The Modelling of Preference Switch from Conventional Food to Genetically Modified Food: Evidence from Malaysia.

Phuah Kit Teng,Bernard Lim Jit Heng, Siti, Intan Nurdiana Wong Abdullah

Abstract:Today, the demand for quality food is increasing and genetically modified food most probably become part of the Asian diet. Genetically modified food are food that derived from genetically modified organisms. The production and marketing of genetically modified food products has raised many concerns especially among the discriminating consumer. Nowadays, consumers not only concern about the price but also on the long-term impacts of GMO food towards the environment, health, food safety, moral, ethical and religious implication of both manufacturing and consuming the product. Therefore, the objective of this study is to determine Malaysia consumer preference switch from conventional food to genetically modified food. This study was conducted in Malaysia where 491 consumers were surveyed using structured questionnaires. Behavioral Perspective Model was adopted and modified in this study along with structural equation modeling to analyze the collected data. The results shows that utilitarian, aversive and informational reinforcement will only increase consumers preference towards genetic modified food when they aware that Genetically modified food bring more advantages than disadvantages to human being. In addition, consumer who prefer to switch will have higher intention recommend GMO food to others and willing to pay more for GMO food.

Index Terms*: *Behavioral Perspective Model, Genetic Modified Food, Preference, Structural Equation Modeling.

I. INTRODUCTION

The biotechnology industry has expanded tremendously and offers new market potential for relevant products that have economic and environmental benefits. Currently, biotechnology is aimed at reducing the use of pesticides, improving the farmers' revenues and enhance the nutritional value of food. However, food biotechnology is relatively new in Malaysia despite the food production is still using traditional biotechnology methods such as fermentation technology for production of soy sauce, yogurt, nata, tempeh, tapai and budu. A number of industries is still producing sweeteners and food additives based on fermentation that existed for decades in this country. Several genetically modified crops containing traits of value was produced at the experimental stage despite that Malaysia is not able to produce a biotechnology crop commercially. Malaysian Agricultural Research and Development Institute (MARDI) has successfully modified rice to resist the tungro virus; and configured the papayas to resist ring-spot virus infection and to have a prolonged shelf life. Other crops reengineering was also conducted where pineapples are innovated to resist "black heart" disorder, bananas and papayas for delayed ripening, and chilies that are virus resistance (Musalmah, 2006).

Malaysia is also focusing on development of genetically engineered oil palm, with the goal of increasing value-added products from the palms, such as benefits on high stearate oil, nutraceuticals (vitamin A and E), biodiesel and bioplastics. Besides plantation, several animal recombinant vaccines have been reengineered to assist the development of animal husbandry. Through biotechnology, research is ongoing in Malaysia to generate cheaper domestic livestock feed to reduce the high costs of imported feed. In Malaysia, the focus of biotechnology progress is on the verge with the nation's aim to improve food production.

The economic crisis during the late '90s has prompted the Government to take a second look at the potential of agriculture especially in food production which can improve the national economy. The Government has stressed the importance of producing sufficient food for national security and stability (The Star Online, 2006). Therefore, the Government is aware of the benefits of genetically modified (GM) crops. At the same time, their benefits on consumers as well as producers is recognized. The Government is aware about food safety and the potential risks of transgenic food crops. The government has the responsibility to assure the public of the food safety, improving the "halalness" of the genetically modified crops and ensuring the genetic modified food beneficial contribution to human health and environment. Due to this, a Genetic Modification Advisory Committee was established under the National Committee on Biodiversity, Science, Technology and the Environment Ministry. The role of this committee is to ensure that risks associated with the use, handling and transfer of Genetically Modified Organisms (GMOs) are safely managed and to advise the Government on matters relating to the GM technology and its application (Musalmah, 2006).

Malaysia aspires to be a biotechnology hub in Asia and this is clearly stated in the National Biotechnology Policy that was launched on 28th April 2005. It is estimated that by the year 2020, the biotechnology sector would create about 280,000 jobs and

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will contribute about five per cent to the country's Gross Domestic Product. Total investment under the National Biotechnology Policy on biotechnology industry is estimated to be around RM30 billion (US$7.9 billion). However, the use of the GMOs raises query from all around the world. Genetically modified crops are currently developed in 26 nations around the world, while dozens of countries have banned farmers from planting GMO crops. Countries that have banned GMOs received considerable attention in 2015, where a majority of European Union nations decided to block the cultivation of new GMO crops within their borders and Russia issued a ban on both cultivation and imports. But most of the nations that prohibit GMO cultivation still allow GMO products particularly animal feed to be imported. European countries; for example, imported 30 million tons of GMO grain annually. Many other nations such as China, Japan and Canada will restrict GMO products if the products do not pass their country's regulatory standards.

The main concern on GMO food is the likelihood of the side effects from the genetic modified foods. Some scientists say it is safe to use while other scientists claimed that GMO is harmful to health, environment, increases the effects of allergy, instigate cancer and raise other health problems which are difficult to identify. United States is one of the country that accept GMO and claimed that it is safe to be consumed. United States are major producers of GMO world where 60 percent of total agricultural revenue is from the GMO products. However, most European countries and a number of countries in Africa rejected GMO because the safety level of GMO products are yet to be proven. Russia is the most populous country in banning both the cultivation and importation of GMO crops. In 2014, Russia banned the imports on biotech crops and officially banned their cultivation except for scientific research purposes. In addition, EU regulations grant individual countries the right to block farmers from growing GMO crops. Using this opt-out process, 19 members, including Germany and France, voted in late 2015 to prohibit the cultivation of eight new biotech crops that were pending for approval from regulators. They also chose to prohibit cultivation of an insect-resistant corn variety (MON810) which was previously approved for cultivation in the EU. These corns are mostly grown in Spain and Portugal. When UN banned the importation or cultivation of GMO products, most experts viewed this move is generally driven by non-science motive since the independent science organizations in every major country have come out with public statements that GM products are safe. Other factors triggered the banning of GMO products are trade protectionism, pressure from activists, public uneasiness or a desire to protect a country's image as seen from the French belief that genetic crops can "contaminate" the country's reputation as a world food capital. On the other hand, many countries have allocated special regulation to monitor GMO use; either under controlled conditions, to be released to the environment or sale in the open market. The reason given was that they seek to avoid or eliminate the side effects of the GMOs. In Malaysia, the Ministry of Science, Technology and Environment had established a committee that gives guidance and advice on the use of GMOs.

Under the Codex Alimentarius Commission, the joint WHO/FAO body which regulates international food standards and the Committee on Food Labeling has been discussing the establishment of a global standard for mandatory GM food labeling. The draft standard on GM labeling has gained support from a majority of the Committee which includes Malaysia. The law is important because some countries require mandatory certification to ensure the supply of imported grains and food are free of GMOs. Labeling also serve an important role to inform consumers about the GM content, persuading exporting countries to segregate their GM and non-GM crops and to identify GMO shipments. Furthermore, mandatory GM labeling would assure Malaysians; who are concern towards their food consumption, that the food products are not contaminated by genes from an unknown species. More than 40 countries around the world including Thailand, South Korea, Japan, Australia and most European countries already require mandatory labeling on GM foods. On the other hand, populous countries like India, China and Indonesia already accepted genetic engineering and have started to develop their own GM crops. However, activists in Malaysia fear that even with mandatory labeling, consumers might not be aware or understand the meaning of GM food. Moreover, local rice farmers may lose out if the import tariffs are reduced under the FTA from 40 percent to zero.

As the GMOs are relatively new to Malaysian consumers, the National Biotechnology Directorate is increasing its efforts to create public awareness on biotechnology. The programs include arranging lectures at public forums and schools, preparing and distributing pamphlets about biotechnology, and promoting a better understanding of biotechnology through the media. Thus, this study will attempt to conduct a consumer research to find out on how Malaysian consumers perceive the use of biotechnology to produce foods and the preference of consumers on the various benefits that biotechnology-derived foods may bring.

II. LITERATURE REVIEW

A. Definition of Genetic Modified Foods

Genetically modified foods are foods that are cultivated using genetically modified organisms. There are specific changes introduced into the genetically modified organisms' DNA through genetic engineering techniques (National Research Council, 2004). Today, the demand for quality foods is increasing; therefore, genetically modified foods probably become an increasing feature in Asian diet. In the western countries, there is a change in production practices and marketing activities of crops and livestock products due to the growth and development of agricultural biotechnology.

The term "biotechnology" refers to the use of living organisms or their products to improve human health and environment. Genetic engineering technologies allow mergers between the different genetic code by using the techniques of gene splicing and recombinant DNA technology (National Research Council, 2004). Functioning lengths of DNA can be taken from one organism and placed into the cells of another organism. Thus, genetic modification and GMOs is not

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limited to plants only but also to the animals. Most of the GMO research are trying to generate superior plant species that can resist pest, capable to produce high-quality output and large quantities in a short growth cycle. The researchers also seek to produce crops that can be stored for a long time and species of plants can be grown in extreme environments such as arid land or desert. In United States and China, millions of acres of land have been planted with GMO cotton tree species which can produce a poison that can kill the pests' larvae. Another instance is Mosanto Company which created a species of corn that have resistant to the popular herbicide; Roundup (Kimbrell, 2014). There is also a plant GMO created for medical purposes such as tomatoes that can produce hepatitis vaccines and vitamins in the cereal producing unusually large quantities.

B. Consumer Behavior toward Food Biotechnology

The production and marketing of genetically modified food products has raised many concerns especially from the petty consumer. Nowadays, consumers not only concern on the price of GMO products, but also on the long-term impacts of GMO products towards the environment, health, food safety, the moral, ethical and religious implication of both manufacturing and consumption of the product. The acceptance and success of genetically engineered food products will be influenced by the consumer interests, want and needs. Today's consumers are increasingly aware of food quality, food safety and environmental quality. Since the introduction of the biotechnology technology, studies on consumer behavior has found that issues related to biotechnology and its acceptance can be classified into three major categories: (1) credibility issues related to industry and its government regulators, (2) safety issues relevant to individual consumers as well as the environment, and (3) the right to know by consumers, the matter of labeling (Mclennon, 2002).

Evidence on the consumers' attitudes towards GMO food products has become visible in European countries. It was noted that some reluctance towards the GM and biotechnology food products exists (Grunert et al., 2003; Bredahl, 2001). However, according to Gaskell (2006), there are also people who support GM and biotechnology food products. The European consumers who support GMPs are mainly classified into three groups regarding their perception of GM and biotechnology food which are the 'optimistic' (25 percent), 'pessimistic' (58 percent) and 'undecided' (17 percent). The people who supported GM food are observed until 2002 where only four countries; Spain, Portugal, Ireland and Finland, supporting such course (Gaskell et al., 2003). However, the results have changed in 2005 when there are more supporting countries involve; which consist of Spain, Malta, Portugal, Czech Republic, Ireland, Italy and Lithuania. A recent study in Ireland which use the cluster analysis techniques has revealed that there was still a considerable segment (25 percent) who could best be described as 'anti-GM' and others (20 percent) who had 'complex reservations' in regards of the wholesale introduction of GM products (O'Connor et al., 2006). In a research that assess the consumers' attitudes towards GM technology, Bech-Larsen and Grunert (2000) and Honkanen and Verplanken (2004) confirmed that the Nordic populations have negative attitude towards GM food. The same result was achieved in the surveys for Poland consumers who in general have a significant distrust of genetic modification especially for food products (Szczurowska, 2005; Bukraba-Rylska, 2003; Janik-Janiec and Twordowski, 2003).

On the other hands, US are insightful where opinions concerning GM foods are not significantly different from those found in Europe. The research shows that US students mainly prefer non-GM products like chips, banana, corn flakes and corn-beef (Onyango and Govindasamy, 2004 and Lusk et al., 2002). Hossain et al. (2003) uses discrete choice modeling for GM fresh fruit and vegetables and finds that there are two main segments which are (1) totally opposed to GM technology and those labeled as 'undecided' (2) who would accept GM technology if there were benefits to the consumer. These results are same in Hossain and Onyango (2004) studies. Finally, a study in South Korea also exhibited a similar result. Onyango et al. (2004) found that consumers are divided in groups that range from acceptance and optimist regarding GM food improvements to pessimist and rejection.**

III. METHODOLOGY

A. Conceptual Framework

Behavioral Perspective Model (BPM) was used in this study where this consumer behavior model is based on the three-term contingency from behavioral psychology aspects. Figure 1 show that the main perspective of the BPM which is the consumer situation that exerts a direct influence on the shaping of consumer behavior in specified surroundings. Behavior produces consequences and the BPM framework defines these consequences as utilitarian reinforcement, informational reinforcement and aversive consequences (Foxall, 2007).

Utilitarian reinforcement is the tangible functional and economic benefit arises from purchase, ownership and consumption of GMO food. Consuming GMO food can offer more utilitarian reinforcement as compare to consuming conventional food product. When consumers purchase GMO food, they are not only consuming it due to hunger but also because of its food nutritional content, environmental contribution and sustainable food security.

Informational reinforcement is a magnitude of consumer behavior that is more likely to involve a lifestyle statement through social attention or appreciation. These are consequences mediated by others and function as feedback to the consumer as how well he or she is performing as a consumer. When a consumer consumes GMO food, it may lead to the thought of creating a new disease or bringing harm to some organisms. This will eventually lead to their reduced numbers in population or even extinction.

Aversive consequences are consequences of consumer behavior that can decrease the probability of future repetition. One aversive consequence of consuming GMO food is the uncertainty of the side effect. For example, consuming GMO food is perceived to cause cancer, allergic reactions, increase toxins and anti-nutrients which is harmful to human health. Consumer

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behavior in switching from conventional food to GMO food produces consequences which can be related utilitarian, informational reinforcing and aversive results. This process does not occur in a vacuum.

Consumer behavior settings comprise the stimuli that form the social and physical environment where the consumer is exposed to stimuli and signals alternative / choice for consumers. Consumer behavior setting in this study refer to the consumer main concern on any food products. Consumer behavior in considering of switching from conventional food to GMO food will be the dependent variable of this study. These initially neutral stimuli are transformed into discriminative stimuli that signal the outcomes of a specific behavior, and becomes part of the consumer's learning history. Consumer learning history is related experience from a consumer in searching information regarding GMO food and consuming GMO food. Consumer situation is defined as the intersection of the consumer behavior setting and the consumer's learning history (Foxall 2007). In this study, consumer situation refers to the likelihood of the consumer to recommend GMO food to others and their willingness to pay.

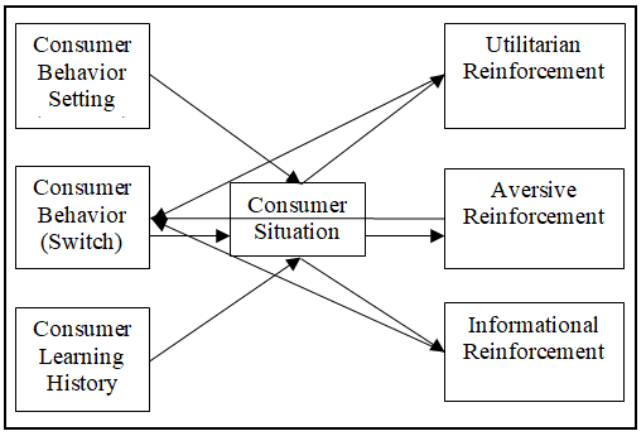

Fig. 1. Adopted Behavioral Perspective Model from Foxall (2007)

B. Hypothesis Testing

The focus of this study is to find the relationship between the components in the Behavioral Perspective Model which influence Malaysian intention to switch to consume genetic modified food. Nine hypotheses were formulated to identify the relationship between the components in different aspects:

H1. There is a positive relationship between consumer behavior setting (concern) and consumer situation towards genetic modified food.

H2. There is a positive relationship between consumer learning history and consumer situation towards genetic modified food.

H3. There is a positive relationship between consumer behavior (switch) and consumer situation towards genetic modified food.

H4. There is a positive relationship between consumer situation towards genetic modified food and utilitarian reinforcement.

H5. There is a negative relationship between consumer situation towards genetic modified food and aversive reinforcement.

H6. There is a negative relationship between consumer situation towards genetic modified food and informational reinforcement.

H7. There is a positive relationship between utilitarian reinforcement and consumer behavior (switch) to consume GM food.

H8. There is a negative relationship between aversive reinforcement and consumer behavior (switch) to consume GM food.

H9. There is a positive relationship between informational reinforcement and consumer behavior (switch) to consume GM food.

C. Sampling and Questionnaire

Data were collected from Malaysia consumers who stay in Klang Valley utilizing personal administered questionnaires. A five point Likert scale from "Strongly Disagree" to "Strongly Agree", "Not Concern at All" to "Extremely Concerned" and "More Unlikely" to "More Likely" were used in this study. These scale is relevant to gauge on the consumers' behavior in considering to switch from conventional food to GM food. The questionnaire was divided into eight sections and it consists of statements that addressed and measured the components of Behavioral Perspective Model. To measure the consumers' switching behavior, Klang Valley was chosen as the main cluster by using cluster sampling methods. Cluster sampling method was used in this study where Klang Valley was divided-into nine sub-clusters; which are Kuala Lumpur, Klang, Kajang, Subang Jaya, Petaling Jaya, Selayang, Shah Alam, Ampang Jaya, Putrajaya, and Sepang. After the respective sub-clusters were selected, simple random sampling was then used to randomly select three clusters. Sub-clusters like Kuala Lumpur, Petaling Jaya and Shah Alam were being selected. Convenient sampling method was then used in this study where Malaysia consumers who walked into the selected supermarkets in each sub-clusters are being interviewed. From this research initiative, a total of 491 consumers were studied.

D. Method of Analysis

Structural equation modeling (SEM) was used in this study to test the hypothesized patterns of directional and non-directional relationships between a set of observed and unobserved variables. The goal of this study is to examine the interrelationships among the multiple variables such as consumer behavior setting (Concern and Switch), consumer behavior, informational reinforcement, aversive reinforcement, utilitarian reinforcement and consumer learning history in Behavioral Perspective Model. This study involves a two-step approach which comprises of a measurement model and a structural model (Anderson and Gerbing, 1988). The measurement model involves conducting a confirmatory factor analysis to measure the contribution of each indicator variable and to evaluate the adequacy of the measurement model (Sridharan et al., 2010). Unidimensionality assessment, convergent validity, discriminant validity, construct reliability (CR), internal reliability (Cronbach's alpha) and average variance extracted (AVE) are utilized in this study to ensure the validity and reliability of the information accumulated for this study. Structural model represents

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the theory with a set of structural equations and is usually depicted with a visual diagram. To achieve the purpose of this study, structural model is used to test the direct and indirect implication of consumers' switching behavior between the independent variables when choosing GMO food. The significance and size of each structural parameter were estimated as this is relevant in establishing the model fit. A series of goodness of fit indexes are required to reflect the fitness of the model to the data in SEM. These indexes consist of absolute fit, incremental fit and parsimonious fit. Hair et al., (2010) and Holmes Smith (2001) suggested that at least three fit indexes are required for such study whereby at least one index from each category of model fit needs to be evaluated. As such, the structural model that best fits the data will be recognized before proceeding to hypotheses testing. **

IV. RESULTS AND POLICY IMPLICATIONS

The Cronbach's α value was 0.847 which was within an acceptable range and showed consistency among the items of the Behavioral Perspective Model such as consumer behavior setting (Concern and Switch), consumer behavior, informational reinforcement, aversive reinforcement, utilitarian reinforcement and consumer learning history. This indicates that the model is reliable and fit for this study.

A. Descriptive Statistic

Table 1 shows the information related to the respondents socio-demographic profile such as gender, race, area, marital status and education level. The result shows that majority of the respondents were female (53.6 percent) and 46.4 percent were male. Most of the respondents were Chinese (83.5 percent), followed by Malay (10.39 percent), Indians (5.7 percent) and others (0.41 percent) who are Indonesia Malay. From a total of 491 consumers, 70.88 percent were single and 59.06 percent lived in an urban area. With regards to education level, majority of the respondents (63.75 percent) had received at least a tertiary education, 29.74 percent had graduated from higher tertiary education and only 6.52 percent had been to secondary education.

Table 1: Socio-demographic profile of respondents (n=491)

Demographic Variables	Description	Frequency	Percentage (%)
Gender	Male	228	46.4
	Female	263	53.6
Race	Malay	51	10.39
	Chinese	410	83.50
	Indian	28	5.70
	Others	2	0.41
Education level	Primary Education	0	0
	Secondary Education	32	6.52
	Tertiary Education	313	63.75
	Higher Tertiary Education	146	29.74
Area	Urban	290	59.06
	Suburban	201	40.94
Marital Status	Single	348	70.88
	Married	143	29.12

B. Structural Equation Modeling

1) Unidimensionality and Convergent Validity

According to Hair et al., (2006), the standardized regression score for each item should be equal to or more than 0.5 to certify the unidimensionality of the measurement model. Convergent validity assesses the overall fit of the measurement model where the magnitude, direction and statistical significance of the estimated parameters exist between the latent variables and their indicators (Steenkamp and Van Trijp, 1991; Hair et al., 2006). For this study, the overall fit of all variables was within the acceptable index range. The magnitudes of the standardized parameter estimations were all more than 0.5 and this proves that there is a statistically significance between the latent and measures variables (Table 2). Thus, the results showed that the construct is unidimensional and convergent valid for this study.

2) Internal Reliability

Cronbach's Alpha was used to assess the internal consistency of each of the construct that was relevant in this study. The result shows that all seven latent construct which are consumer behavior setting (Concern and Switch), consumer behavior, informational reinforcement, aversive reinforcement, utilitarian reinforcement and consumer learning history have sufficient internal reliability consistency as indicated by Cronbach's Alpha scores since all the value are above 0.6 as shown in Table 2.

3) Construct Reliability

Table 2 illustrates the outcome of construct reliability (CR) and average variance extracted (AVE). The construct reliability ranges from 0.692 to 0.901 which is more than the benchmark of 0.6 (Bagozzi and Yi, 1988). The output of average variance extracted was reported from 0.5603 to 0.734. The computed figures are within the acceptable range (AVE>0.50). Thus, it can be concluded that all measures have strong and adequate reliability.

Table 2: Summary of Measurement Model

Item Code	Statement	Standardized Regression Weight	Cronbach Alpha	CR	AVE
Consumer Behavior Setting (Concern)			0.757	0.692	0.734
B1	I am concern whether the food contained additives or not.	1.358			
B2	I am concern whether herbicides or pesticides were used in food items or not.	0.571			

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Item Code	Statement	Standardized Regression Weight	Cronbach Alpha	CR	AVE
Consumer Behavior (Switch)			0.738	0.807	0.592
B5	I will consider to switch from conventional food to GM food in the future.	0.687			
B6	I look forward to buy GM food that conventional food.	0.861			
Consumer Learning History			0.704	0.78	0.551
C3	People who are important to me introduce GM food to me.	0.674			
C4	I was informed adequately by the government about genetic engineered food.	0.808			
Consumer Situation			0.762	0.788	0.627
G7	How likely will you be willing to pay more for GM food?	0.735			
G8	How likely will you recommend your family/ friends to consume GM food?	0.815			
Utilitarian Reinforcement			0.662	0.805	0.503
D1	GMO food improves the food nutritional content.	0.720			
D2	GMO food creates food that are more appealing to eat.	0.683			
Aversive Reinforcement			0.776	0.901	0.546
E1	GM food products may trigger/cause cancer.	0.763			
E2	GM food products in general are more likely to trigger allergic reactions to people.	0.792			
E3	The process of genetic modification (literally making changes to the plant's DNA) itself can create or increase toxins and anti-nutrients which will harm human health.	0.653			
Informational Reinforcement			0.673	0.806	0.518
F3	GMO food products can create new diseases.	0.548			
F4	GMO food products could prove toxic to some organisms, which can lead to their reduced numbers or even extinction.	0.926			

4) Construct Validity

Table 5 exhibits the summary of the model fit index of structural model on genetic modified food for this study. The structural model evaluates the adequate model fit according to the established fit indices. Absolute fit measure is used to provide the most fundamental indication of how well the proposed theory can fit the collected data. The result shows that the adjusted goodness of fit index (AGFI) and goodness-of-fit index (GFI) was above the acceptable threshold (GFI = 0.968; AGFI = 0.944), the standardized root mean square error was below 0.08 (RMSEA=0.041) and the standardized root mean square residual was below 0.05 (SRMR = 0.0378).

Incremental fit assessment is used to evaluate the significance of the developed theoretical models. A good

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incremental fit measure denoted by normed fit index (NFI = 0.941), incremental fit index (IFI = 0.973), tucker lewis index (TLI = 0.958) and comparative fit index (CFI = 0.972) was obtained in the model. The results indicated that the null hypotheses is uncorrelated with one another.

Parsimonious fit evaluation is used to adjust the fitness measures where different number of coefficient of estimation are being compared to determine the extent of the estimated coefficients can acquire. The model reported normed $\chi 2$ of 1.815, where the threshold was below 5 and Parsimony goodness fit index (PGFI) value and Parsimony Normed Fit Index (PNFI) value were above the acceptable threshold (PGFI = 0.556; PNFI = 0.618). In short, the structural model could adequately measure and predict the causal relationships of the exogenous and endogenous variables as suggested by Hair et al., (2010) where at least one index from each category of model fit are at the acceptable range.

Table 5: Model Fit Index on the Structure Model

Name of Category	Name of Index	Index Value
Absolute Fit Measure	Root Mean Square Error of Approximation (RMSEA)	0.041
	Standardized Root Mean Square Residual (SRMR)	0.0378
	Goodness of Fit Indices (GFI)	0.968
	Adjusted Goodness of Fit Indices (AGFI)	0.944
Incremental Fit Measure	Comparative Fit Index (CFI)	0.972
	Incremental Fit Index (IFI)	0.973
	Normed Fit Index (NFI)	0.941
	Tucker Lewis Index (TLI)	0.958
Parsimonious Fit Measure	Chi Square/ Degree of Freedom (Chisq/df)	1.815
	Parsimony Goodness Fit Index(PGFI)	0.556
	Parsimonious Normed-Fit Index(PNFI)	0.618

5) Hypothesis Testing

In this study, the structural equation modeling examined the relationships between consumer behavior setting (Concern and Switch), consumer behavior, informational reinforcement, aversive reinforcement, utilitarian reinforcement and consumer learning history. Table 6 shows the result of hypothesis testing and figure 2 shows the diagram of structural model of Malaysia consumers' switching behavior toward genetic modified food.

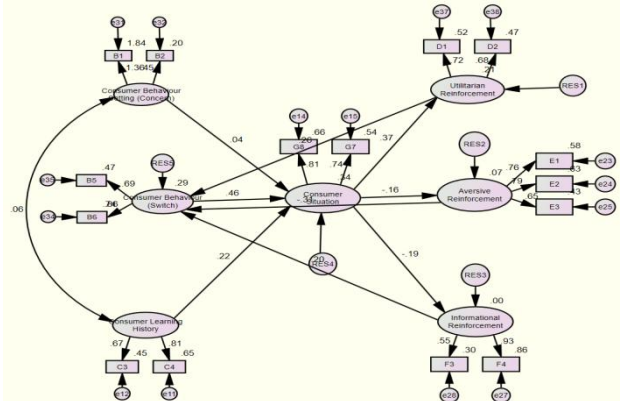

Fig. 2. Structural Model of Malaysian Consumers Intention to Switch to Consume Genetic Modified Food.

The examination of the Behavior Perspective Model for genetic modify food shows the main predictor influencing consumer to consider switch from conventional food to GM food were the utilitarian reinforcement (β=0.317), followed by informational reinforcement (β=0.187) and aversion reinforcement (β=-0.332). For hypothesis H_7, the probability of getting a critical ratio as large as 3.478 in absolute value is less than 0.001. In other words, the regression weight for utilitarian reinforcement in the prediction of consumer preference is significantly different from zero at the 0.001 level. When consumers' perception on GMO food's improvement in food nutritional content and appealing for consumption (utilitarian reinforcement) increase by 1, consumer preference to switch to consume genetic modified food will increase by 0.317.A similar result was found in the research done by Lang (2013), Turker et. al., (2013) and Lusk et. al., (2005); when consumer perceived GMO food have potential for improved nutritional qualities in bioengineered foods, consumers are willing to pay if they are being informed of GMO benefits such as improved nutrition. This indicates that nutrition may increase the acceptability of GMOs.

Furthermore, Hypothesis H_8 shows that the probability of getting a critical ratio as large as 4.992 in absolute value is less than 0.001. In other words, the regression weight for aversive reinforcement in the prediction of consumer preference is significantly different from zero at the 0.001 level for a two-tailed test.When consumer perceived that GMO food may trigger cancer, allergic reactions and increase toxins which may harm human health (aversive reinforcement) goes up by 1, consumer prefer to consume genetic modified foodwill goes down by 0.332.According to Sorgo et al., (2015), negative emotions including fear and disgust have strong correlation with GMO rejection. This indicates that any cause of fear can play a role in negative attitudes toward biotechnology.On the other hand, for hypothesis H_9, the probability of getting a critical ratio as large as 2.058 in absolute value is 0.040. In other words, the regression weight for informational reinforcement in the prediction of preference towards GMO food is significantly different from zero at the 0.05 level. When informational reinforcement goes up by 1, consumer preference to switch to consume genetic modified food goes up by 0.187. Despite there is a negative reinforcement on GMO food used in this study, apparently the preference to switch still exist since many consumers are not aware of the difference between GMO and non-GMO products. Amin et. al (2014) stated that it is not the consumers' perception of the "content knowledge" that is relevant but rather their perception of being able to differentiate whether the food is good or bad and whether they have control on the consumption that matters.

Table 6 shows that the main predictor influencing consumer situation such as likelihood to pay or recommend GMO food were consumer behavior (switch) (β=0.456) and consumer learning history (β=0.213). The result shows that whether the food

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contained additive, herbicides or pesticides or not will not influence consumer preference. However, if consumer was informed adequately by the government and people who are important to them, this will positively influence consumer situation which are willingness to pay for GMO food. The probability of getting a critical ratio as large as 3.251 in absolute value is 0.001. In other words, the regression weight for consumer learning history in the prediction of consumer situation is significantly different from zero at the 0.001 level A study of risk perception by Dean et al., (2007) and Pudury et al., (2010) suggested that the public trusts experts (including university scientists, environmental groups, and consumer organizations) government, supermarket and industry scientists are relevant sources of GMO information. When these expert sources agreed with government agencies about GMOs, government messages appeared to be more impartial and were viewed more positively by consumers. This implies that consumers trust the messages from expert more compare to those without knowledgeable input. For hypothesis H_3, the result shows that the probability of getting a critical ratio as large as 6.045 in absolute value is less than 0.001. In other words, the regression weight for consumer preference in choosing GMO food in the prediction of consumer situation is significantly different from zero at the 0.001 level with two-tailed test.When consumers prefer to choose GMO food over conventional food goes up by 1, their willing to pay and recommend GMO food to others people goes up by 0.456. This result is similar with Huffman et. al., (2007), where consumers with high self-reported GMO knowledge have shown lesser willingness to pay for GM products as compare to those with low self-reported knowledge. This study was done based on an auction of both GM and non-GM consumer goods.

As show in Table 6, for hypothesis H_4, the probability of getting a critical ratio as large as 4.773 in absolute value is less than 0.001. In other words, the regression weight for consumer situation in the prediction of utilitarian reinforcement is significantly different from zero at the 0.001 level. When consumer situation increases by 1, utilitarian reinforcement goes up by 0.308. On the other hand, for hypothesis H_5 and H_6, consumer behavior have a negative influence on aversion reinforcement (β=-0.152) and informational reinforcement (β=-0.200).When consumers perceived that GMO food has lesser side effect, will not create new diseases or toxic and will not be harmful to human health, they are willing to pay for it and recommend GMO food to others consumer. McComas et.al (2014) and Mielby et.al (2013) stated that lesser negative opinions on GM products resulted higher acceptance especially for GM products that has less distinction.

Table 6: Result of Hypothesis Testing

	Hypothesis			β	Standard Error (S.E)	Critical Ratio (C.R)	p-value	Decision
H_1	Consumer Situation	<--	Consumer Behavior	0.022	0.038	0.584	0.559	Not Supported
H_2	Consumer Situation	<--	Consumer Learning History Setting (Concern)	0.213	0.066	3.251	0.001**	Supported
H_3	Consumer Situation	<--	Consumer Behavior (Switch)	0.456	0.075	6.045	***	Supported
H_4	Utilitarian Reinforcement	<--	Consumer Situation	0.308	0.065	4.773	***	Supported
H_5	Aversive Reinforcement	<--	Consumer Situation	-0.153	0.069	-2.218	0.027*	Supported
H_6	Informational Reinforcement	<--	Consumer Situation	-0.200	0.073	-2.747	0.006**	Supported
H_7	Consumer Behavior (Switch)	<--	Utilitarian Reinforcement	0.317	0.091	3.478	***	Supported
H_8	Consumer Behavior (Switch)	<--	Aversive Reinforcement	-0.332	0.066	-4.992	***	Supported
H_9	Consumer Behavior (Switch)	<--	Informational Reinforcement	0.187	0.091	2.058	0.040*	Supported

***Significant at 0.001, ** Significant at 0.01, *Significant at 0.05

V. CONCLUSION

Based on the potential of GM food products and Malaysia's plan to expand its biotechnology industry, the market for GMO exists if Malaysian consumers are appropriate educated on the benefits of GM food products from the perspective of environment, health, food safety, the moral, ethical and religious implication. Based on the result from this study, it is found that consumer learning history and switching behavior is conducive in affecting Malaysian consumers' preference towards GMO food products. Reinforcement factors like utilitarian (nutritional value and food appeal), aversive (cancerous outcome, allergic problem and anti-nutrients) and informational (disease and impact on other organism) do affect consumer's preference and can be considered be marketers for

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strategy implementation in promoting GMO food products.

Malaysian firms that involved in manufacturing and distributing GMO food products might utilize consumer learning to promote the consumption of GMO food products. One of the strategies that firms can innovate if the establishment of positive GMO food tagline. Such taglines are important to create a positive mindset from consumers towards GMO food products. Themes or elements that corporate firms can utilize on its tag lines are food security and natural resource scarcity. Relevant promotional campaign can be established to promote the benefits of GMO foods and such campaign will be more effective if there is a collaboration between the private firm and government bodies since influence from government play an important role in educating the public. In addition, medical practitioners can also spread positive word-of-mouth on the benefit of GMO food products. One of the challenges that face by consumers are the ability to differentiate the GMO food products from others. Logo or symbol for GMO can be established to provide proper identity for the GMO food products. Such logo /symbol can be included in the packaging of the food for the convenience of the consumers. Government agencies like MARDI, FAMA and PORIM can also further research on the potential of GMO food products by enhancing its resistance to illness, productivity, nutritional value, durability and others.

After conducting this research, researchers can look into a few perspectives to improve on the study of GMO food products or its relevance application. Researchers can focus on qualitative research on GMO Food through comparison of preference between GMO, conventional food products and organic. In-depth interview and experimental research can be conducted to explore the preference of consumers. Besides, areas like willingness to pay and satisfaction after consuming GMO food products can be further explored in the field of consumer behavior.

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