata Ayer had been chosen due to its location; which is Arau, the Agroclimate Zone for Harumanis. Data were collected during movement control order due to Covid 19; therefore, the data collection coverage must be limited to certain district only. The sampling frame for this study was obtained from DOA farmers, in which there were 128 Harumanis farmers registered with DOA. Based on Krejcie and Morgan (1970), 97 farmers were needed as the respondents for this study. Respondents were chosen based on systematic sampling techniques.

### Measurement Design

There were six variables tested for this study. All measurements were adapted from previous literature. The adaptation of measurement was refined in accordance to the context of the study. A total of 42 measured items had been designed based on the operational definition of this study. All measured items were measured using 5-point Likert scale ranging from '1' as strongly disagree to '5' as strongly agree. Apart from the measured variables, demographic factors such as gender, age, marital status, ethnicity, level of education, ethnicity and level of involvement with DOA were also analyzed.

Table 2 presents the operational definition for this study, total items and source of items to represent the constructs.

**Table 2:** Operational Definitions, Total Measured Items and Sources of Measurement

Constructs	Operational Definitions	Total Items	Source
Intent to Use Pesticide	Intention to use is factor that refer to the intention of Harumanis farmers to use pesticide based on the guideline provided by DOA	7	Monfared et al., (2015); Rezaei et al., (2019); Savari & Gharechae, (2020)
Attitude	Farmer's evaluation either favors or not favors to use pesticide for their Harumanis farm	7	Khan et al (2021); Monfared et al., (2015)
Subjective Norms	The pressure perceived by the farmers from other farmers to influence the use of pesticide for their Harumanis farm	7	Monfared et al., (2015); (Wang et al., 2017)]; Bagheri, Bondori, et al., (2019)

**Table 2:** Operational Definitions, Total Measured Items and Sources of Measurement (continue)

Constructs	Operational Definitions	Total Items	Source
Perceived Behavioral Control Knowledge	Farmer's evaluation of the possibilities to the use pesticide in certain situation for their Harumanis farm	7	Rezaei et al., (2019); Bagheri, Bondori, et al., (2019)
	The acquisition of pesticide knowledge DOA and how it influences the decision to use pesticide in their Harumanis farm	7	Rezaei et al., (2019); Bagheri, Bondori, et al., (2019)
Moral Norms	The morality of farmers should follow by moral rules and moral standard of the Harumanis farmers group members.	7	Monfared et al., (2015); Savari & Gharechae, (2020)

The measurement had gone through the pre-testing process. It had been reviewed by one DOA officer, two lecturers of Faculty of Plantation and Agrotechnology from UiTM and three Harumanis farmers. The corrections of the questionnaires were made based on the feedback and suggestions from the pre-testing process. The pilot testing had not been conducted because of the small sampling frame.

### Procedure of Data Collection

Data were collected in November 2020. Because of the movement control order during pandemic Covid-19, we need to restrict our face-to-face contact with the respondents. Therefore, we prepared the questionnaires using google form. The identified respondents were contacted using mobile phones and the link was given to the respondents for their responses. For the older farmers, we facilitated them by reading the questions and asked them to choose their preferred response.

### Method of Data Analysis

Data input and data cleaning were made using SPSS software. Prior to the analysis, preliminary analysis was conducted to test the normality and common method variances. The results from the preliminary analysis showed that this dataset qualified to be analyzed using SmartPLS with bootstrapping procedure.

## DATA ANALYSIS

### Profiles of the respondents

Table 3 presents the profiles of the respondents. Six demographic factors had been collected, namely gender, age, marital status, ethnicity, years of involvement and education level. A majority of the respondents were male ( $n=72$ , percentage = 72.4). 75.2% of the respondents were above 40 years of age. Meanwhile, those respondents aged between 41 to 50 were 37 (38.1%), and above 51 were 36 (37.1%). The Malay community is the majority of the Mata Ayer residents, hence 96 (99%) of the respondents were Malay. In terms of education level, most of the respondents were Sijil Pelajaran Malaysia or SPM holders – 87 (89.7%). Finally, the years of involvement as Harumanis farmer were almost similar among the age groups: below 3 years 14 (14.4%), 4 to 6 years 23 (23.7%), 7 to 9 years 29 (29.9%) and above 10 years 31(32%).



**Table 3:** Profiles of Respondents

<b>Demographic</b>	<b>Categories</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Gender	Male	72	74.2
	Female	25	25.8
	<i>Total</i>	97	100
Age	Below 30	7	7.2
	31 – 40	17	17.6
	41 – 50	37	38.1
	51 and above	36	37.1
	<i>Total</i>	97	100
Marital Status	Single	19	19.6
	Married	78	80.4
	<i>Total</i>	97	100
Ethnicity	Malay	96	99.0
	Others	1	1.0
	<i>Total</i>	97	100
Education Level	SPM	87	89.7
	Diploma	7	7.2
	Degree	3	3.1
	<i>Total</i>	97	100
Years of Involvement	Below 3	14	14.4
	4 – 6	23	23.7
	7 – 9	29	29.9
	10 and above	31	32.0
	<i>Total</i>	97	100

### Preliminary Analysis

Prior to conducting the analysis, preliminary assessments had been conducted to ensure that (1) normality test, and (2) this set of data is free from common method bias. For the normality test, we had tested this data using skewness and kurtosis calculator by Webpower (<https://webpower.psychstat.org/>), as suggested by Cain and Zhang, (2016). The result for skewness:  $\beta = 12.322$ , or for kurtosis:  $\beta = 61.098$ ; indicating that the data were not normal. Therefore, this set of data can be analyzed using SmartPLS through the employment of bootstrapping procedure. In order to ensure that this set of data is free from common method variance, we used the full collinearity estimates approach as suggested by Kock and Lynn (2012). The result (Table 4) exhibits that the data comply with the threshold values for VIF (below 3.3); hence they are free from the common method variance issue. The preliminary analyses' results for normality and common method bias indicate that this set of data could proceed for further data analysis using SmartPLS.

**Table 4:** Full Collinearity Estimates for the Study

<b>Constructs</b>	<b>ATT</b>	<b>Intent</b>	<b>KNW</b>	<b>MN</b>	<b>PBC</b>	<b>SN</b>
VIF	1.166	1.980	1.617	1.795	1.069	1.088

Note: ATT – Attitude; SN – Subjective norm; PBC – Perceived behavioural control; KNW – Knowledge; MN – Moral norm; Intent – Intent to use safe pesticides

### Assessment of Measurement Model

Table 5 exhibits the reliability using composite reliability (CR) and convergence validity using average variance extracted (AVE) outlined by Hair et al. (2014). Several items had been deleted due to low loading namely – Knowledge (K2, K3, K4), Perceived Behavioral Control (PBC1, PBC2), Subjective Norm (SN1, SN2). Loading values for all items are above 0.50. Moreover, the CR values for all constructs – Attitude (0.857), Knowledge (0.872), Moral Norm (0.833), Perceived Behavioral Control (0.865), Subjective Norm (0.926) and Intention to Use (0.879) are above 0.80. Also, the values for AVE - Attitude (0.502), Knowledge (0.535), Moral Norm (0.561), Perceived Behavioral Control (0.524), Subjective Norm (0.717) and Intention to Use (0.597) are above 0.50. Hence, this set of data achieves the reliability and convergence validity. As such, valid to be tested for discriminant validity.

**Table 5:** Assessment of the Measurement Model

<b>Constructs</b>	<b>Items</b>	<b>Loading</b>	<b>CR</b>	<b>AVE</b>
Intention to Use	g1	0.627	0.879	0.597
	g2	0.796		
	g3	0.763		
	g4	0.575		
	g5	0.753		
	g6	0.840		
Attitude	A1	0.604	0.857	0.502
	A2	0.716		
	A3	0.652		
	A4	0.827		
	A5	0.736		
	A6	0.698		
Subjective Norm	SN3	0.720	0.926	0.717
	SN4	0.911		
	SN5	0.699		
	SN6	0.851		
	SN7	0.651		

**Table 5:** Assessment of the Measurement Model (Continue)

Constructs	Items	Loading	CR	AVE
Perceived Behavioral Control	PBC3	0.837	0.865	0.524
	PBC4	0.842		
	PBC5	0.935		
	PBC6	0.847		
	PBC7	0.763		
Knowledge	K1	0.602	0.872	0.535
	K5	0.857		
	K6	0.840		
	K7	0.665		
Moral Norm	MN1	0.554	0.833	0.561
	MN2	0.830		
	MN3	0.778		
	MN4	0.538		
	MN5	0.764		
	MN6	0.820		

The discriminant validity was tested using Heterotrait-Monotrait ratio (HTMT). Table 6 presents the discriminant validity value. All the values are below the  $HTMT_{0.85}$  ratio. Moreover, the VIF values for the constructs are 1.058 (Attitude), 1.448 (Knowledge), 1.397 (Moral Norm), 1.047 (Perceived Behavioral Control), 1.087 (Subjective Norm); hence, free from multicollinearity problems. As such, there is discriminant validity and valid for further analysis.

**Table 6:** Discriminant Validity using Heterotrait-Monotrait Ratio (HTMT)

Constructs	1	2	3	4	4
Attitude					
Intention to Use	0.332				
Knowledge	0.141	0.647			
Moral Norm	0.207	0.725	0.651		
Perceived Behavioral Control	0.130	0.110	0.283	0.138	
Subjective Norm	0.297	0.141	0.147	0.122	0.195

### Assessment of Structural Model

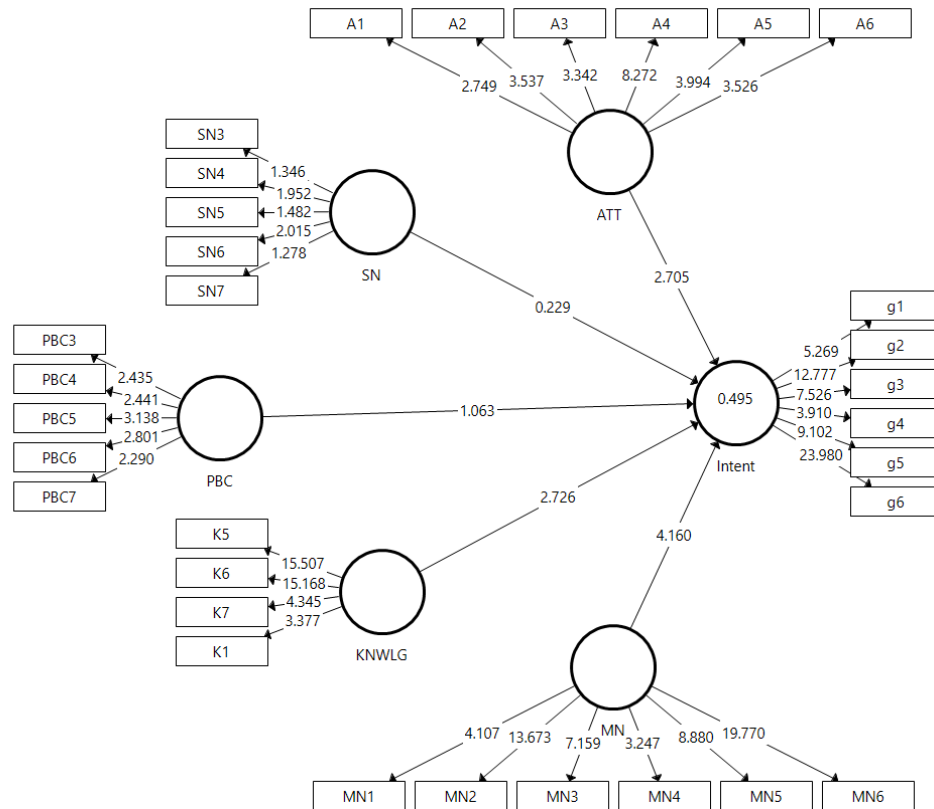
Assessment of structural model was used to analyze the hypotheses of this study. There were five hypotheses tested in this study. The results in Table 7 indicate that Attitude has positive significant relationship with the intention to use pesticides among Harumanis farmers ( $\beta = 0.234$ ,  $t$ -value = 2.705,  $p < 0.01$ ). Similarly, Knowledge exhibits a positive significant relationship with the intention to use pesticides among Harumanis farmers ( $\beta = 0.292$ ,  $t$ -value = 2.726,  $p < 0.01$ ). Finally, Moral Norm also has a positive significant relationship with the intention to use pesticides among Harumanis farmers ( $\beta = 0.448$ ,  $t$ -value = 4.160,  $p < 0.001$ ). However, this study could not provide sufficient evidence to support Hypothesis 2 and Hypothesis 3. The tested variables included in this study explain 49.5% of

variance in the intention to use pesticides among Harumanis farmers. ( $R^2 = 0.495$ ) and  $Q^2$  value for intention are greater than zero for a particular endogenous latent construct, suggesting that the conceptual model can predict the endogenous latent construct. Figure 1 shows the assessment of the structural model using SmartPLS.

**Table 7:** Hypotheses Testing for this Study

Hypo	Relationship	Std Beta	Std Dev	t-value	p-value	BC LL 5%	BC UL 95%	$R^2/Q^2$	$f^2$
								0.495/0.220	
H1	ATT -> Intent	0.234	0.086	2.705	0.003	0.045	0.342		0.102
H2	SN -> Intent	0.018	0.072	0.229	0.403	-0.165	0.094		0.001
H3	PBC -> Intent	0.106	0.098	1.063	0.142	-0.069	0.245		0.021
H4	KNW -> Intent	0.292	0.109	2.726	0.004	0.096	0.450		0.117
H5	MN -> Intent	0.448	0.109	4.160	0.000	0.286	0.629		0.284

Note: ATT – Attitude; SN – Subjective norm; PBC – Perceived behavioural control; KNW – Knowledge; MN – Moral norm; Intent – Intent to use safe pesticides



**Figure 1.** Assessments of the Structural Model

### Summary of Hypothesis Testing

There are five hypotheses being tested by this study. The results support three hypotheses (H1, H4 and H5). However, this study does not have enough evidence to support two more hypotheses, namely H2 and H3. The summary of the results is presented in the Table 8.

**Table 8:** Summary of Hypotheses Testing

Hypotheses	Description	Results
H1	There is a positive significant relationship between attitude and intent to use pesticides among Harumanis farmers.	Supported
H2	There is a positive significant relationship between subjective norm and intent to use pesticides among Harumanis farmers.	Not Supported
H3	There is a positive significant relationship between perceived behavioral control and intent to use pesticides among Harumanis farmers.	Not Supported
H4	There is a positive significant relationship between knowledge and intent to use pesticides among Harumanis farmers.	Supported
H5	There is a positive significant relationship between moral norm and intent to use pesticides among Harumanis farmers.	Supported

## DISCUSSION

This study attempts to investigate factors that influence the intention to use safe pesticides among Harumanis farmers in Mata Ayer, Perlis, Malaysia. The intention to use safe pesticides among the Harumanis farmers reflects the strong intention to use pesticides using procedure outlined by DOA. This study was underpinned by the Theory of Planned Behavior (TPB), and three TPB variables were tested in the research framework. Apart from that, knowledge and moral norm had been added as the additional variables in the research framework. The result revealed that only one TPB variable had sufficient evidence to support the hypotheses in the context of intention to use safety pesticide among Harumanis farmers.

These Harumanis farmers are registered farmers with the DOA Perlis. They received guideline and training from DOA, hence, they understand that certain decisions need to be made for the best of their income. Since Harumanis is one of the important income sources for Perlis, DOA must ensure that this exotic fruit is sold optimally. Harumanis is a very delicate fruit, very sensitive to pests and weather, hence it requires more care as compared to other mangos. The unpredictable condition of weather has particularly made the Harumanis farmers to rely more on the information and guidance provided by the DOA as compared to their own practices or other Harumanis farmers' opinions. This situation served as the evidence in explaining why attitude is a significant influence on the intention to use safe pesticides among farmers. The close relationship between farmers and authorities has built the farmers' trust in DOA where they seek guidance to improve their income specifically, and Perlis generally. The result of this study aligns with previous scholars such Abadi (2018) where the study found that attitude is an important influence in the use of pesticides. This is because it is a part of the requirements for their farming activities to ensure the quality and the quantity of their crops. Similarly,

previous studies had showed a positive influence of attitude on the use of pesticide safely among apple farmers in Iran (Bagheri, Emami, et al., 2019), cotton farmers in Mutan (Khan et al., 2021) and cereal farmers in Iran (Bagheri, Bondori, et al., 2019).

However, another two of TPB variables - subjective norm and PBC had not provided enough evidence to support the hypotheses of this study. This situation happened because of the pandemic of Covid19. During the enforcement of movement control order, farmers were facing difficulties to communicate with one another; hence they rely more on the information and advice of the DOA officers to make decisions related to their farming activities. Several studies about the environment (Razali et al., 2020) and agriculture including the use of pesticides (Abadi, 2018; Bagheri, Bondori, et al., 2019) found that subjective norm has significant positive influence on behavior. However, scholars also found that subjective has a significant negative relationship with behavior (Ekasari & Zaini, 2020), while others found that subjective norm is not significant in influencing behavior (Shin & Hancer, 2016). For PBC, this study found a contradictory result as compared to previous studies in various contexts. PBC consistently has a significant positive relationship with behavior in the study about food consumption (Ekasari & Zaini, 2020), environment such as waste separation behaviour (Razali et al., 2020), the use of eco-friendly reusable bag (Ekasari & Zaini, 2020), and agriculture sector such as the use of pesticide among farmers such as cereal (Bagheri, Emami, et al., 2019), cucumber (Abadi, 2018), and vegetables (Nguyn et al., 2018).

Harumanis farmers in Perlis received their trainings and support from DOA. Some of the modules include on how to care for Harumanis trees all year round. The use of pesticides is unavoidable but DOA educates the farmers on the procedure of how to use pesticides safely on their plants. Hence, it is not surprising when knowledge becomes one of the important factors that influences the intention to use pesticide. The farmers understand on the importance of using pesticides to control pest. Nonetheless, they are mindful of not to use them excessively that it will affect the health of the fruits. Moreover, they understand the importance of using safe pesticide for export products. The study about knowledge in various research contexts exhibit that knowledge has a huge impact on the behavior to use pesticides among farmers (Abadi, 2018; Khalid et al., 2020; Maddah et al., 2020; Masruri et al., 2021; Nguyn et al., 2018). However, when tested as the extension of TPB, knowledge has been found to lead to a mixed result. This is similar to the study by Bagheri, Bondori, et al., (2019) who found that knowledge has a significant influence on the intention to use pesticides. Meanwhile, another study found that specific knowledge such as indigenous knowledge appears to be insignificant with the intention to use pesticides (Abadi, 2018). This result indicates that more studies are needed in the context of the agriculture to conclude how knowledge impacts behaviour.

Moral norm is the extension variable included in the research framework of this study. Moral norm shows a significant influence on the intention to use pesticides. From all the variables tested in the framework, moral norm appears to be the most significant variable that influences the intention to use pesticides among farmers. By looking at the distribution of age among registered Harumanis farmers in Mata Ayer, it is almost similar. This means that everyone is exposed to the training and information provided by DOA. Regardless of age, the famers understand that they need to be alert and comply to the regulations and procedures outlined by DOA to ensure their incomes are optimal. To care for a delicate and vulnerable exotic fruit such as Harumanis, it does not only require knowledge but also the discipline of the farmers to care for their plants and orchards. The result of this study aligned with most of the studies that found moral norm has a positive influence on the intention or behaviour of the participants (Bagheri, Emami, et al., 2019; Ekasari & Zaini, 2020; Razali et al., 2020; Shin & Hancer, 2016). This study produces a similar result with a study conducted by Razali et al., (2020), in which it

was found that moral norm has the most significant impact on the behavior in respect to this research context.

## CONCLUSIONS AND RECOMMENDATIONS

This study attempts to investigate factors that influence the intention to use safe pesticides among the Harumanis farmers in Mata Ayer, Perlis, Malaysia. This study is underpinned by Theory of Planned Behavior (TPB); hence attitude, subjective norm and perceived behavioral control were tested in the research framework. Additionally, knowledge and moral norm had been included as the extension variable of TPB in the context of this study. Two of TPB variables appeared to be not significant to the intention to use of pesticides among Harumanis farmers. Meanwhile, attitude and two additional variables, namely moral norm and knowledge have significant influence on the exogenous variable, intention to use safety pesticide. Based on the result of this study, it can be concluded that in the context of Harumanis farmers who are assisted by DOA, TPB requires more variables to explain the situation. This is because there is no sufficient evidence to support the hypotheses that subjective norm and perceived behavioral control have an influence on behaviour, particularly when the farmers face difficulties during the Covid19 pandemic. This situation could be explained by the relationship between the authorities and the farmers whereby there was a reduced dependency by the farmers on their circles in making decisions due to the movement control order. Moreover, all registered farmers understand the need to abide to the regulations and procedures provided by DOA for an optimal income during the harvest season.

Based on the results we obtained from this study, we urge future research to look into how the trainings provided by DOA give impacts to the decisions made by the farmers. If the situation permits, more respondents should be included as study sample with wider coverage area of Harumanis in Perlis. Other variables such as sustainable agriculture, policies and regulations must not be neglected since they may have an influence on income. Moreover, the distribution of Harumanis within the right timeframe to consumers during the Covid19 pandemic could also to be considered as the future subject in research related with Harumanis, particularly in Perlis.

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