

THE GLOBAL & MALAYSIAN FOOD CRISIS AND THE NEED OF GENETICALLY MODIFIED (GM FOODS)

NOORAZLIN RAMLI, ROZITA ABU & SALMALINA SALLEH

Faculty of Hotel and Tourism Management

Universiti Teknologi MARA

Dungun, Terengganu, Malaysia.

ABSTRACT

This study empirically examines the level of consumers' understanding and knowledge about food crisis and Genetically Modified (GM) foods. Through self reported experiences on consumers' understanding and knowledge about food crisis and GM foods, the consumers that had been shopped in hypermarkets around Shah Alam area were surveyed. Result revealed the consumers do understand and have knowledge about global and Malaysian food crisis, but have little knowledge and understanding about GM foods. In further, it can be concluded that during global and Malaysian food crisis, there is a need for GM foods and GM foods might be a viable option to deal with the crisis. Consumers' understanding from the interviews were validated and supported through qualitative information obtained from interview approach. The face-to-face interview approach was conducted among experts of various areas such as biotechnology, economic and food industry and it provided truly significant and in-depth information for this study. The overall findings from this study could be streamlined and at the end it clearly indicates that during global and Malaysian food crisis, there is a need for GM foods and the scientific advance such as GM foods is important to deal with the long term needs. However, it is important to see a more focused initiative and systematic development for biotechnology in Malaysia. Thus, efforts to increase funding and improve coordination between government agencies, private companies, academicians and experts responsible for food assistance are all excellent initiatives that have to be looked into.

Keywords: Genetically Modified (GM Foods); Food crisis; Global Food Crisis; Malaysian Food crisis

INTRODUCTION

According to International Monetary Fund (2008) in the revisions of October 2008, global economic growth will slow down to 3.9% in 2008 and 3.0% in 2009. The forecasts have been downgraded in the wake of the financial and stock market crises of September and October 2008, which saw the failure of several prominent financial institutions, a crash in most world stock markets and the partial nationalization of several major banks in advanced economies. In 2010, however, world growth is expected to rebound to 4.2% and then stabilize at 4.8% in 2011 and 2012 (World Bank Report, 2008). Forecasts have deteriorated owing to a crisis in global financial and credit markets in September and October 2008, which some analysts consider to be the most serious since the Wall Street crash of 1929.

The report also revealed that strong inflationary pressures continue to be led by oil and food prices, which remain comparatively high, and while prospects for the 2009-2012 periods are uncertain, most projections conclude that the global economy should start to recover in 2010.

A key factor in determining the economic outlook will be inflation, which is strongly affected by global oil and food prices (Pilbeam, 2001). U.S Department of Statistics (2008) noted that these remained uncertain when oil prices reached a record high of US\$147 per barrel in July 2008. Food prices remain partially dependent on climatic conditions and harvests, for instance with drought in parts of East Asia and Australia in 2008 cutting rice production and raising prices. Given rising

global food demand and the ongoing use of crops for bio-fuels, future crop failures could place more upward pressure on prices (Food & Agriculture Organization (FAO), 2008).

Moreover, the World Bank (2008) reports that global food prices rose 83% over the last three years. On the other hand, FAO (2008) cites a 45% increase in their world food price index during the past nine months. It also has been stated that as of March 2008, average world wheat prices were 130% above their level a year earlier, soy prices were 87% higher, rice had climbed 74%, and maize was up 31%.

Additionally, prices for corn, wheat, soybeans, rice, and other food staples have risen sharply over the past year (FAO, 2008 and World Health Organization (WHO), 2008). This has strained the ability of poor people in developing countries to feed their families and augmented widespread anger. Patel (2007) stated that since mid-2007, the rising prices have led to protests and riots in Burkina Faso, Cameroon, Egypt, Haiti, Somalia, and number of other countries.

Regrettably, some countries including Indonesia and Kazakhstan have exacerbated the problem by restricting exports of rice and wheat, respectively. Although consumers in developed countries are better able to adjust to higher prices because of their higher incomes, they too have felt the pinch of higher food prices.

Number of factors has contributed to these price increases. Ethanol and other bio-fuel mandates have created a competition between food and fuel, which in turn has helped to drive up food prices (Pilbeam, 2001). According to Braun & Joachim (2007), agricultural subsidies and other policies in developed and developing countries distort the market, creating shortages or surges and undermining global economic growth. Increases in the price of oil and natural gas such as key inputs for fertilizer, chemicals, and fuel, which are necessary for planting, growing, harvesting, and transporting crops to market have also driven up prices. Export bans reduce domestic prices, creating disincentives for production while reducing global supply and contributing to price increases in other countries. In addition, adverse weather in key agricultural producer countries has reduced harvests and therefore global stocks of corn, wheat, and soybeans (FAO, 2007).

In addition, many researchers (McPherson, 2008; Braun, 2008; Floto, 2003) noted that global food crisis also occurs due to overpopulation. They stated that the world population has increased year by year and food demand has continued to rise. However, Floto (2003) argued that incomes in the high populated and developing countries have also increased. Higher incomes mean people could afford more food and change their diets to include more meat, dairy products and processed foods. Thus, all of these products require more energy from cereal crops to produce than if cereal crops were eaten directly by humans. In line with that, this has resulted in a dramatic rise in global demand for cereal crops.

Furthermore, the uncertainty of climate conditions is also a factor to food crisis (Ghosh, 2008; Loewenberg, 2008; Smith, 2003; Singh, 2009; Walker, 2008). For example, the authors revealed that in Ethiopia drought is a main concern, where the failure of successive rains resulting in poor harvests in 2007 has been a key factor behind rising prices in the Amhara Region. Smith (2003) added that the uncertainty of climate conditions caused the food production to be low. Moreover, tropical storms such as Cyclone Sidr in Bangladesh and Typhoon Lekima in Vietnam during the 2007 growing seasons had already reduced food production at a time of rising food prices. In addition, Schaefer (2008) added that severe flooding could reduce overall production and lead to shortages of some items and rising prices.

Thus, genetically modified foods also increasingly came to be seen as a technical savior (Morris and Adley, 2000; FAO, 2008; Hayward, 2008; World Wild Fund for Nature (WWF), 2006). Food could

be grown with higher yields and in places where natural conditions are usually unfavourable. With increasing threats of climate change, overpopulation and higher prices, it would seem this technology is potentially more important (FAO, 2008). In fact, Malaysia could also be one of the countries that propose the need of GM Foods due the food crisis problem; after facing with uncertainty of economic conditions recently and it could be a preparation for the Malaysian food supply system (Melati, 2008).

Problem in Context

The years 2007 until 2008 saw dramatic increases in world food prices, creating a global crisis and causing political and economical instability and social unrest in both poor and developed nations. The systemic causes for the worldwide increases in food prices continue to be the subject of debate. Moreover, initial causes of the late 2006 price spikes included unseasonal droughts in grain-producing nations and rising oil prices (Wahlberg, 2008). Besides that, oil prices further heightened the costs of fertilizers, food transport, and industrial agriculture. In addition, other causes may be the increasing use of bio-fuels in developed countries and an increasing demand for a more varied diet across the expanding middle-class populations of Asia. These factors, coupled with falling world-food stockpiles have all contributed to the dramatic worldwide rise in food prices. Hence, long-term causes remain a topic of debate. These may include structural changes in trade and agricultural production, agricultural price supports and subsidies in developed nations, diversions of food commodities to high input foods and fuel, commodity market speculation, and climate change. As found by WHO (2006), globally a number of factors have contributed to the current food crisis such as high oil prices and transportation costs, growing demand for food, crop damage due to pests, diseases, floods and drought, and crop diversion for bio-fuels. Additionally, according to U.N. World Food Programme (2007), the food crisis worsened the situation whereby shortages of food happened and this can be seen from statistics which revealed that one child dies of hunger every five seconds.

Furthermore, by 2025 there will be a shortage of 400 billion tonnes of cereal grains that make up the staple diet due to overpopulation and the uncertainty of climate conditions which will force food prices to increase by that year (FAO, 2008). As a result, the world prices for rice, wheat, soybeans and corn have all increased sharply and ironically, rice and wheat prices will be doubled. Chronically, rice is up 30% or more in a week. Hunger is always knocking on the door of the poor and any increase in inflation, in food prices, will affect their ability to eat (FAO, 2008). The situation thus forces people to seek for lower prices, and affordable and nutritious food as an alternative.

In Malaysia, the dramatically increase of fuel prices to 40% in June 2008 affected the food prices to be increased by 20% - 30% (Abdullah et al, 2007). Ironically, the shortages of commodity reported to be occurred due to the exported food restrictions by other countries and the most affected are commodity foods and staple diets. The world's biggest rice exporter, Thailand and other Southeast Asian nations like Cambodia, Vietnam and Myanmar will impose a ban on rice exports to help stabilize domestic food prices and to create disincentives for production. Thus, it is a factor that leads to reduced global supply and contributing to price increases in other countries. Due to this situation, many people in the region are worried over the reports that rice is getting more expensive and supplies are dwindling. Considering the high price of rice, Malaysia will gradually import less rice in the near future and is now looking to be self-sufficient.

Due to this problem, biotechnology or precisely genetic engineering is a part of the solution (Prakash, 2008). The Genetically Modified (GM) plants which are then used to grow GM food crops will help in increasing food production. This is meant to translate into a product with a lower price, greater benefit in terms of durability, availability, longer shelf life and nutritional value (Eicher et al., 2006). The main objective is further support by the immediate objectives (i) to determine the level of consumers' understanding and knowledge about food crisis and GM Foods (ii) to determine to what extent Global and Malaysian Food Crisis need the use of GM Foods.

METHODOLOGY

Research Design

A research design provides the basic directions for carrying out the study. The present study was conducted by way of two approaches which are quantitative and qualitative. The quantitative approach was used because it is easy to determine its rigor and enables the researcher to collect a significant amount of data within a short time frame (Ticehurst & Veal, 1999). With that, a series of self-administered questionnaires have been developed to obtain the customer's knowledge and understanding of the issues.

The qualitative approach was also used in this study. Qualitative research is best suited to the types of questions which require exploration of data in depth over a not particularly large sample. One of the strengths of qualitative research is that it allows to gain an in depth perspective, and to grapple with complexity and ambiguity. This is what makes it suitable to analyse particular groups. Interview is the most appropriate for this study. However, it would be difficult for the researcher to interview the respondents face to face throughout the period of study.

The combination of these methods or known as triangulation method was found as the most appropriate method of information gathering compared to using any single method of research. According to Sekaran (2000), the triangulation method seems to be the best way for this study because it requires conducting similar research using several different methods and comparing the findings. This theory is supported by Hair et al. (2007) because the study carried out a quantitative survey and need more in-depth information about particular aspects of the survey and it may decide to use in-depth interviews, a qualitative method.

Thus, in this study, the questionnaire survey is developed to evaluate consumers' understanding, knowledge and the perception of food crisis and GM Foods which are the main issues of this research, while for the qualitative approach; interview sessions were held to support the results.

Population and Sampling

In order to measure the knowledge and understanding of customers of the food crisis and GM foods, a self-reported experience through a questionnaire survey was chosen as the best approach for data collection. This approach was selected to ensure that the result would be based upon actual customers' understanding of the issues regarding this study.

The hypermarkets were targeted for the purpose of the study. First, because hypermarkets have become more developed and are rapidly growing in the retail business of Malaysia, have dominated the Malaysian hypermarket environment and food accounted for the highest share of total hypermarket value sales in 2007 (Euromonitor, 2007). Secondly, the Malaysian Hypermarkets also have broader types of food products than other retail outlets; basically from raw and fresh products, dried products, canned until pre-cooked food products (ACNielsen, 2006).

With regard to this statement, the Klang Valley area had been chosen because it is the most saturated with hypermarkets in Malaysia with a total of 18 outlets (Euromonitor, 2007). However, from the total 18 hypermarkets in the Klang Valley, this study was only undertaken in 4 hypermarkets around the Shah Alam area due to time and budget constraints. Besides that, lack of in-depth or empirical investigation or publication of such a study in Malaysia has meant the present study which use Shah Alam as a location therefore will act as a benchmark and basis for other researchers to look at larger perspectives in the near future. This study might be a fundamental basis for further research to be replicated in the same situational area of study.

Apart from that, the only 4 hypermarkets chosen were Tesco Hypermarket in Section 13, Tesco Extra in Section 13, Giant Hypermarket in Section 13 as well as Giant Hypermarket in Section 18. Owing to the large population in the Shah Alam area, it would be difficult for a researcher to survey the whole population. Salkind (2003) states that studying a sample rather than the entire population is likely to lead to a more reliable result. Based on this statement, thus convenience sampling is the most appropriate for this study. Given that consideration, all the customers who shopped in the food area at every 4 hypermarket were the respondents of the questionnaires distributed. The respondents included students of higher institutions, government servants and private company employees.

With regard to the sufficient number of respondents for this study, Roscoe's (1975) rule of thumb indicated that sample sizes larger than 30 and smaller than 500 are appropriate for most research. With this benchmark plus the time constraints, 30 customers from each hypermarket were surveyed and this came to a total of 120 respondents thus giving reliable and meaningful results.

Research Instruments Design

In planning the research instrument, consideration was initially given to two related issues. In this research, questionnaires were adopted. Considering the difference in customers' profiles and educational levels, the questionnaires had to be simple and easy to understand with minimum reading and writing. Questions were therefore composed as understandable as possible with simple language to reduce any possible uncertainty. In order to obtain a good level of response and useable data, Salkind (2003) noted that it was essential to keep the survey instrument as straightforward to complete as possible. The second issue is related to the language use for the instrument. The use of Bahasa Malaysia and English versions, is appropriate as both languages are widely used in Malaysia and because some respondents might have a poor understanding of either language. The questionnaire was prepared in English and then was translated into Bahasa Malaysia. Preparing the questionnaires in two languages allowed subjects to answer in the language they were more familiar with.

In planning the style and format of the questionnaires, closed-ended questions using a numerical Likert type of scale was used in this study. Sekaran (2003) noted that this type of scale shows reliability when ranking or ordering items with regard to particular attitudes. On the other hand, respondents only needed a short of time to complete the set of questionnaires and it helps them to make quick decisions to choose the scales option. Besides that, there was a section in the questionnaire that applied the ranking scales type of questions. This type of scale is relevant to answer the objectives of the study and it was used to tap preferences between more objects or items (Hair et al, 2007). Moreover, respondents consistently showed preferences for product one over product two, three and four so the researcher reliably understood which product line demanded utmost attention. However, in order to seek a wider range of respondents' opinion and comments, there were several questions that were designated in an open-ended style in the last section of the questionnaires.

The survey questionnaire was divided into four major sections. Each section contained questions addressing the variables to suit the research objectives. The next section further discussed the source of questions and the rationale for their selection.

Procedure of Data Collection

Questionnaire distribution took place over a one-month period in August 2009 at each of the selected hypermarket in the Shah Alam area namely; Tesco Hypermarket, Tesco Extra, Giant Hypermarket Section 13 and Giant Hypermarket Section 18. The questionnaires were distributed during weekends (Saturday and Sunday) so that the broad range of customers could be reached rather than on week days. The customers who shopped at the food area received a set of questionnaire. Before proceeding with a set of questions, each respondent who agreed to take part

was briefed about the study and given the information through the information sheet attached to the questionnaire. The information also stated that participation was voluntary and respondents were free not to complete, or to answer any question in the questionnaire. In addition, the information sheet informed respondents that all information provided by them was strictly confidential and that no individual respondent would be identified. As a result, a total of 145 questionnaires were collected and 120 were found useable. The questionnaires were then coded and keyed in Social Statistical Package (SPSS) Version 16.

Analyses and Results

In order to achieve the stated objectives, a basic descriptive statistical technique was employed. This statistical technique is important to be used in this study to find the result of quantitative data. Data was entered into Statistical Packages for Social Windows Version 16.0 (SPSS) programme to analyze the findings. The last step in analyzing quantitative data (questionnaires) is to discuss the open-ended questions to support the results given by respondents.

On the other hand, another part will present and discuss the findings of the qualitative part of the study. The results are mainly based on the qualitative findings from the interviews with the respective experts of the various areas involved. Unstructured interviews were conducted only to support the results obtained from quantitative data. Finally, the last section discusses the findings of the qualitative part of the research. The results are mainly based on the qualitative findings from the interviews with the respective experts in various areas of study such as in biotechnology, food industry as well as economics. The findings will support the quantitative analysis results.

QUANTITATIVE ANALYSIS AND DISCUSSION

Analysis on Consumer Understands and Knowledge about Food Crisis and GM Foods.

The descriptive statistic looking at the mean scores given by the respondents on their understanding and knowledge about food crisis and GM Foods. The respondents' scores are presented in (Table 1).

Table 1: The Mean Scores for Consumer Understands and Knowledge about Food Crisis and GM Foods

No.	Item	n	Mean (m)	S. D
1.	The food crisis is a critical issue	120	3.90	1.064
2.	The uncertainty of global economic conditions worsens the food crisis	120	4.18	0.635
3.	The increasing prices of food are expected to remain higher	120	4.25	0.770
4.	There are people who go through hunger because of rising food prices	120	4.16	0.767
5.	The food crisis appears because there are too many people in the world	120	4.16	0.979
6.	The food shortages force people to consume food without thinking of nutrition	120	4.23	0.695
7.	The uncertainty of climate conditions (eg: global warming) affects food production.	120	4.37	0.699
8.	GM Foods are the same as Engineered Food	120	4.17	0.882
9.	GM Foods will prolong shelf life of food, increase appearances, offer lower prices and are more nutritious.	120	4.22	0.601
10.	GM Crops are important for pest and disease resistance	120	4.26	0.704

Looking at the mean scores of the listed items, it appears that the respondents agreed with the overall questions regarding their knowledge and understanding on food crisis in Section B. The questions regarding knowledge on food crisis comprise of item 1 to 7. This is in line with the magnitude of mean scores given on the knowledge of customers if they thought that the food crisis is a critical issue (Item 1, m = 3.90).

On the other hand, there are several items which are rated as agreed by the respondents. It seems like the respondents mostly agreed with the statement that the uncertainty of global economic

conditions worsens the food crisis (Item 2, $m = 4.18$). Besides that, the respondents also agreed that the increasing price of food is expected to remain higher (Item 3, $m = 4.25$) and there are people who go through hunger because of the rising food prices (Item 4, $m = 4.16$).

In addition to these, respondents agreed to the statement, the global food crisis seems to have exploded because there are just too many people in the world (Item 5, $m = 4.16$) and they agreed that the food shortages supply force people to consume food without thinking of nutrition (Item 6, $m = 4.23$). This notion is further supported when respondents also agreed that the uncertainty of climate conditions affect food production (Item 7, $m = 4.37$). These results are expected as the respondents have some knowledge and understanding on the issue regarding global food crisis.

However, it can be said that the respondents are slightly agreed with the statement regarding GM foods and it seems that they were slightly understood on what exactly GM foods mean. As evidence, all three questions related to GM Foods received mean scores ranging only from 3.66 to 3.82. The questions of knowledge and understanding about GM foods comprise of item 8 to 10.

By looking at the table, it can be clearly seen that the respondents slightly agreed with the statement that GM foods are the same as engineered food (Item 8, $m = 3.78$). The respondents also slightly agreed with the statement which stated that GM foods will prolong shelf life of food, increase appearances, offer lower prices and are more nutritious (Item 9, $m = 3.66$). The respondents also have slightly understood the question that GM crops are important for pest and disease resistance (Item 10, $m = 3.82$). What can be said from this overall result is that the respondents have some knowledge and understanding about the issues of food crisis but they slightly understood about what are the GM foods all about.

Analysis to What Extent Global and Malaysian Food Crisis Needs the Use of GM Foods.

The descriptive statistics look at the mean scores given by the respondents in order to determine to what extent global and Malaysian food crisis need the use of GM foods. The respondents' scores are presented in (Table 2).

Table 2: The Mean Scores for What Extent Global and Malaysian Food Crisis Needs the Use of GM Foods.

No.	Item	n	Mean (m)	S.D
1.	Global food crisis needs the use of GM Foods	120	4.64	0.531
2.	Malaysian Food Crisis needs the use of GM Foods	120	4.50	0.502
3.	Overpopulation throughout the world may cause Global Food Crisis	120	4.53	0.501
4.	Overpopulation throughout the world forces people to choose GM Foods.	120	4.54	0.533
5.	Higher food prices may cause Global Food crisis	120	4.58	0.602
6.	Higher food prices lead to the need of GM Foods	120	4.41	0.542
7.	The uncertainty of climate condition is a factor that leads to Global Food Crisis.	120	4.36	0.683
8.	The uncertainty of climate condition leads to the need of GM Foods	120	4.54	0.533
9.	Higher food prices are the main factors to Malaysian Food Crisis	120	4.64	0.547
10.	Higher food prices may lead to the need of GM Foods in Malaysia	120	4.74	0.440

By looking at the table, it can be said that the respondents were strongly agreed to the most of the questions of to what extent global and Malaysian food crisis need the use of GM foods. Out of nine items, seven (7) appeared to have strongly agree result; meaning that they have a very strong agreement with the statement given. This is in line with the magnitude of mean scores given on the statement that the respondents think that global food crisis need the use of GM foods (Item 1, $m = 4.64$). Similarly, respondents seem to strongly agree with the statement that the Malaysian food crisis needs the use of GM foods (Item 2, $m = 4.50$).

In addition, respondents robustly agreed that overpopulation throughout the world causes global food crisis (Item 3, $m = 4.53$) and it forces people to choose GM foods. (Item 4, $m = 4.54$). Besides

that, the respondents also have a strong agreement about the statement that higher food prices may cause global food crisis (Item 5, $m = 4.58$) and they viewed that it leads to the need of GM foods (Item 6, $m = 4.41$). On the other hand, the respondents also agreed that the uncertainty of climate conditions is a factor that leads to global food crisis (Item 7, $m = 4.36$) and they strongly agreed if GM foods can be a viable option in that kind of situation (Item 8, $m = 4.54$). The result is also similar towards the statement that 'Higher food prices is the main factor to Malaysian food crisis' (Item 9, $m = 4.64$). Conversely to other results, it was found that most of the respondents were slightly agreed if the higher food prices may lead to the need of GM foods (Item 10, $m = 3.44$).

QUALITATIVE ANALYSIS AND DISCUSSIONS

Areas Background

To begin with, the three (3) areas participating in this study are covered and no interpretation is provided in this section. The three areas related to this study are biotechnology, economic and food industry. It is important to note that three (3) areas have different backgrounds, particularly in terms of their major impinge on food crisis. Moreover, their background information was gained from face-to-face interviews with the experts of that particular area as well as external sources such as faculties and universities. Furthermore, for each of the area, there were 2 experts interviewed; and to sum up there were 6 interview sessions conducted.

Global and Malaysian Food Crisis Need the Use of GM Foods

This section analyses the first three (3) questions from the respective managers of all food SMEs which participated in this study. Based on the objective of the study, the researcher seeks to discover to what extent Global and Malaysian Food Crisis need the usage of GM Foods. However, as a starting point for the interview, Questions 1 and 2 were asked in order to retrieve the experts' understanding of the whole scenario behind the Food Crisis issues and GM Foods. Subsequently, Question 3 was introduced to identify to what extent Global and Malaysian Food Crisis need the use of GM Foods. These three questions are as follows:

1. Do you know about Global Food Crisis as well as the Malaysian Food Crisis?
2. In your opinion, do you think that the Malaysian Food Crisis is a critical issue?
3. Do you think that GM Foods can be a viable option to ease food crisis?

From the interview, it was found that all six (6) experts knew about the issues of Global Food Crisis as well as the Malaysian Food crisis. However, only three (3) of the experts viewed that the Malaysian food crisis is a critical issue, while the rest viewed that the Malaysian food crisis is only at the early stages. They stated that, the only main factor of the Malaysian food crisis is because of higher food prices and it happened due to the uncertainty of economic conditions.

As might be inferred, all six (6) experts from different areas had different views on the issue of Food crisis and the need of GM foods. To illustrate, Expert A, first made a statement that GM Foods might be a possible way to ease food crisis, but not to solve the crisis at all. He stressed the importance of economic aid in the short term to deal with the crisis, but discussed the need for scientific advances in the long term. He in verbatim quoted that:

"If we are really going to raise the yield thresholds significantly then probably biotechnology is going to help. For example, if we can make wheat and rice more like corn, the plants could be more productive. The photosynthesis process in corn allows the crop to thrive with less water. Mmm..(thinking)..It would be very complicated to do, but it may be possible. I think... in order to ease the world's food crisis issues, we must embrace these kinds of scientific interventions into nature.."

Expert B shared the same view as the Expert A. She further asserted that biotechnology is a way to deal with food crisis. However, with the recent efforts spearheaded by the government to deal with the issues, it is important to see a more focused initiative and systematic development for biotechnology in Malaysia. She then noted that the right mentality is needed to develop the biotechnology industry in Malaysia. The correct combination of experts and strategic thinkers will fuel success and ensure practicality for Malaysian biotechnology initiatives. Thus, participation and

opinion from the private sector is necessary to drive practical initiatives for the country. In this case, Expert B revealed that:

“In order to move competitively in this fast paced biotechnology race, while building our skills and technology domestically, Malaysia should be more aggressive in obtaining technology transfer opportunities by merging with appropriate biotechnology incumbents. Acquisition of strategic biotechnology companies will provide an immediate boost to our domestic biotechnology players and provide them with global reach. Available matching funds will enhance the bridge between local and foreign companies...”

In further, Expert C and D represented for the economic area of study. From economist perspectives, Expert C viewed that higher food prices is a main factor to the food crisis globally and nationally. She asserted that the global rise in food prices is felt acutely around the world specifically in the Asia-Pacific region, with greater impact on net food-importing countries. She then added that food prices have increased sharply since 2005 but have surged dramatically since 2007 and the price spikes have been more pronounced in grains and oil. Expert D further pointed to the sluggish growth in global food production, the rapid population growth, compounded by crop failures due to extreme weather-related and climate variability as one of the main reasons for the rise in food prices. Moreover, food production shortfalls have been linked to competing use of land, labour and water, driven by demands from the export market. Thus, both agreed that GM Foods might be a viable option to increase the food production and supply in dealing with the food crisis. When asked about the idea of GM foods commercialisation to deal with the food crisis, she replied: *“Certainly, biotechnology can be one of the solutions to fight back food shortage. But the issue remains on what programmess, particularly on the food crop production, that we must focus on..”*

Expert E and F who represented food industry also gave positive feedback on the use of GM Foods during food crisis. Expert E noted that during food crisis, people seek lower food prices, affordable and malnourished foods. She added that GM foods are developed and marketed because there is some perceived advantages to either producers or consumers of these foods. This is meant to translate into a product with a lower price, greater benefit in terms of durability or nutritional value or both. However, Expert F argued that consumers started to wonder about safety because they perceive that modern biotechnology is leading to the creation of new species. This is all about consumers' perception toward GM Foods. In line with that, he added that it is important to educate and expose to the public about what GM Foods is all about and the importance in labeling GM Foods. As he quoted in verbatim that:

“Consumers frequently ask, “What is in it for me?”I think, consumers' concerns have triggered a discussion on the desirability of labeling GM Foods, allowing an informed choice...It is not impossible to make GM Foods as a viable option to food crisis, it is just a matter of how, we have to change the perception of people first towards GM Foods.

The overall findings in this section do support the previous Sections 4.6, 4.7 and 4.8. This indicates the level of consumers' understanding and knowledge about food crisis and GM Foods. Besides, the result also supports the results of to what extent Global and Food crisis need the use of GM Foods. With that, the next chapter discusses the overall findings, recommendations, limitations and conclusion of the study.

DISCUSSIONS

As highlighted before, it was important to answer the first research objective; to determine the consumers' level of knowledge and understanding on Global and Malaysian food crisis as well as GM foods. It was apparent that the majority of the respondents understood and has some knowledge about the recent global and Malaysian food crisis issues. With regard to this, it was found that they understood that the issues of global food crisis are caused by three main factors which are overpopulation, higher food prices and the uncertainty of climate conditions.

However, from the results, it was found that consumers viewed the Malaysian food crisis as not a critical issue yet and it is just at the early stage. In line with that, the statements had been supported by some Malaysian experts who declared that the Malaysian Food crisis is a matter of higher food prices as there is a problem of food supply shortages. The results found confirmed previous studies

by Abdullah et al (2000), Singh (2009) and Chen (2007) who agreed that the issues of food availability is the issue of stability and the lack of stability in food supplies can lead to a number of problems, one of which is fluctuations in price.

Unlike the higher knowledge and understanding about food crisis, consumers were found to have less knowledge about GM foods. The consumers in fact, are on familiar terms with GM foods that it is just an altered and modified food. Despite having a low level of knowledge and understanding of what GM foods are, they believe that science intervention or modern biotechnology namely GM foods may change the attributes of foods in term of appearances, shelf life, availability, supply as well as nutritional value. On the other hand, there was a general understanding that GM food is the same as Engineered Foods and it is perceived to important for pest and disease resistance.

Contrary to the above findings, respondents agreed that the higher food prices is the main factor to the Malaysian Food Crisis, nevertheless they slightly agreed if higher food prices may lead to the need of GM Foods. The findings clearly showed that the respondents somewhat agreed if during the Malaysian food crisis, GM foods would be an alternative to deal with the crisis. Furthermore, the experts in various areas such as biotechnology, economic and food industry supported and strengthened the notion that during food crisis in Malaysia, GM foods may be a viable option to ease the crisis. However, they added that it is important to see a more focused initiative and systematic development for biotechnology in Malaysia. Thus, the scientific advance such as GM foods is important to deal with the long term needs.

In conclusion, consumers do understand and have knowledge about global and Malaysian food crisis, but have little knowledge and understanding about GM foods. This probably happens because they are not being exposed extensively to GM foods and consumers' general lack of experience with foods produced by means of genetically modified food products. In further, it can be concluded that during global and Malaysian food crisis, there is a need for GM foods and GM foods might be a viable option to deal with the crisis.

CONCLUSIONS AND RECOMMENDATIONS

The research findings clearly show the results of consumers' knowledge and understanding on the global and Malaysian food crisis as well as GM foods. Besides, the study determines to what extent global and Malaysian food crisis need the use of GM foods. This study shows that GM foods are needed and it can be a viable option during the food crisis. The summary of research findings show the issues and an approach to deal with the food crisis and it could be contributed to the industry and to the body of knowledge.

First and foremost, this study contributes to the food industry in providing some knowledge about the importance of GM Foods in the Malaysian food crisis situation. In line with that, it will help in reducing problems related to shortages of supply and it may assist in facing the higher food price crisis in Malaysia. The study found that during the food crisis, the lack of stability in food supplies lead to a number of problems and it may cause higher food prices. From the study, it was revealed that several instances where instability of supplies of such foods had caused their prices to fluctuate, and to lead to high prices in the market especially when imports are not forthcoming. This is when GM foods are really needed to deal with the Malaysian food crisis.

Apart from that, an important feature of this study is to intensify research and development activities in GM foods and food production practices. This study is important in informing the community of biotechnology and agriculture on the food crisis situation and the need of GM foods. It can be seen as preparation for long-run measures. By knowing that GM foods can be a viable option to food crisis, Genetic Farming is such an example to help in cultivating crops and it will be

pest resistant. This also increasingly came to be seen as a technical saviour. If it works, food could be grown with higher yields and in places where natural conditions are usually unfavourable. With increasing threats of climate change, it would seem this technology is potentially more important. As previously mentioned, there are a few research carried out regarding GM foods. However, there is limited information and research being done regarding food crisis and the need of GM foods as it is just a recent issue. So, this study has flourished the research on related areas such as biotechnology, food industry and economic study especially in Malaysia. Besides that, it will be the basic foundation for other researchers and to inform the academic community on the food crisis situation and the need of GM foods.

Despite the above notion, the study found that Malaysians have not been well exposed to GM foods and its benefits. The major issues surrounding perception to accept modern technology or GM foods stem from the lack of accurate knowledge consumers have about the processes and applications of it as applied to food production. If people were aware of the possible benefits and global food supply that genetically modified may eventually give way to, then they would be in a better position to objectively weigh up the pros and come to a rational decision. In line with this, the study will educate the public regarding the need of GM Foods during food crisis situations; consequently enhance their awareness on the importance of GM foods in tackling such crises.

Additionally, from the findings that during food crisis there will be a need of GM foods, the study could inform GM food marketers to make special efforts and prepare to face the situation. They have to convince the public that this new emerging technology as applied to food production will provide more benefits than can be imagined. With that, consumers will hold a more positive attitude towards GM foods with the result that they will follow it up with acceptance during food crisis. Finally, since the study found that GM foods is important in dealing with food crisis, the Malaysian government, related parties and the mass media could take the responsibility to disseminate the relevant information and educate the public about gene technology in general and GM Foods in particular and how we can prepare ourselves to face the food crisis situation. Probably, biotechnology companies in Malaysia could be given support and incentives to market its products and services globally. Besides, this study could encourage professional marketing strategies to ensure that more locally-made biotechnology products reach the global market and help the country to raise the standard of its readiness to be a world player.

In addition to support from government institutions, private institutions especially financial institutions would provide more facilities and programmes to nurture and catalyse the development of the biotechnology industry in the country. Bankers, financial institutions, venture capitalists would work towards creating an environment which promotes and encourages capital liquidity and injection into biotechnology ventures. Thus, from these initiatives, Malaysia is prepared to face the crisis and not rely on importing foods from other countries as the main food supplies.

All in all, it is hoped that the findings of this study will facilitate Malaysian to be prepared for the Global and Malaysian food crisis and the importance of GM foods in dealing with the crisis. It was proved that Global food crisis was caused by overpopulation, higher food prices, and the uncertainty of climate conditions and we do need GM foods to ease the crisis. On the other hand, the Malaysian food crisis which was caused by higher food prices was related to the availability and stability of food supplies. Therefore, GM foods were found to be one of the viable options to ease the food crisis. However, there are challenges to be faced which deals with educating the public about GM foods. Besides that, it is imperative to ensure early emergency reaction to food shortage episodes, including the capacity to mobilise food quickly and cheaply in Malaysia. Thus, efforts to increase funding and improve coordination between government agencies, private companies, academicians and experts responsible for food assistance are all excellent initiatives that have to be looked into.

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