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NAME: Miss Sarobol Krualee

THIS THESIS HAS BEEN ACCEPTED BY

_____ **THESIS ADVISOR**
(Mrs. Orachos Napasintuwong Artachinda, Ph.D.)

_____ **THESIS CO-ADVISOR**
(Associate Professor Somporn Isvilanonda, M.A.)

_____ **DEPARTMENT HEAD**
(Associate Professor Ruangrai Tokrisna, Ph.D.)

APPROVED BY THE GRADUATE SCHOOL ON _____

_____ **DEAN**
(Associate Professor Gunjana Theeragool, D.Agr.)

THESIS

ECONOMIC ASSESSMENT OF INFORMATION AND LABELING REGULATION OF GM SOYBEAN MILK IN BANGKOK

SAROBOL KRUALEE

A Thesis Submitted in Partial Fulfillment of
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The introduction of Genetically Modified (GM) food to the market has become a controversial topic in many countries. Several aspects of GM food need to be addressed, particularly consumers acceptance and attitudes toward GM food which is essential information for producers and policy makers. Soybean milk is one of the most popular products among Thai consumers in comparison to other soybean products. On this background, we have investigated the acceptance of GM food using Logit Model. Furthermore, the choice of paying for Non-GM labeling is also conducted using Multinomial Logit Model. The survey data of 340 soybean milk purchasers in Bangkok metropolitan areas are representatives for this study.

The results indicate that consumers acceptance toward GM food is significantly affected by their attitudes towards GM products. Consumers who perceive health hazard and negative environmental effect are more likely not to purchase GM food, whereas those who perceive the benefit of GM food resulting in lower food price are more likely to purchase it. Regarding the impact on the probability of paying for non-GM labeling information on soybean milk, the results indicate that the probability of paying less for non-GM labeling is positively influenced by their lower willingness to pay for GM labeling than without GM labeling, attitudes towards health hazard from GM food consumption and environmental benefit from GM crop production. Furthermore, the probability of paying the same for non-GM labeling as no GM information is positively influenced by perceived benefit from GM crop production, whereas it is negatively influenced by their lower willingness to pay for GM labeling than without GM labeling and their attitude towards health hazard from GM food consumption. Interestingly, the probability of paying higher for soybean milk with non-GM labeling is negatively influenced by attitude towards environmental benefit from GM crop production.

These findings suggest that for GM food producers, lowering price of GM food would promote consumers acceptance on GM products. As for non-GM food producers, the result suggests that it may not be profitable to invest in Non-GM labeling, as it could increase producer's transaction cost, whereas consumers are unwilling to pay more for non-GM information.

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Student's signature Thesis Advisor's signature

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Sarobol Krualee

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CHAPTER I

INTRODUCTION

Statement of the Problem

Genetically Modified or GM foods are produced or processed foods from living things. Those living things may be plants, animals or microorganisms where their genetic material is altered by a scientific procedure called modern biotechnology or genetic engineering. This procedure will transfer or move genes from one organism into another organism in order to create a new desirable organism. However, this technology cannot generally occur by natural procedure as it has to be controlled by humans. Initially, this technology enhances yield and decreases production cost. More recently, the advantages have been extended to consumers in terms of nutrient improvement as well as lower food price. On the other hand, Non-GM foods are foods where all of the components are produced by natural or traditional production systems, but not by way of genetic modification.

Although GM foods may offer many advantages to consumers, there remains apprehensiveness on the part of consumers as to whether GM foods are safe and whether they have a detrimental impact on human health in the long term. In fact, there is no apparent evidence insists on hazard and risk from consuming GM foods, Thai consumers still have a negative attitude towards them (Valyasevi *et al.*, 2003). The main problems which encourage a lack of acceptance of GM foods include a lack of understanding together with inadequate government information. As a result, this has periodically led to campaign against GM foods by some consumers and other stakeholders.

Thailand prohibits commercial production and importation of GM crops according to the Ministry of Agriculture and Cooperatives announcement (Ministry of Agriculture and Cooperatives, 1964). However, soybeans are exempted from import prohibition. In effect, interesting data revealed that due to insufficient domestic supply to meet domestic demand, Thailand has to import over 85% of the total demand for soybean grains; while only 15% is supplied domestically (Office of Agricultural Economics, 2007). Most imported soybean grains come from Brazil, Argentina and the United States, which are recognized as the major countries of GM soybean production (Office of Agricultural Economics, 2007). Consequently, GM soybean consumption is unavoidable. This causes consumer concern about soybean products. To reduce the confusion, Thailand has announced an obvious classification policy for both domestic and imported soybeans: domestically planted soybeans are Non-GM while all of the imported soybeans are assumed to be GM (Office of Agricultural Economics, 2007).

In an attempt to solve the controversy of GM foods safety among Thai consumers, the Thai government announced that products processed from GM plants must be proven as safe before they can be permitted to be used as foods or food ingredients. An assurance of GM food safety will be subject to the authority of Food and Drug Administration (FDA) whose standards Thai consumers can rely on. Furthermore, the rudimentary rights of consumers are protected by the Principle of Right to Know provided in The Consumer Protection Act 1979 which requires that **"Consumer has the rights to obtain information including correct and sufficient description about products or services, as well as the right to get the sincere advertisement and labeling in order not to mislead in purchasing products and services"** (Office of the Consumer Protection Broad, 1979). The FDA has announced labeling regulations[1] for foods containing ingredients derived from GM soybeans and maize. The regulation requires that the ingredients must be the top three components by weight representing more than 5% of the total weight and must have more than 5% of GM in each ingredient (Ministry of Health, 2002). This regulation aims to provide useful information and expects consumers to make use of them before making a

[1] See Appendix A

purchase. In addition, another important reason of GM labeling is to eliminate the asymmetric information about foods between food producers and consumers (Valyasevi *et al*. 2003). It is without doubt that food producers have more information than consumers, including whether their foods are contaminated with GM ingredients. In contrast, it is impossible for consumers to know which foods are GM or Non-GM. It is necessary to build up GM food labeling when providing useful information for consumers.

Although GM foods labeling regulations have been enforced in Thailand since May, 2003, it seems to be ineffective for various reasons. Under this law, there are only twenty-two product items[2] derived from two kinds of GM plants, soybeans and maize where GM labeling is enforced. In addition, this regulation does not provide truthful information to consumers; it has a loophole that may mix GM foods which are not in that requirement with Non-GM foods. For instance, in cases where the GM ingredient is not in the top three components even if it represents more than 5% of the total weigh, it does not require labeling as a GM food. Therefore, consumers will not know which foods actually contain GM ingredients and they are, therefore, at risk of consuming foods that contain GM ingredients. It is consistent with published information that 20% of diverse foods sold in supermarkets are foods with GM ingredients without GM labeling (GREENPEACE Southeast Asia, 2002)

Additionally, forbiddance to express misleading statements to consumers, such as GMO free, Non-GM food, do not contain GMO or GMO has been removed, is also another reason that made GM foods labeling inefficiently. In that case, producers who use Non-GM materials cannot proclaim their product as Non-GM foods. Considering food production cost, it was found that Non-GM foods have more production cost than GM foods (Valyasevi *et al*., 2003). The major cost arises from identity preservation and segregation system that Non-GM food producers would bear inevitable so as to guarantee and gain credibility from consumers. Therefore, despite spending more production cost, Non-GM food producers are forbidden to promote their product to consumers as Non-GM, and sell them at a higher price. This point

[2] See Appendix B

brings about that Non-GM food producers may gain less profit than GM food producers, and make them feel discourage to produce Non-GM foods (Suzuki *et al* 2004).

With changing consumer behavior to pay more interest to healthy foods, soybean milk is a good choice for those who are looking for a source of protein as an alternative to meat consumption. As a result, soybean milk consumption has been increasing continuously. Even though various products derived from soybean are offered, it is an interesting consideration to select soybeans milk as an example for this study. Because soybean milk is one of the twenty-two food items derived from GM soybean that must be labeled. Additionally, among food items, soybean milk is the most favorable processed product obtained from soybean (Pusdavo, 2006). If a state agency neglects to enforce the GM labeling regulation, soybeans milk consumers face a high possibility of consuming GM soybean milk.

Previous studies on GM food with respect to consumer behavior focus mostly on consumer acceptance. Most of them suggest that important factors such as benefits and risks attitude toward GM food are significantly related to consumer acceptance (Kiesel, Buschena and Smith, 2000; Moon, Balasubramanian and Rimal, 2006; Chern, Richertsen, Tsuboi and Fu, 2007). Likewise, this study focuses on the acceptance and attitude of consumers toward GM foods and investigates further factors influencing acceptability. Consumer acceptance of GM food plays an important role in shaping the market for GM food and the future development of agricultural biotechnology and trade. In order to examine consumers' response to soybean milk with Non-GM labeling, this study tries to analyze the impact on probability of paying Non-GM information on soybean milk. Presumably, consumers who wish to avoid consuming GM soybean milk are willing to pay more for soybean milk with Non-GM labeling. Identifying the impact of Non-GM labeling will be useful for Non-GM food producers in making decisions to apply Non-GM labeling.

Objectives of the Study

This study specifically aims to;

1. To investigate consumer preference on soybean milk consumption and attitudes toward GM food.

2. To investigate factors influencing consumers acceptance of GM food.

3. To analyze the impact on probability of paying Non-GM labeling information on soybean milk.

Hypotheses

Hypotheses for each of the variables are as follows;

1. Demographic characteristics such as gender, age, income, occupation, education, GM knowledge and the environmental effects of GM crop planting are expected to have an effect on the acceptance of GM food.

2. Risk attitude toward GM food is expected to have a negative effect on the acceptance of GM food.

3. Benefit attitude toward GM food is expected to have a positive effect on the acceptance of GM food.

4. Demographic characteristics such as gender, age, income, occupation and education are expected to have an effect on the probability of paying higher for soybean milk with Non-GM labeling.

5. Risk attitude toward GM food is expected to have a positive effect on the probability of paying higher for soybean milk with Non-GM labeling.

6. Benefit attitude toward GM food is expected to have a negative effect on the probability of paying higher for soybean milk with Non-GM labeling.

7. Environmental benefit of GM crop production is expected to have an effect on the probability of paying higher for soybean milk with Non-GM labeling.

8. Willingness to pay less for soybean milk with GM labeling than without Non-GM labeling is expected to have a negative effect on the probability of paying higher for soybean milk with Non-GM labeling.

9. The importance of Non-GM labeling is expected to have a positive effect on the probability of paying higher for soybean with Non-GM labeling.

Scope of the Study

This research focuses on consumers at age 18 or over who purchase soybean milk at supermarkets/hypermarkets in Bangkok, specifically those who generally purchase 250 ml. cartons of soybean milk.

Expected Benefits

The results of the study could assist in the explanation of the acceptance and attitudes toward GM food products in Bangkok. It will be useful for soybean milk producers and other related organizations in providing facts, knowledge and understanding concerning GM labeling regulations. Understanding the factors that influence consumer acceptance of GM food will assist producers and vendors in specifying product attributes which attract consumers' interest so that they can adequately customize products to match consumer demand. Moreover, the related organizations can use knowledge on consumer responses to soybean milk with Non-GM labeling as a guideline for planning Non-GM labeling in the future.

CHAPTER II

LITERATURE REVIEW

Theoretical Framework

Consumer Demand

Consumer demand can be generally explained by two approaches: utility maximization with a constrained budget and expenditure minimization a constrained utility level.

1. Utility maximization

This approach indicates that subject to a limited budget, each consumer can purchase a number of differentiated goods in order to maximize utility. The consumer's direct utility function is represented by:

$$\text{Max } u(X) \qquad \text{subject to} \qquad m - PX = 0 \qquad (1)$$

Where $u(X)$ = direct utility function

X = vector of private goods, $X = x_i, (i = 1, 2, \ldots n)$

m = consumer income/budget

P = vector of price of private goods, $P = p_i, (i = 1, 2, \ldots n)$

After setting the partial derivatives to solve for optimal levels of x_i, the optimal levels of each good is also known as/ an ordinary demand function or money-income constant demand function (x_i^m) which is in general will depend on the prices of all goods and on the individual's income which are given in Eq.(2),

$$x_i = x_i^m (P, m) \quad (2)$$

Substituting the optimal levels of goods X from Eq.(2) in the direct utility function to yield the indirect utility function (v), it shows that an individual's optimal level of utility will depend indirectly on the prices of goods and the individual's income. The resulting indirect utility function is given by,

$$v(P, m) = \text{Max} \left[u(x) \mid PX - m = 0 \right] \quad (3)$$

2. Expenditure minimization

This approach shows that at a given level of utility ($\bar{u}$), a consumer can choose a number of differentiated goods that minimizes expenditure. The consumer's direct expenditure function can be expressed by:

$$\text{Min } m = PX \quad \text{subject to} \quad u(X) = \bar{u} \quad (4)$$

After setting the partial derivatives to solve for the optimal levels of x_i, the optimal levels of each goods is also known as the compensated demand function or utility-constant demand function (x_i^u) which in general will depend on the prices of all goods and on the given level of utility of an individual which are given in Eq.(5):

$$x_i = x_i^u (P, u) \quad (5)$$

Substituting the optimal levels of goods X from Eq.(5) in the direct expenditure function to yield the indirect expenditure function (e) shows that the minimizing of expenditure obtainable will depend indirectly on the prices of goods and the individual's given utility. The resulting indirect expenditure function is given by:

$$e(P,u) \quad = \quad \text{Min}\left[PX \mid u - \bar{u} = 0\right] \qquad (6)$$

The relationship between the ordinary demand function and compensated demand function are considered as a dual problem, where the constrained level of $\bar{u}$ in expenditure minimization function (Min m) is the same utility level obtained from the utility maximization function (Max u). Moreover, the expenditure (e) obtained from the expenditure minimization function is the same level as the constrained budget (m) set up in the utility maximization.

Consumer Welfare Measurement for a Quantity or Quality Change

Considering the utility maximization with a constrained budget, the indirect utility function can be rewritten as $v = (P, m, q)$, where q represents the level of a good's quality. Now assume that an improvement in a level of good's quality converts from q^0 to q^1 causing the utility to shift from u^0 to u^1. The indirect utility of goods at level q^1 will be greater than at level q^0. The changed indirect utility function can be expressed as follow:

$$\Delta v \quad = \quad v(P,m,q^0) \quad - \quad v(P,m,q^1) \qquad (7)$$

The better welfare affected by an improvement of quantity or quality of goods can be estimated through two essential measures: compensating surplus and equivalent surplus (Hanemann, 1984).

1. Compensate Surplus (CS)

When an improvement of quantity or quality of goods occurs $(q^0 < q^1)$, an increasing consumer utility is obtained $(u^0 < u^1)$. The value the consumer places on this improvement is CS which is defined as the maximum amount of money a consumer is willing to pay (WTP) for goods improvement (q^1). This amount of money paid leaves him restore at the initial utility level (u^0). It is expressed implicitly in the indirectly utility function,

$$v(P, m, q^0) = v(P, m - CS, q^1) \tag{8}$$

or, it is given explicitly by the indirect expenditure function,

$$CS = WTP = e(P, u^0, q^0) - e(P, u^0, q^1) \tag{9}$$

2. Equivalent Surplus (ES)

When an improvement of quantity or quality of goods occurred $(q^0 < q^1)$, ES value is the minimum amount of money a consumer willing to accept (WTA) to forgo goods improvement or maintain at the original level of goods (q^0). This amount of money given allows him to reach the new utility level (u^1). It is expressed implicitly in the indirectly utility function,

$$v(P, m + ES, q^0) = v(P, m, q^1) \tag{10}$$

or, it is given explicitly by the indirect expenditure function,

$$ES = WTA = e(P, u^1, q^0) - e(P, u^1, q^1) \tag{11}$$

Utility Choice

The consumers' choices can be described using a random utility model based on utility maximization: an individual makes choice that maximizes his utility (Maddala, 1983). Given the utility of the individual i choose choice j denotes as U_{ij}, can be written as (Bateman *et al*., 2002);

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (12)$$

Where U_{ij} = the unobservable utility of the individual i choose choice j

V_{ij} = the observable utility function in systematic component

ε_{ij} = the random utility component

The observable utility function (V_{ij}) can be assumed as a linear utility function of explanatory variables X_{ij}. Given β_j refers to the estimated parameters that reflect the impact of changes in X_{ij}. α_j is an intercept term;

$$V_{ij} = \alpha_j + \beta_j X_{ij} \quad (13)$$

In binary choice model, an individual is assumed to make the decision by choosing the choice that maximizes the utility. Suppose the individual i is likely to choose the choice 1 if the utility of choosing the choice 1, U_{i1}, is greater than the utility of choosing the choice 0, U_{i0}, denotes $U_{i1} > U_{i0}$. The probability that the utility associated with choice 1 exceeds choice 0 of the individual i can be expressed;

$$P(U_{i1} > U_{i0}) = P[(V_{i1} + \varepsilon_{i1}) > (V_{i0} + \varepsilon_{i0})] \quad (14)$$

In multinomial choices model, suppose that an individual faces m unordered choices. Similarly, the individual choose one out of m choices that offers the maximum utility. In taking decision, the individual i decide to choose choice j from all m choices, defines, $U_{ij} > U_{ik}$, for all $j \neq k$. The probability that the utility associated with choice j exceeds all other choices of the individual i can be expressed as (Bateman *et al*., 2002);

$$P(U_{ij} > U_{ik}) = P[(V_{ij} + \varepsilon_{ij}) > (V_{ik} + \varepsilon_{ik})] \quad \text{for all} \quad j \neq k \qquad (15)$$

The knowledge of attributes and their levels in creating consumer utility is important for suppliers in order to customize products matching consumers' desire. Therefore, the method is often used to remedy this problems is logistic regression, as it is easily applicable and the interpretation of results is meaningful (Vanit-Anunchai, 2006).

Logit Model

The logit model or logistic regression is often used to predict the probability of occurrence of an event by fitting data to the logistic function. It extends the techniques of multiple regression to investigate the situations in which a dependent variable is categorical. Although the dependent variable in a logit model is usually two categories, which is called a binary or dichotomous logit model, the application of a logit model has also been extended to cases where the dependent variable is more than two categories, known as a multinomial or polytomous logit model. The parameter estimates in a logit model are obtained using Maximum Likelihood Estimation (MLE) rather than using Least Square Estimation (LSE).

1. Binary Logit Model

Considering the case when consumer faces two choices of making decision, the term linear probability model is used to denote a regression model in which the dependent variable (Y_i) is a binary variable taking the value of 1 if the event occurs and 0 otherwise. Suppose X is a vector of independent variables ($X = x_1, x_2, ..., x_k$). β is a vector of parameters that reflects the impact of changes in X on the probability of the occurrence of the event ($\beta = \beta_0, \beta_1, \beta_2, ..., \beta_k$). ε is an unobserved error term. We can write Y as a linear function:

$$Y_i = \beta X_{ik} + \varepsilon_{ik} \quad (16)$$

To simplify the notation, we define $\pi(x)$ as the conditional probability distribution, $\pi(x) = \mathrm{E}(Y \mid x)$ is the conditional expectation of Y given x when the logistic regression model is used (Hosmer and Lemeshow, 2000). The probability that the event will occur given the particular value of x can be defined as follows:

$$P(Y_i = 1) = \pi(x) \quad (17)$$

And the probability that the event will not occur is:

$$P(Y_i = 0) = 1 - \pi(x) \quad (18)$$

In binary model, ε cannot be assumed to be a normal distribution due to the estimates of response outside the (0,1) interval (Abraham and Ledolter, 2006). The probabilities $\pi(x)$ can be expressed in term of the logistic distribution function as:

$$\pi(x_k) = \frac{e^{\beta_k x_k}}{1 + e^{\beta_k x_k}} \quad (19)$$

And $1 - \pi(x_k) = 1 - \frac{e^{\beta_k x_k}}{1 + e^{\beta_k x_k}}$ (20)

The probability in Eq. (19) and (20) are nonlinear functions of β. The transformation to linearity is:

$$\ln \frac{\pi(X)}{1 - \pi(X)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2, ..., \beta_k X_k \quad (21)$$

where $\pi(x) / [1 - \pi(x)]$ is the odds ratio comparing the probability of the occurrence of characteristics to the probability of its nonoccurrence. The logarithm of the odds, $\ln [\pi(x_k) / (1 - \pi(x_k))]$, is referred to as log-odds ratio or logit. The terms β_0 and β_k in this model represent unknown parameters that need to be estimated based on the data obtained on x_k and Y (Vanit-Anunchai and Schmidt, 2006).

2. Multinomial Logit Model

The multinomial logot model is appropriate to use when dependent variable is nominal and has more than two choices. The probability that the individual i choose choice j among all m choices can be expressed in term of the logictic distribution as;

$$P_{ij} = \frac{e^{\beta_j X_j}}{\sum_{k=1}^{m} e^{\beta_k X_k}} \quad \text{for all } j \neq k \quad (22)$$

Since the probability in Eq. (22) is unidentified, there is more than one solution to the coefficients that lead to the same probabilities (Ender, 2004). To make these equations identifiable, we have to set one choice of the dependent variable as the comparison/base choice. The multinomial logit regression will, therefore, estimates $n - 1$ models, where n is the number of levels of the dependent variable. An interesting feature of the multinomial logit model is the interpretation of coefficients, which is written in the form of odds ratio, representing the probability of choosing

choice j relative to the base choice associated with a one unit change on the independent variable. The log-linear model of odds ratio is given;

$$\ln \frac{P_j}{P_{base}} = \beta_0 + \beta_j X_j \quad (23)$$

The Maximum Likelihood Estimation (MLE) is used to estimate parameters. The sign of parameters can be interpreted as the direction of influence of variables, but it is meaningless (Schmidheiny, 2007). An alternative way of comparing would be consider the marginal effect which is calculated in order to measure the effects of changes in one of the independent variable on the probability of the predicted choice. The marginal effects are obtained by computing the partial derivative of the probability, P_j, with respect to x_k given by:

$$\frac{\partial P_j}{\partial x_k} = \beta_j P_j (1 - P_j) \quad (24)$$

Related Literature

Currently there have been no studies conducted to estimate consumer's willingness to pay for GM foods and Non-GM foods in Thailand. Thus, other related literature will be considered, including the analytical studies conducted on consumers' acceptance, perception, as well as attitude toward GM foods both in Thailand and foreign countries.

Literature associated with GM foods

In 2005, the ABAC Poll Research Center, Assumption University, conducted a survey between September 27 and October 15 selecting 2,071 people from five urban areas, Bangkok, Chiang Mai, Khon Kaen, Songkla and Chon Buri. The findings showed that only 47 percent of respondents know about the meaning of GMOs which

is similar to the 50 percent of respondents who do not know the meaning. The survey also indicated that over two-thirds or 65 percent of those who know about GMOs have never seen products labeled as “GMOs” in the market while 11 percent have seen it. It also demonstrated that 75 percent of respondents who know about GMOs did not know that the labeling regulation for GM foods has been enforced by the Ministry of Health since May 11, 2003. However, 26 percent of respondents do know about it. Another important finding among respondents who know about GMOs was in support of a ministerial regulation to label “GMOs” for products containing even 1 percent of GM contamination, whereas 8 percent do not agree. In addition, approximately 70 percent of all respondents in this study expressed that GM labeling information was inadequately promoted, meanwhile 37, 30 and 24 percent want to see GM labeling on fresh foods, on products containing 5 percent of GM contamination and over, and on other foods, not only those products containing soybeans and maize, respectively.

Similarly, Thai Topic had conducted a survey in cooperation with BIOTEC (2003) in order to examine public perception, understanding and adoption of GM plants and GM animals. The data were obtained from 2,454 samples covering 6 regions across the country; Ubonratchathani, Chiang Mai, Nakhonsawan, Nakhon Sri Thammarat, Srakaew and Bangkok. Among several criteria, most of respondents expressed the view concerning foods production that they will choose to grow or to conduct only animal farming which has high yield or high price, and rarely focused on growing crops and animals that are not genetically modified. With regard to fresh food consumption, they gave precedence to foods free from residual chemicals, followed by freshness, cleanliness and price when making purchasing decision, only a few tended to choose Non-GM foods. Similar result was also revealed for processed foods, most of respondents gave more importance to cleanliness and expiration date than whether they are GM foods. Regarding GM perception and understanding, 75 percent of respondents have heard about GM mainly from television, only 10 percent have never heard about it. However, this study also indicated that most respondents agree with the need to study and conduct research and development on GM plants to enhance nutrients including labeling on GM products as “contained GM ingredients”.

The result also revealed that respondents concerned about foreign and domestic market acceptance, and the impacts on health and environment. Most of respondents did not support the importation of GM products, including GM seeds. Furthermore, lack of knowledge and comprehension on GM are the most concern over the development of biotechnology in Thailand.

Kongthanaritha (2000) studied media exposure, knowledge, attitude and acceptance of GMO consumption among Bangkok people. The objective was to find out the relationship between of media exposure to knowledge, attitude and acceptance of GMO consumption among Bangkok people, as well as identifying the factors in acceptance of GMO consumption. A group of 404 samples was opinion surveyed and the analysis was conducted using Windows SPSS. The results of the regression analysis showed that people of different sex, age, level of education, occupation and income are different in media exposure of GMO consumption. While people who differ in sex, age, level of education, occupation and income have different knowledge, attitudes and acceptance of GMO consumption. With regard to media exposure influence, it was discovered that it had significant influence on GMO knowledge and acceptance of GMO consumption. But there were no correlation between media exposure and attitudes to GMO. In addition, attitude and age are two variables best explaining acceptance of GMO consumption.

Subcharoenkul (2002) conducted a study on the influence of GMO perception and acknowledgement toward the GM cereal consumption of consumers in Bangkok. This study aimed to investigate GM cereal purchasing behavior as well as to find out cognitive factors affecting GM cereal purchasing behavior such as GMO perception and acknowledgement, including a study of consumer characteristic factors that may affect those cognitive factors. Basic statistical approaches, such as standard deviation, T-test, F-test and so on, with regression model analysis were employed in this study to obtain the results. The result of regression analysis showed that gender, age, level of education, occupation, income, GMO perception and GMO acknowledgement have affected purchasing decision behavior in terms of quantity. Age, income and GMO acknowledgement have significance related to purchasing decision behavior in terms

of frequency. In addition, purchasing decision behavior in terms of size is related only to income and GMO acknowledgement.

Vilei and McCarthy (2001) studied consumer acceptance and understanding of genetically modified food products. This research aimed to study consumer attitudes toward the use of gene technology in food production, as well as to evaluate relationships between demographic factors and acceptance in food production and between knowledge and acceptance. Data were collected in June 2000 from two hundred Irish respondents. A survey methodology was employed and then calculated using basic statistical techniques, such as chi-square, one way ANOVA to analyze relationships.

The result of the study indicated that all respondents were aware of the existence of gene technology in food production. Calculating consumers' attitude toward gene technology, it was found that 66 percent of respondents regarded it as a negative development, 11 percent believed that it was a positive development while 23 percent were unsure. On the other hand, respondents perceived understanding of gene technology in food production was low, whereas younger people and males were essentially perceived as having a better understanding of gene technology in food production than middle-aged people and females. By calculating the relationship between demographic factors and acceptance in the application of gene technology in food production, it was found that younger people and males showed significantly greater acceptance of gene technology than older people and females. Respondents with third level education and from upper social classes also showed significantly greater acceptance than those with second level education and from lower social classes. In addition, younger people and males were more knowledgeable about gene technology than females and middle-aged people. In the summary they also demonstrated that consumers were willing to buy GM food products only when they perceived personal benefits.

Literature associated with willingness to pay

Moon and Balasubramanian (2001) conducted research employing the Maximum Likelihood Estimation Method (MLEM) for a probit model to examine the link between risk and benefit perception toward willingness to pay for Non-GM breakfast cereals. In this study, the data were collected from 5,200 samples of United States' households and 2,568 samples of United Kingdom households. The result showed UK consumers had a significantly greater probability of being willing to pay for Non-GM breakfast cereals than US consumers. In addition, the study also revealed that the impact of risk perception plays a more important role than benefit perception in both countries. Among consumers of these two countries, the probability of willingness to pay in UK consumers who perceived the relative impact of risk was 71 percent while it was 50 percent for US consumers. Conversely, the probability of willingness to pay in UK consumers who perceived the relative impact of benefits was 50 percent and 37 percent for US consumers.

Wuyang Hu (2006) studied Chinese and Japanese preferences and willingness to pay (WTP) for Non-GM vegetable oil. He employed a Contingent Valuation Method (CVM) as an analytical tool to reach the WTP value and used Logistic Regression to determine the influence of various factors toward WTP. In this study 628 and 378 questionnaires were collected in Beijing, China and Tokyo, Japan respectively from August to October 2002. Based on the random utility theory consumers were directly asked about two contrasting oil products. Oil A is made from GM oil seeds and its price remains unchanged for all of the survey, 30 Yuan for China and 400 Yen for Japan. Oil B is specified as being made from Non-GM oil seeds and its price varies according to consumers' payments for them.

The study findings indicated that in both countries price is found to have negative impacts on Non-GM vegetable oil purchasing probabilities in that the higher the price is for Non-GM vegetable oil, the less the consumers will purchase it. The study pointed out a higher premium for Non-GM vegetable oil than GM vegetable oil in both countries. However, Japanese consumers are willing to pay more for Non-GM

vegetable oil than Chinese consumers. The estimate result of Mean WTP for Non-GM vegetable oil is 640.13 Yen for Japanese consumers and 39.26 Yuan for Chinese consumers. The results of regression analysis showed the significant difference in consumer's attitude and demographic characteristics in terms of its impact on purchasing Non-GM vegetable in these two countries. In China, male, older and better-educated Chinese consumers are more likely to purchase Non-GM vegetable oil compared with others and for those who perceived the risk of GM technology application are also willing to purchase them. For Japanese consumers, only those who are married and older are more likely to purchase Non-GM vegetable oil and for those who believe that GM-related issues should be left to experts to discuss are also willing to purchase them.

CHAPTER III

RESEARCH METHODOLOGY

Population and Sampling

Population

The population of this study is people who are aged 18 or over and purchase soybean milk at supermarkets/hypermarkets in Bangkok. Bangkok consumers can be assumed to have knowledge about GMOs that would be representative of other consumers in Thailand.

Sample size

The sample size in this study refers to the estimated proportion of soybean milk consumers reported by Pusdevo (2006). Her research result found that roughly 33% (0.33) of consumers in Bangkok prefer the most favorable soybean milk rather than other soybean products. Therefore, the sample size can be calculated according to the Zikmund Formula (2000).

$$n = \frac{Z^2 p(1-p)}{e^2} \quad (25)$$

Where n = Sample size

z^2 = Square of the confidence level at 95% (standard value of 1.96)

p = The estimated proportion of soybean milk consumers (0.33)

e^2 = Square of the error at 5% (0.05)

Substitution

$$n = \frac{(1.96^2)(0.33)(0.67)}{(0.05^2)}$$

$$n = 339$$

$$n \sim 340$$

The total sample size of this study is rounded to 340 soybean milk consumers.

Sampling procedure

To cover different categories of soybean milk consumers, the sample is drawn from 137 supermarkets/hypermarkets across Bangkok. A two-stage sampling procedure used in this study is based on income and GM knowledge which are hypothesized to have an essential influence on GM food purchasing decisions. The sampling procedure can be described as follows:

The first step: 137 supermarkets/hypermarkets are listed and divided into two groups based on consumers' income. Consequently, forty-one supermarkets/hypermarkets are considered as high income consumers, and ninety-six are considered as low income.

The second step: Both separated supermarkets/hypermarkets are divided again based on their location (urban and suburban) as a proxy for GM knowledge. In urban areas, consumers are assumed to have high levels of GMO knowledge, and suburban area consumers are assumed to have lower levels of GMO knowledge. In total, thirty supermarkets are found in urban areas with high income consumers, eleven are in suburban areas with high income consumers, forty-one are in urban areas with middle/low income consumers and fifty-five are in suburban areas with middle/low income consumers. 85 respondents are interviewed in each group, totaling 340 respondents as shown in Table 3.1.

Table 3.1 Number of respondents classified by income and store location

Qualifications of Supermarkets/Hypermarkets	No. of Supermarkets/ Hypermarkets	Sample size (person)
Urban areas with high income consumers	30	85
Suburban areas with high income consumers	11	85
Urban areas with middle/low income consumers	41	85
Suburban areas with middle/low income consumers	55	85
Total	137	340

Research Instrument

The research instrument is a structured questionnaire created after studying relevant documentation and previous research as guidelines. The questionnaire consists of six sections as follows:

Section 1: Willingness to pay for Non-GM labeling information regulation

Section 2: Soybean milk purchasing pattern.

Section 3: Knowledge on GMO facts.

Section 4: Attitudes towards GMO by aspects

Section 5: Awareness on GMO labeling

Section 6: The characteristics of the respondents.

Data Collection

A total of 340 questionnaires were collected by interviewing people buying soybean milk during the opening hours of the supermarkets/hypermarkets. The questionnaires were distributed in September, 2009 and finished in October, 2009.

Data Analysis

After gathering data from the completed 340 questionnaires, all data were edited, coded and entered in order to be analyzed using a computer program with the following regulations;

1. To achieve the first objective, descriptive analysis is utilized to describe respondents' characteristics, soybean purchasing patterns, knowledge on GMO facts, attitudes towards GMO by aspects and awareness on GMO labeling. The data were analyzed and presented by frequency, percentage, means and standard variation.

2. To achieve the second objective, consumers' acceptance toward GM foods is analyzed using a binary choice model. It is appropriate to use when dependent variable is qualitative choice model, and the outcome can take one of only two possible values of dependent variable.

The acceptance toward GM foods is usually modeled as a choice between two choices: purchase and not purchase. Consider the linear probability model in Eq. (19), assuming $Y_i = 1$ if consumers' decision to purchase GM foods and $Y_i = 0$ if consumers' decision not to purchase GM foods. The probability that the individual decide to purchase GM foods can be expressed as,

$$P\ (\ Y_i = 1) \qquad = \qquad \frac{e^{\beta_k x_k}}{1 + e^{\beta_{ki} x_k}} \qquad (26)$$

Where $P(Y_i = 1)$ = The consumers' decision to purchase GM foods.

x_k = The k th determinants of consumers' decision to purchase GM foods.

β_k = The k th parameters estimated using Maximum Likelihood Estimation.

Model specification for analyzing consumers' acceptance toward GM foods can be written as follows:

$$\begin{aligned} Y \quad = \quad & \beta_0 + \beta_1 Gender + \beta_2 Age + \beta_3 Governor + \beta_4 Merchant \\ & + \beta_5 Employee + \beta_6 Hired\ labor + \beta_7 Education + \beta_8 Income \\ & + \beta_9 Antibiotic + \beta_{10} Low\ price + \beta_{11} E\cos ystem + \beta_{12} GM\ knowledge \end{aligned}$$

Dependent variable

Y = consumers purchasing decision of GM foods

= 0 = not willing to purchase GM foods

= 1 = willing to purchase GM foods.

Independent variables

Gender = gender of respondents

1 = female, 0 = male

Age = age of respondents (number of years)

Student	=	1 = students (reference category) 0 = otherwise
Governor	=	1 = governor / state enterprise officers 0 = otherwise
Merchant	=	1 = merchants/ private business owners 0 = otherwise
Employee	=	1 = privates business/ store employees 0 = otherwise
Hired labor	=	1 = housewife/househusband/hired labor/retirees 0 = otherwise
Education	=	1 = no schooling 2 = primary school 3 = junior high school 4 = high school/vocational school 5 = advanced diploma/diploma 6 = bachelor degree 7 = master degree 8 = doctoral degree
Income	=	1 = lower or equal to 10,000 baht/month 2 = 10,001-20,000 baht/month 3 = 20,001-30,000 baht/month 4 = 30,001-40,000 baht/month 5 = 40,001-50,000 baht/month 6 = over 50,000 baht/month
Antibiotic	=	GM food consuming can lead to antibiotic-resistant diseases 1 = strongly disagree; 5 = strongly agree

Low price = GM food is cheaper than conventional food
1 = strongly disagree; 5 = strongly agree

Ecosystem = GM crop planting cause unbalanced ecosystem
1 = strongly disagree; 5 = strongly agree

GM knowledge = level of GM knowledge of respondents
1 = low level of GM knowledge
2 = moderate level of GM knowledge
3 = high level of GM knowledge

3. To achieve the third objective, factors influencing consumers' choice of paying for soybean milk with Non-GM labeling and its impact are analyzed using a multinomial logit model. It is often used when dependent variable is unordered and has more than two categories.

The dependent variable used in this study is a contingent valuation WTP data on soybean milk with Non-GM labeling, which is described as qualitative choice. In open-ended questions, a respondent is requested to elicit the WTP for soybean milk with Non-GM labeling. A value of WTP can be transformed into three categories which are being the dependent variables: $Y_i = 1$ indicates consumers' WTP for soybean milk with Non-GM labeling less than without Non-GM labeling, $Y_i = 2$ indicates consumers' WTP for soybean milk with Non-GM labeling equal to without Non-GM labeling and $Y_i = 3$ indicates consumers' WTP for soybean milk with Non-GM labeling higher than without Non-GM labeling. The probability for each of the category responses which is developed in Eq. (22), can be obtained as follows:

$$P\ (\ Y_i = 1\ ) \quad = \quad \frac{e^{\beta_1 x_1}}{e^{\beta_1 x_1} + e^{\beta_2 x_2} + e^{\beta_3 x_3}} \tag{27}$$

$$P\ (\ Y_i = 2\ ) \quad = \quad \frac{e^{\beta_2 x_2}}{e^{\beta_1 x_1} + e^{\beta_2 x_2} + e^{\beta_3 x_3}} \tag{28}$$

$$P\ (\ Y_i = 3\ ) \quad = \quad \frac{e^{\beta_3 x_3}}{e^{\beta_1 x_3} + e^{\beta_2 x_2} + e^{\beta_3 x_3}} \tag{29}$$

Since the probabilities in Eq.(27), (28), (29) are unidentified, there is more than one solution to the coefficients that lead to the same probabilities (Ender, 2004). To make these equations identifiable, we have to set one of the coefficients equal to zero. In this study, suppose β_2 is chosen to be zero and probability of this category becomes a base category. After solving the three probabilities developed, we get

$$P\ (\ Y_i = 1\ ) \quad = \quad \frac{e^{\beta_1 x_1}}{1 + e^{\beta_1 x_1} + e^{\beta_3 x_3}} \tag{30}$$

$$P\ (\ Y_i = 2\ ) \quad = \quad \frac{1}{1 + e^{\beta_1 x_1} + e^{\beta_3 x_3}} \tag{31}$$

$$P\ (\ Y_i = 3\ ) \quad = \quad \frac{e^{\beta_3 x_3}}{1 + e^{\beta_1 x_1} + e^{\beta_3 x_3}} \tag{32}$$

The important feature of the multinomial logit model is that it will estimate $n-1$ models, where n is the number of categories of the dependent variable. In this study, we set WTP for soybean milk with Non-GM labeling equal to without Non-GM labeling (category 2) as the base category, and therefore estimated the odds ratio for the consumers' WTP for soybean milk with Non-GM labeling less than without Non-GM labeling relative to the base category, the model can be written as:

$$\frac{P(Y_i = 1)}{P(Y_i = 2)} \quad = \quad e^{\beta_1 X_1} \tag{33}$$

$$\text{or} \qquad \ln \frac{P(Y_i = 1)}{P(Y_i = 2)} \quad = \quad \beta_0 + \beta_1 X_1 \tag{34}$$

And estimated the odds ratio for the consumers' WTP for soybean milk with Non-GM labeling more than without Non-GM labeling relative to the base category, the model can be written as:

$$\frac{P(Y_i = 3)}{P(Y_i = 2)} = e^{\beta_3 X_3} \quad (35)$$

or $$\ln \frac{P(Y_i = 3)}{P(Y_i = 2)} = \beta_0 + \beta_3 X_3 \quad (36)$$

The Maximum Likelihood Estimation (MLE) is used to estimate parameters. The marginal effect, which is developed in Eq. (24), is calculated in order to measure the effect of change in the particular independent variable on the predicted probability. They are obtained by computing the partial derivative of the probability, P_i, with respect to x_k given by:

$$\frac{\partial P(Y_i)}{\partial x_k} = \beta_i P_i (1 - P_i) \quad (37)$$

The model specification for multinomial logit model to examine factors affecting the consumers' choice of paying for soybean milk with Non-GM labeling and to derive the marginal effects can be written as follows:

$$\begin{aligned} Y = {} & \beta_0 + \beta_1 Gender + \beta_2 Age + \beta_3 Education_1 + \beta_4 Education_3 + \beta_5 Income \\ & + \beta_6 Occupation_2 + \beta_7 Occupation_3 + \beta_8 Occupation_4 + \beta_9 Occupation_5 \\ & + \beta_{10} WTP\_GM\ label + \beta_{11} Non\text{-}GM\ label + \beta_{12} Label\_import \\ & + \beta_{13} Health\ Hazard + \beta_{14} Low\_Price + \beta_{15} Pollution \end{aligned}$$

Dependent variable

Y = willingness to pay for soybean milk with Non-GM labeling.
(Appendix C: see Figure 2.4 (Question no.2 in part 1))
1 = willingness to pay less than without Non-GM labeling
2 = willingness to pay equal to without Non-GM labeling (base category)
3 = willingness to pay more than without Non-GM labeling

Independent variables

Gender = gender of respondents
1 = female, 0 = male

Age = age of respondents (number of years)

$Education_1$ = 1 = lower bachelor degree
= 0 = otherwise
$Education_2$ = 1 = bachelor degree (reference category)
= 0 = otherwise
$Education_3$ = 1 = upper bachelor degree
= 0 = otherwise

Income = income of respondent (median level of income range)

$Occupation_1$ = 1 = students (reference category)
0 = otherwise
$Occupation_2$ = 1 = governor/ state enterprise officers
0 = otherwise
$Occupation_3$ = 1 = merchants/ private business owners
0 = otherwise

$Occupation_4$ = 1 = privates business/ store employees
0 = otherwise

$Occupation_5$ = 1 = housewife/househusband/hired labor/retirees
0 = otherwise

WTP_GM label = willingness to pay for soybean milk with GM labeling (less than 5% of GM contaminant)
(Appendix C: see Figure 2.2 (Question no.2 in part 1))
1 = willingness to pay less than without GM labeling
0 = willingness to pay more than/equal to without GM labeling

Non-GM label = The importance of Non-GM label
1= important
0 = unimportant

Label_import = GM food labeling regulation should cover GM imported food product.
1 = strongly disagree; 5 = strongly agree

Health Hazard = GM food consuming can cause long-term health hazard
1 = strongly disagree; 5 = strongly agree

Low price = GM food is cheaper than conventional food
1 = strongly disagree; 5 = strongly agree

Better_envi = GM crop production reduces chemical use and make a better environment
1 = strongly disagree; 5 = strongly agree

CHAPTER IV

RESULTS

This chapter presents descriptive and econometric results. The study on demographic and behavioral aspects of respondents is reported. Based on the estimated model developed in the previous chapter, it presents the estimation of the logistic regression model with binary response, and the estimation of multinomial logistic regression model. The chapter is divided into two parts: descriptive results and econometric results.

Descriptive Results

The collected data is edited in order to provide information on the demographic characteristics of the respondents, followed by the descriptive summary of behavioral aspects of the respondents.

Demographic Characteristics of Respondents

The demographic characteristics of 340 respondents are summarized in Table 4.1. The majority of respondents are female which accounted for 62.6% or 213 persons and 37.4% or 127 persons are male. The age distribution ranks between 18 and 62 years and the average age of the whole survey is 31 years.

With respect to the occupation of respondents, it is found that 45.3% or 154 persons are full-time business and store employees, 19.4% or 66 persons are students, 15.3% or 52 persons are public service officers or state enterprise officers and 9.7% or 33 persons are merchants or private business owners.

With respect to the educational level of respondents, it is found that 58.2% of respondents or 198 persons have the educational level of bachelor degree, 19.1% or 65 persons have the educational level of master degree and 12.9% or 44 persons have educational level of high school or vocational school.

With respect to the income per month of respondents, it is found that 35.3% or 120 persons earn income between 10,001-20,000 baht/month, 29.4% or 100 persons earn income lower or equal than 10,000 baht/month, 17.1% or 58 persons earn income between 20,001-30,000 baht/month and 11.5% or 39 persons earn income between 30,001-40,000 baht/month. Regarding the marital status of respondents, about 67.9% or 231 persons of respondents are single and 29.4% or 100 persons are married or live together. Most of the respondents are Buddhist which accounted for 95.0% or 323 persons.

Table 4.1 Summary of demographic characteristics of respondents

Demographic characteristics	Frequency	Percent
No. of observations	340	100.0
Gender		
Female	213	62.6
Male	127	37.4
Age: Average = 31; Min = 18; Max = 62		
Occupation		
Student	66	19.4
Public service / State enterprise officer	52	15.3
Housewife / Househusband	8	2.4
Merchant / Private business owner	33	9.7
Hired labor	15	4.4
Private business / Store employee	154	45.3
Retired officer	2	0.6
Others	10	2.9

Table 4.1 (Continued)

Demographic characteristics	Frequency	Percent
Highest educational level		
No schooling	1	0.3
Primary school	1	0.3
Junior high school	8	2.4
High school / Vocational school	44	12.9
Advanced diploma / Diploma	18	5.3
Bachelor degree	198	58.2
Master degree	65	19.1
Doctoral degree	5	1
Income (Baht/Month)		
Lower or equal to 10,000	100	29
10,001-20,000	120	35
20,001-30,000	58	17
30,001-40,000	39	12
40,001-50,000	10	3
Over 50,000	13	4
Marital status		
Single	231	68
Widowed	4	1
Married/Lived together	100	29
Divorced/Separated	5	2
Religion		
Buddhist	323	95
Islam	14	4
Christian	3	1

Source: consumer survey

Sources of Receiving GMO Information

In order to generate information on consumer behavior, they are asked additional questions. It was found that television is the main source of GMO information. 64.7% or 220 persons know about GMO from the television, 50.0% or 170 persons read about it in printed media such as newspaper, brochures and pamphlets, and 37.4% or 127 persons acquire the information over the internet. Despite the strong opposition of NGOs in Thailand (i.e. Greenpeace and BIOTHAI), the results show a relatively low percent of exposure to GMO information (20.3% or 69 persons) by NGOs. The summary is presented in Table 4.2.

Table 4.2 Proportion of respondents classified by sources of GMO information

GMO information sources*	Frequency	Percent
Television	220	64.7
Printed media (newspapers, brochures, pamphlets)	170	50.0
Internet	127	37.4
NGO e.g. GREENPEACE	69	20.3
Teacher, scholar, specialist	67	19.7
Academic courses	53	15.6
Radio	27	7.9
Others (Friends, Colleagues, family)	2	0.6

Note: * Respondents can answer more than one

Source: Consumer survey

Frequency of foods label read

Respondents are asked "how frequently do you read food labels?" The majority of respondents at 41.8% or 142 persons sometimes read food labels, followed by 33.8% or 115 persons who always read them, 21.5% or 73 persons read food labels only at the first new food purchase and 2.9% or 10 persons never read them, as shown in Table 4.3

Table 4.3 Proportion of respondents classified by food label reading frequency

	Frequency	**Percent**
No. of observations	400	100.0
Always read	115	33.8
Sometimes read	142	41.8
Read only before a new food purchase	73	21.5
Never read	10	2.9

Source: Consumer survey

Importance of Food Label Information

Respondents are asked to rank the most important food label information from very important (Rank 1), moderately important (Rank 2) and important (Rank 3), respectively. It was found that the food label information that respondents pay most attention to is the manufactured date/expired date, followed by FDA label and price, which accounted for 66.5% or 226 persons, 24.4% or 83 persons and 19.1% or 65 persons, respectively. The summaries are shown in Table 4.4.

Table 4.4 Proportion of the top three types of food label information which are regarded as important by respondents

Label information	Rank 1		Rank 2		Rank 3	
	N	%	N	%	N	%
No. of observations	340	100.0	340	100.0	340	100.0
Manufactured/Expired date	226	66.5	61	17.9	40	11.8
Ingredients	14	4.1	77	22.6	64	18.8
Brand/Manufacturer	22	6.5	20	5.9	19	5.6
Food safety label	3	0.9	6	1.8	15	4.4
Organic food label	-	-	2	0.6	3	0.9
Content	1	0.3	13	3.8	12	3.5
Price	19	5.6	34	10.1	65	19.1
FDA label	43	12.5	83	24.4	49	14.4
Nutritional label	8	2.4	27	7.9	43	12.6
Calories/Energy	2	0.6	12	3.5	11	3.2
GMO label	1	0.3	5	1.5	15	4.4
Country of origin	-	-	-	-	2	0.6
Others	1	0.3	-	-	2	0.6

Source: Consumer survey

GM Foods Purchasing Preference

To know respondents preferences toward GM foods, they are asked whether they will purchase GM foods. The result shows that 66% or 226 persons think that they will not purchase GM foods and the rest think they will purchase GM foods, as shown in Table 6. This result is consistent with the findings reported by Srisawad (2003), who found that 70% of housewives in metropolitan Bangkok would not purchase GM products, and 30% would. The summaries are in Table 4.5.

Table 4.5 Proportion of respondents classified by GM foods purchasing preference

	Frequency	Percent
No. of observations	340	100.0
Purchase GM foods	114	33.5
Not purchase GM foods	226	66.5

Source: Consumer survey

Labeling for Non-GM food

After describing the information about GMO, the first part of the questionnaire intends to investigate the respondents' opinion with respect to their personal view on policy when a Non-GM soybean milk labeling regulation is proposed. Specifically, it seeks to determine how much they would be willing to pay for this to be achieved.

1. The importance of Non-GM soybean milk labeling

There are 90.5% of respondents or 308 persons who say that the Non-GM labeling regulation is important. The main reasons for Non-GM soybean milk labeling regulation being seen as important are that consumers have the right to know the origin of food (48.5% or 165 persons), followed by labeling regulation being seen as beneficial for consumers who want to avoid GM food (24.1% or 82 persons), labeling regulation providing consumers more options to buy (14.7% or 50 persons), and to support domestic Non-GM soybean producers (3.2% or 11 persons).

While 9.5% of respondents or 32 persons say that Non-GM labeling regulation is unimportant. The main reasons for Non-GM soybean milk labeling regulation being seen as unimportant are that it will confuse consumers (3.8% or 13 persons), followed by consumers not having sufficient knowledge about GMO (1.8% or 6 persons), food producers may boast about their food being Non-GM food (1.5% or 5 persons), soybean milk price will increase (1.5% or 5 persons), and giving

disadvantage to smaller food producer (0.9% or 3 persons). The summaries are shown in Table 4.6.

Table 4.6 Proportion of respondents about their opinion toward Non-GM soybean milk labeling regulation

Item	Frequency	Percent
No. of observations	340	100.0
The importance of Non-GM labeling		
Important	308	90.5
Unimportant	32	9.5
Reasons for important		
Consumer has the right to know the origin of food.	165	48.5
Consumer has more options to buy.	50	14.7
To provide information for consumer who want to avoid GM food.	82	24.1
To support domestic Non-GM soybean producers.	11	3.2
Others.	-	-
Reasons for unimportant		
It will confuse consumer.	13	3.8
Food producers may boast their food as Non-GM food.	5	1.5
Give disadvantage to smaller food producer.	3	0.9
Soybean milk price increases.	5	1.5
Don’t have knowledge on GMO	6	1.8

Source: Consumer survey

2. Willingness to pay for soybean milk with Non-GM labeling

One of the main purposes of this study is to elicit the value of soybean milk with Non-GM labeling. Respondents are presented with two soybean milk cartons, a base carton and unknown price carton. Both of them are identical; made from Non-GM soybean seed, appearance, taste and nutritional value, but differentiated by the GM food label. The base carton, which exists in the markets, does not have any text indicating the status of GM and its price is stable at 10 baht/carton for all survey respondents. In contrast, the unknown price carton (see in part 1 question 2 figure 2.4, Appendix C) has text indicating that the product is Non-GM and its price is dependent on respondents' bidding. With an open-ended question, respondents are asked to specify the maximum amount of money they would be willing to pay for soybean milk with Non-GM labeling.

The majority of respondents would be willing to pay equal to the base carton which accounted for 54.1% or 184 persons, followed by 38.5% or 131 persons would be willing to pay more and 7.4% or 25 persons would be willing to pay less, as presented in Table 4.7.

Table 4.7 Proportion of respondents classified by their willingness to pay for soybean milk with Non-GM labeling as compared with the base carton*

Item	Frequency	Percent
No. of observations	340	100
Willingness to pay less than base carton*	25	7.4
Willingness to pay equal to base carton*	184	54.1
Willingness to pay more than base carton*	131	38.5

Note: Based cartons define soybean milk with no GMO information, no GMO contamination, no Non-GM labeling and price = 10 baht. (see in part 1, question 2, figure 2.0, Appendix C)

Source: Consumer survey

3. Willingness to pay for soybean milk with GM labeling

The result obtained from this question used to generate as one of the various factors in empirical model. Respondents are presented with two soybean milk cartons, a base carton and unknown price carton. Both of them are identical; made from GM soybean seed (<5% of GM contamination), appearance, taste and nutritional value, but differentiated by the GM food label. The base carton, which exists in the markets, does not have any text indicating the status of GM and its price is stable at 10 baht/carton for all survey respondents. In contrast, the unknown price carton (see in part 1, question 2, figure 2.2, Appendix C) has text indicating that the product is GM and its price is dependent on respondents' bidding. With an open-ended question, respondents are asked to specify the maximum amount of money they would be willing to pay for soybean milk with GM labeling.

The majority of respondents would be willing to pay les than the base carton which accounted for 61.1% or 208 persons, followed by 24.4% or 83 persons would be willing to pay equal and 14.5% or 49 persons would be willing to pay more, as presented in Table 4.8.

Table 4.8 Proportion of respondents classified by their willingness to pay for soybean milk with GM labeling as compared with the base carton*

Item	Frequency	Percent
No. of observations	340	100
Willingness to pay less than base carton*	208	61.1
Willingness to pay equal to base carton*	83	24.4
Willingness to pay more than base carton*	49	14.5

Note: Based cartons define soybean milk with no GMO information, no GMO contamination, no GM labeling and price = 10 baht. (see in part 1, question 2, figure 2.0, Appendix C)

Source: Consumer survey

Soybean Milk Purchasing Patterns

In order to generate more background information on consumer behavior, respondents are asked about their soybean milk purchasing behavior, patterns and the reasons behind it. The summary of these finding are presented in Table 4.9.

The main focus of this study is on soybean milk, therefore, only soybean milk purchasers are interviewed. This study also addresses the reasons behind soybean milk purchasing. Most respondents, 57.6% or 196 persons, give the reason that they like it, followed by good for health, purchase only during vegetarian festivals and to substitute dairy products which accounted for 19.4% or 66 persons, 17.6% or 60 persons and 5.3% or 18 persons, respectively. With respect to the most preferred places of soybean milk purchasing, it was found that 77.1% of respondents or 262 persons always buy soybean milk from supermarkets/hypermarkets, followed by grocery/stall, convenience shop and cart/peddle shop which accounted for 15.3% or 52 persons, 4.4% or 15 persons and 3.2% or 11 persons, respectively.

With respect to the frequency of soybean milk purchase, it was found that most respondents, 30.6% or 104 persons, purchase soybean milk at least 2-3 times/month, followed by 2-3 times/week and once a week which accounted for 30.3% or 103 persons and 16.1% or 55 persons, respectively. Additionally, the survey asked respondents to identify the most preferred package of soybean milk. In Thailand, soybean milk packages can be categorized into three groups; carton, bottle and plastic bag. Carton and bottle are available in supermarkets, hypermarkets or general stores; whereas plastic bag are available in fresh markets, peddle shops and carts. GMO information, however, can be obtained from the labels of cartons or bottles, but not plastic bags. This is because GMO information provision does not apply to small vendors who sell products directly to consumers, such as carts and peddle shops. It was found that consumers prefer purchasing soybean milk contained in cartons: 250 ml. most which accounted for 38.5% or 131 persons.

Table 4.9 Proportion of respondents classified by soybean milk purchasing pattern

Item	Frequency	Percent
No. of observations	340	100.0
Reason to buy soybean milk (carton/bottle)		
Like soybean milk	196	57.6
To substitute dairy products	18	5.3
Only during vegetarian festivals	60	17.6
Others (good for health)	66	19.4
Place of soybean milk buying		
Grocery/Stall	52	15.3
Supermarket/Hypermarket	262	77.1
Cart/Peddle shop	11	3.2
Others (convenience shop)	15	4.4
Frequency of soybean milk buying		
Everyday	17	5.0
4-6 times/week	23	6.8
2-3 times/week	103	30.3
Once a week	55	16.1
2-3 times/month	104	30.6
Others	38	11.2
Favorite type of soybean milk package		
Plastic	24	7.1
Carton		
125 ml.	35	10.3
200 ml.	64	18.8
250 ml.	131	38.5
300 ml.	27	7.9
500 ml.	5	1.5

Table 4.9 (Continued)

Item	Frequency	Percent
1,000 ml.	7	2.1
Bottle		
210 ml.	21	6.2
280 ml.	15	4.4
300 ml.	11	3.2

Source: Consumer survey

Knowledge on GMO Facts

To measure knowledge on GMO facts, respondents were asked to evaluate ten different statements and to state whether each is true or false. The ten statements (the correct answer is in parenthesis) are as follows:

1. Genetic material plays an important role in determining the appearance and behavior of organisms. (True)

2. GMO is the abbreviation of Genetically Modified Organisms. (True)

3. Genetically modified organisms including animals, plants and microorganisms. (True)

4. GMO requires the use of a technique called genetic engineering which is controlled by humans only. (True)

5. Genetic engineering is a transfer of genetic material from one organism to another organism. (True)

6. Cross-breeding between plants and animals cannot occur naturally, but genetic engineering can achieve it. (True)

7. Natural selection takes so long to get the best species, but genetic engineering takes a shorter time and can specify the needed species. (True)

8. Genetically modified foods are foods derived from genetically modified plants or animals. (True)

9. When you consume meats or plants means you consume their genetic material also. (True)

10. Genetic engineering can be used in medical treatment. (True)

These answers are scored if true = 1 and false = 0. The knowledge on GMO can be classified into three groups using the values of score as follows:

1. Group with low level of GMO knowledge – group with range of score 1-4

2. Group with moderate level of GMO knowledge – group with range of score 5-7

3. Group with high level of GMO knowledge – group with range of score 8-10

According to the analysis result, 79.1% of respondents or 269 persons have knowledge on GMO facts at high levels, 20.6% or 70 persons have knowledge on GMO facts at moderate levels and less than 1% or 1 person have knowledge on GMO facts at low levels, as presented in Table 4.10.

Table 4.10 Proportion of respondents classified by level of GMO knowledge

Level of GMO knowledge	Frequency	Percent
No. of observations	340	100.0
Low level of GMO knowledge	1	0.3
Moderate level of GMO knowledge	70	20.6
High level of GMO knowledge	269	79.1

Source: Consumer survey

Attitudes toward GMO

Respondents' attitudes toward GMO are measured by asking whether they strongly disagree, disagree, are neutral, agree and strongly agree in four aspects; health hazards, consumption benefits, environmental effects and GM food labeling regulations.

1. Aspect of health hazards

Overall, respondents show a negative attitude toward GMO in respect to health hazards, as presented in Table 4.11. It is found that 41.2% of the respondents or 140 persons are uncertain whether GM food consumption can cause an allergic reaction, 40.0% or 136 persons agree and 18.8% or 64 persons of respondents disagree.

There are 56.2% of the respondents or 191 persons agree that GM food consumption can lead to antibiotic-resistant diseases, 107% or 31.5% are uncertain and 12.3% or 42 persons disagree.

There are 57.7% of the respondents or 196 persons who agree that GM food consumption causes long-term health hazards, 28.2% or 96 persons are uncertain and 14.1% or 48 persons disagree.

There are 39.4% of the respondents or 134 persons who disagree that nutrients in GM foods are less than conventional food, 33.8% or 115 persons agree and 26.8% or 91 persons are uncertain.

There are 38.0% of the respondents or 129 persons who agree that GM food consumption causes human gene mutation, 34.7% or 118 persons are uncertain and 27.3% or 93 persons disagree.

Table 4.11 Proportion of respondents about their attitude toward GMO by aspect of health hazards

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N	N	N	N	N
Cause an allergic reaction.	13 (3.8)	51 (15.0)	140 (41.2)	109 (32.1)	27 (7.9)
Lead to antibiotic-resistant Diseases.	7 (2.0)	35 (10.3)	107 (31.5)	151 (44.4)	40 (11.8)
Cause long-term health hazard.	11 (3.2)	37 (10.9)	96 (28.2)	136 (40.0)	60 (17.7)
Nutrients in GM food are less than conventional food.	24 (7.0)	110 (32.4)	91 (26.8)	81 (23.8)	34 (10.0)
May cause human gene mutation.	15 (4.4)	78 (22.9)	118 (34.7)	92 (27.1)	37 (10.9)

Note: Numbers in parenthesis refers to percent value

Source: Consumer survey

2. Aspect of consumption benefits

Overall, respondents show a positive attitude toward GMO in aspect of consumption benefits, as presented in Table 4.12. It is found that 59.7% of the respondents or 203 persons agree that GM food has higher quality than conventional food, 21.1% or 72 persons disagree and 19.1% or 65 persons are uncertain.

There are 55.6% of the respondents or 189 persons who agree that GM food has less residual chemical than conventional food, 22.9% or 78 persons are uncertain and 21.4% or 73 persons disagree.

There are 60.3% of the respondents or 205 persons who agree that GM food can delay ripening or can be stored longer, 21.2% or 72 persons are uncertain and 18.5% or 63 persons disagree.

There are 54.4% of the respondents or 185 persons agree that GM food is cheaper than conventional food, 23.0% or 78 persons disagree and 22.7% or 77 persons are uncertain.

Table 4.12 Proportion of respondents about their attitude toward GMO by aspect of consumption benefits

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N	N	N	N	N
GM food has higher quality than conventional food.	11 (3.2)	61 (17.9)	65 (19.1)	174 (51.2)	29 (8.5)
GM food has less residual chemical than conventional food..	11 (3.2)	62 (18.2)	78 (22.9)	159 (46.8)	30 (8.8)

Table 4.12 (Continued)

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N	N	N	N	N
GM food can delay ripening/ can be stored longer.	13 (3.8)	50 (14.7)	72 (21.2)	178 (52.4)	27 (7.9)
GM food is cheaper than conventional food.	19 (5.6)	59 (17.4)	77 (22.7)	155 (45.6)	30 (8.8)

Note: Numbers in parenthesis refer to percent value

Source: Consumer survey

3. Aspect of environmental effects

Overall, respondents show a different attitude toward GMO regarding environmental effects, as presented in Table 4.13. They have a positive attitudes toward GMOs as beneficial to the environment and negative attitudes toward GMOs as a hazard to the environment. It is found that 68.3% of the respondents or 232 persons agree that GM crop production causes an unbalanced ecosystem, 20.3% or 69 persons are uncertain and 11.5% or 39 persons disagree.

There are 80.0% of the respondents or 272 persons who agree that GM crop production has effects on biodiversity change, 14.1% or 48 persons are uncertain and 5.9% or 20 persons disagree.

There are 52.9% of the respondents or 180 persons who agree that GM crop production reduces chemical use, 29.4% or 100 persons are uncertain and 17.7% or 60 persons disagree.

There are 75.0% of the respondents or 255 persons who agree that GM crop production causes cross-pollination of GM crops with conventional crops, 17.6% or 60 persons are uncertain and 7.4% or 25 persons disagree.

There are 57.0% of the respondents or 194 persons who agree that GM crop production can conserve crops nearing extinction, 27.4% or 93 persons are uncertain and 15.6% or 53 persons disagree.

There are 61.2% of the respondents or 208 persons who agree that GM crop production can solve difficult crop production, 29.7% or 101 persons are uncertain and 9.1% or 21 persons disagree.

Table 4.13 Proportion of respondents about their attitudes toward GMO with respect to environmental effects

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N	N	N	N	N
Cause unbalanced ecosystem.	4 (1.2)	35 (10.3)	69 (20.3)	162 (47.7)	70 (20.6)
Effect on biodiversity change.	6 (1.8)	14 (4.1)	48 (14.1)	187 (55.0)	85 (25.0)
Reduce chemical use and make a better environment.	6 (1.8)	54 (15.9)	100 (29.4)	150 (44.1)	30 (8.8)
Cross-pollination of GM crop with conventional crop.	1 (0.3)	24 (7.1)	60 (17.6)	179 (52.6)	76 (22.4)
To conserve crops nearing extinction.	12 (3.5)	41 (12.1)	93 (27.4)	150 (44.1)	44 (12.9)
Solving difficult crop production i.e. salt-resistant rice.	6 (1.7)	25 (7.4)	101 (29.7)	169 (49.7)	39 (11.5)

Note: Numbers in parenthesis refer to percent value

Source: Consumer survey

4. Aspect of GM food labeling regulation

Overall, respondents show a positive attitude toward GMO in aspect of GM food labeling, as presented in Table 4.14. It is found that 88.2% of the respondents or 300 persons agree that the government should allow the use of Non-GM labels for Non-GM food products, 6.5% or 22 persons are uncertain and 5.3% or 18 persons disagree.

There are 88.5% of the respondents or 301 persons who agree that GM food labeling regulation should cover all GM food products, not only those derived from GM soybean and GM corn, 7.1% or 24 persons are uncertain and 4.4% or 15 persons disagree.

There are 91.2% of the respondents or 310 persons who agree that GM food labels should specify the proportion of GM contamination, 7.0% or 24 persons are uncertain and 1.8% or 6 persons disagree.

There are 93.2% of the respondents or 317 persons who agree that GM food labeling regulation should cover GM imported food product, 5.0% or 17 persons are uncertain and 1.8% or 6 persons disagree.

There are 96.2% of the respondents or 327 persons agree that the government should promote and disseminate more information on GM food labeling regulation to the public, 2.6% or 9 persons are uncertain and 1.2% or 4 persons disagree.

Table 4.14 Proportion of respondents about their attitude toward GMO with regard to GM food labeling regulation

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N	N	N	N	N
Allow the use of Non-GM label for Non-GM food product.	4 (1.2)	14 (4.1)	22 (6.5)	177 (52.0)	123 (36.2)
GM food labeling regulation should cover all GM food products.	3 (0.9)	12 (3.5)	24 (7.1)	163 (47.9)	138 (40.6)
GM food label should specify the proportion of GM contamination i.e. 2% of GM contamination.	1 (0.3)	5 (1.5)	24 (7.0)	169 (49.7)	141 (41.5)
GM food labeling regulation should cover GM imported food product.	1 (0.30)	5 (1.5)	17 (5.0)	166 (48.8)	151 (44.4)
The government should promote and disseminate more information on GM food labeling regulation to public.	2 (0.6)	2 (0.6)	9 (2.6)	159 (46.8)	168 (49.4)

Note: Numbers in parenthesis refer to percent value

Source: Consumer survey

Awareness toward GM food labeling regulation

To assess respondents' awareness toward GM food labeling regulation, they are asked to answer whether they know or do not know five statements concerning GM food labeling regulations. Not surprisingly, large numbers of respondents are unaware toward GM food labeling regulation, as presented in Table 4.15.

There are 89.4% of respondents or 304 persons do not know that GM food labeling regulation has been enforced by the Ministry of Public Health since May 11, 2006, 10.6% or 36 persons know.

There are 84.4% of respondents or 287 persons do not know that food products containing GM ingredients in the top three ingredients by weight representing more than 5% of the total weight and have more than 5% of GM in each ingredient must be labeled as GM food, 15.6% or 53 persons know.

There are 71.8% of respondents or 244 persons who do not know that only food products containing ingredients derived from GM soybean and GM corn must be labeled as GM food, 28.2% or 96 persons know.

There are 82.6% of respondents or 281 persons who do not know that GM food labeling regulation does not cover food directly sold by small vendors, 17.4% or 59 persons know.

There are 84.4% of respondents or 287 persons who do not know that the message on labels must not mislead the public by stating "Non-GM" or "GMO-free", 15.6% or 53 persons know.

Table 4.15 Proportion of respondents classified by awareness toward GM food labeling regulation

Statement	Know		Don't know	
	Frequency	**Percent**	**Frequency**	**Percent**
GM food labeling regulation has been enforced by the Ministry of Public Health since May 11, 2006.	36	10.6	304	89.4
Food product containing GM ingredients in the top three components by weight representing more than 5% of the total weight and have more than 5% of GM in each ingredient must be labeled as GM food.	53	15.6	287	84.4
Only food product containing ingredient derived from GM soybean and GM corn must be labeled as GM food.	96	28.2	244	71.8
GM food labeling regulation does not cover food directly sold by small vendors.	59	17.4	281	82.6
In Thailand, message on label must not mislead the public by stating "Non-GM", "GMO-free"	53	15.6	287	84.4

Source: Consumer survey

Empirical Results

Respondents decision to purchase GM food

Logistic regression is used to evaluate the relationship between independent variables and the probability of purchasing GM food. The significant factors can be separated into two groups; demographic and attitudinal factors. The results are reported in Table 4.16.

Demographic characteristics are significantly influence purchasing decisions on GM foods. Compared to students, the result indicates that governor/state enterprise officers and private business/store employees have a lower probability to purchase GM food. Additionally, the age of respondents is another factor that influences probability to purchase GM food, in that older respondents have a lower probability to purchase GM food compared to younger respondents.

Attitudes toward GMO are essential factors influencing the decision to purchase GM food. With regard to consumption benefits, the estimated result suggests that respondents who thought GM food is cheaper than conventional food have a higher probability to purchase GM food. In contrast, attitude toward GMO with regard to environmental effects is associated with the purchasing decision. This shows that respondents who agree that GM crop planting can cause an unbalanced ecosystem have a lower probability to purchase GM food. Likewise, with regard to health hazards, respondents who thought GM food consumption can lead to antibiotic-resistant diseases have a lower probability to purchase GM food.

Table 4.16 Estimates of the binary logit model of GM food purchasing decisions

Variables	Coefficient	Standard Error
Constant	1.7025	1.3885
Gender	-0.3829	0.2770
Age	-0.0424*	0.0220
Governor	-1.0049*	0.5373
Merchant	0.2269	0.5331
Employee	-0.8169**	0.3788
Hired labor	-0.2192	0.5285
Education	0.1860	0.1396
Income	-0.0361	0.1481
Antibiotic	-0.7239***	0.1616
Low price	0.5080***	0.1456
Ecosystem	-0.2959**	0.1465
GM knowledge	0.1755	0.3208
Log likelihood	-179.2695	
Chi-square	75.21	

Note: *, **, *** Estimates are significant at the 10%, 5% and 1% level, respectively

Source: Estimated based on consumer survey data

Factors influencing probability of paying for soybean milk with Non-GM labeling

Based on the data from the consumers' willingness to pay for soybean milk with Non-GM labeling, consumers choices is allocated into three groups; willingness to pay less than without Non-GM labeling, willingness to pay equal to without Non-Gm labeling and willingness to pay more than without Non-GM labeling. The multinomial logit model is employed to estimate the coefficients given the "willingness to pay for soybean milk with Non-GM labeling equal to without Non-GM labeling" as the base choice. However, the estimated coefficients are difficult to interpret and provide a basic level of information; this means the direction of the

relationship between the dependent and independent variables. (Kaye-Blake et al 2004). The parameters with the negative sign indicate that the higher value of the independent variable decreases the probability of the particular choice relative to the based choice. Likewise, the positive sign indicate that the higher value of the independent variables increases the probability of the particular choice relative to the based choice. Three coefficients are statistically significant; WTP_GM label, health hazard and pollution. The results are presented in Table 4.17.

WTP_GM label This variable means consumer is willing to pay less for the information that soybean milk is GM than without GM information. The positive sign for both equations indicates that consumer who is willing to pay less for soybean with GM labeling than without GM labeling increases the probability of paying less and paying higher for soybean milk with Non-GM labeling, relative to paying equal for soybean milk with Non-GM labeling.

Health hazard This variable concerns a negative attitude by aspect of long-term health hazard from GM food consumption. The positive sign for both equations suggests that the more consumer believe that GM foods consumption can cause long-term health hazard increases the probability of paying less and paying higher for soybean milk with Non-GM labeling, relative to paying equal for soybean milk with Non-GM labeling.

Better_envi This variable concerns a positive attitude in environmental effect of GM crop production reduces chemical use and make a better environment. The negative sign on the probability of paying higher for soybean milk with Non-GM labeling suggests that the more consumers believe that GM crop production reduces chemical use and make a better environment decreases the probability of paying higher for soybean milk with Non-GM labeling, relative to paying equal for soybean milk with Non-GM labeling.

Table 4.17 Estimates factors influencing probability of paying for soybean milk with Non-GM labeling

Variables	WTP less than base carton[a]		WTP higher than base carton[a]	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**
Constant	-4.662	2.354	-0.252	1.176
Gender	-0.429	0.472	0.061	0.258
Age	-0.015	0.036	-0.014	0.019
$Education_1$	0.301	0.539	-0.234	0.328
$Education_3$	-1.190	0.825	-0.460	0.318
Income	-0.000	0.000	0.000	0.000
$Occupation_2$	0.500	0.963	0.618	0.486
$Occupation_3$	0.299	0.810	-0.427	0.538
$Occupation_4$	0.230	0.662	-0.181	0.369
$Occupation_5$	1.271	0.949	0.339	0.510
WTP_GM label	1.586***	0.596	0.439*	0.252
Non-GM label	0.100	0.815	0.544	0.455
Label_import	-0.337	0.335	-0.177	0.189
Health hazard	0.540**	0.258	0.224*	0.130
Low price	0.116	0.253	0.157	0.131
Better_envi	0373	0.316	-0.352**	0.149
Log-likelihood = -269.1735		N = 340		

Note: *, **, *** Estimates are significant at the 10%, 5% and 1% level, respectively

[a] Base carton defines soybean milk with no GMO information, no GMO contamination, no Non-GM labeling and price = 10 baht. (see in part 1, question 2, figure 2.0, Appendix C)

Source: Estimated based on consumer survey data

Marginal effects on probability of paying for soybean milk with Non-GM labeling

As discussed in the methodology, marginal effects are calculated to determine the impact of a change in a variable on the probability of paying for soybean milk with Non-GM labeling. However, the sign of the estimated parameters (presented in Table 4.17) do not imply the same sign for the marginal effect with respect to the same variable. A positive sign of marginal effect suggests that the higher value of the independent variable increases the probability of the associated choice of paying for soybean milk with Non-GM labeling. Likewise, a negative sign of marginal effect suggests that the higher value of the independent variable decreases the probability of the associated choice of paying for soybean milk with Non-GM labeling. Three different models are estimated. Four coefficients are statistically significant: $Education_3$, WTP_GM label, Health hazard and Pollution. The marginal effects are presented in Table 4.18.

$Education_3$ The result suggests that consumer who has higher educational level increases the probability of paying the same for soybean milk with Non-GM labeling by about 12.6 percent. As the result, it does not support the hypotheses as it appears that the higher educated consumers are not willing to pay more for soybean milk with Non-GM labeling. Perhaps higher educated consumers are not seeing the uncertain benefits and risks of GM food.

WTP_GM label Consumer who is willing to pay less for the information that soybean milk is GM than without GM information implies that he is unfavorable to GM foods. It is hypothesized that they prefer soybean milk with Non-GM labeling and are willing to pay more for it. However, this result does not support such a hypothesis. The result suggests that consumer who is willing to pay for soybean milk with GM labeling less than without GM labeling has a higher probability of paying less for soybean milk with Non-GM labeling by about 5.9 percent, but has a lower probability of paying the same for soybean milk with Non-GM labeling by about 13.5

percent. It could be explained that price would be a barrier for their purchasing decision whether or not food is labeled.

Health hazard Most of consumers believe that GM foods consumption can cause long-term health hazards (57 percent). This statement is expected to have a higher probability of paying less for soybean milk with Non-GM labeling. However, the finding does not support such a hypothesis, illustrated by a lower probability of paying the same for soybean milk with Non-GM labeling by about 6.4 percent. In contrast they have a higher probability of paying less for soybean milk with Non-GM labeling by about 2.0 percent. One plausible explanation is that the existing knowledge of GM food among Thai consumers is still limited. In this context, consumers may undervalue tangible benefits for soybean milk with Non-GM labeling.

Better_envi As consumers are concerned about the positive effects of GM crop production, they tend to accept GM foods and reject food with Non-GM labeling. As expected, the result suggests the more consumers believe that GM crop production reduces chemical use and make a better environment, the lower the probability of paying higher for soybean milk with Non-GM labeling by about 9.1 percent. On the contrary, they have the higher the probability of paying less and paying the same for soybean milk with Non-GM labeling by about 2.3 percent and 6.7 percent, respectively.

It is noticed that many characteristics of consumers showed an insignificant correlation on the probability choice of paying for soybean milk with Non-GM labeling, for instance, gender, age, income level, occupation. Similarly, some attitude variables showed the insignificant correlation to the probability of paying for Non-GM information; those are the importance of Non-GM labeling regulation, benefit from lower price of GM food than the conventional food, and the importance of GM labeling regulation for GM imported food products. The reason may be these attitude variables do not have a strong impact on the choice of paying for Non-GM information on soybean milk.

Table 4.18 Marginal effects on probability of paying for soybean milk with Non-GM labeling

Variables	Choice of WTP for soybean milk with Non-GM labeling		
	Less than base carton[a]	**Equal to base carton[a]**	**Higher than base carton[a]**
Gender	-0.022	-0.001	0.023
	(0.023)	-	(0.060)
Age	-0.000	0.003	-0.003
	(0.001)	(0.004)	(0.004)
$Education_1$	0.020	0.041	-0.061
	(0.029)	(0.075)	(0.073)
$Education_3$	-0.036	0.126*	-0.090
	(0.022)	0.071	(0.070)
Income	-1.360	-2.960	4.320
	(0.000)	(0.000)	(0.000)
$Occupation_2$	0.010	-0.150	0.140
	(0.048)	(0.116)	(0.116)
$Occupation_3$	0.025	0.078	-0.102
	(0.055)	(0.117)	(0.112)
$Occupation_4$	0.014	0.033	-0.047
	(0.030)	(0.086)	(0.085)
$Occupation_5$	0.077	-0.120	0.042
	(0.089)	(0.121)	(0.121)
WTP_GM label	0.059***	-0.135**	0.076
	(0.022)	(0.058)	(0.057)
Non-GM label	-0.004	-0.115	0.120
	(0.039)	(0.095)	(0.093)
Health hazard	0.020*	-0.064**	0.043
	(0.011)	0.031	(0.030)

Table 4.18 (Continued)

Variables	Choice of WTP for soybean milk with Non-GM labeling		
	Less than base carton[a]	**Equal to base carton[a]**	**Higher than base carton[a]**
Low price	0.002	-0.038	0.035
	(0.011)	0.031	(0.031)
Better_envi	0.023*	0.067*	-0.091***
	(0.014)	0.035	(0.035)
Label_import	-0.012	0.048	-0.036
	(0.015)	(0.045)	(0.044)

Note: *, **, *** Estimates are significant at the 10%, 5% and 1% level, respectively

[a] Base carton defines soybean milk with no GMO information, no GMO contamination, no Non-GM labeling and price = 10 baht. (see in part 1, question 2, figure 2.0, Appendix C)

Source: Estimated based on consumer survey data

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

For many years, GM foods have been commercially produced. This caused GM foods are increasingly available to consumers. But at the same time they have expressed concerns regarding the uncertain effects of GM foods, especially in the aspects of risks, benefits and environment. Many previous studies revealed these attitudes become essential factors in the acceptance of GM foods. An increasing attention also paid to the regulations concerning GM foods, in particular GM foods labeling. This study was based on the assumption that consumers acceptance on GM foods would be related to their willingness to pay for foods with Non-GM labeling, the lower the acceptance, the higher willingness to pay for foods with Non-GM labeling. Initially, the study made an examination of consumers acceptance on GM foods. Then the effect of Non-GM labeling was analyzed. The study surveyed 340 soybean milk consumers interviewed in supermarkets/hypermarkets across Bangkok.

With respect to the level of GM knowledge, the result indicated that the majority of respondents have a highly level of GMO knowledge. The main sources of receiving GMO information was mass media such as television, printed media and internet. As the strong opposition of NGO in Thailand, the receiving GMO information from this source was considered low. The survey indicated those respondents were sometimes read food label. In addition, manufactured/expired date, FDA label and brand/manufacturer were ranked as top three most important of label information respondents gave attention, respectively. However, even a little percent of paying attention to GMO label information, respondents aware on the importance of Non-GM food labeling. Presumably, consumers did not care about GMO, they just want to reserve their right to refuse GM foods.

With respect to GM foods purchasing decision, the result indicated that more than 66 percent of consumers deny purchasing food if they know before that food has GM ingredients, reflecting the low acceptance on GM foods. Considering the result of willingness to pay for soybean milk with Non-GM labeling, it is in the contradiction that almost all consumers found Non-GM labeling is important, it appears that most of them are willing to pay as the same price with soybean milk without Non-GM labeling, implying the additional cost of labeling should be a burden of consumers.

The consumers attitude toward GMO are varied by aspects. The result indicated that consumers have a negative attitude in all aspects of health hazard from consuming GM foods. The highest concerns were in the aspect of GM foods consuming cause long-term health hazard followed by GM foods consuming can lead to antibiotic-resistant diseases, GM foods consuming cause an allergy reaction, nutrients in GM foods are less than conventional foods and GM foods consuming cause human gene mutation, respectively.

On the other hand, consumers attitude toward GM foods in aspects of benefits consumption are overall positive. The highest appreciations were in the aspects of GM foods can delay ripening or store longer followed by GM foods have higher quality than conventional foods, GM foods have less chemical residual than conventional foods and GM foods are cheaper than conventional foods, respectively.

Attitudes toward environmental effects of GMO are mixed. The results indicated consumers have positive attitudes toward GMO as beneficial to the environment, such reduce chemical use and make a better environment, and conserve plants or animals nearing extinction, whereas, negative attitudes are found in the aspects of hazard to the environment, such as GM crops production cause unbalanced ecosystem, biodiversity change and cross-pollination with natural crops.

Food labeling becomes an important tool in providing consumers information, but it seems to be in the opposition to consumers who have a low awareness on overall GM foods labeling, particularly, the enforcement of GM foods labeling regulation. In addition, consumers also request more promote and disseminate on GM foods labeling by government.

Consistent with previous studies, consumers acceptance toward GM foods is significantly affected by attitudinal factors. Among all factors, the most important factors that influence the decision to purchase GM foods are consumers attitudes towards GM foods. Consumers who perceived health hazard and negative environmental effects are more likely not to purchase GM foods, whereas, for those who perceived the benefits of GM foods resulting in lower food price are more likely to purchase GM foods. Demographic factors also influence purchasing decision. The result predicts that older consumers have a higher probability not to purchase GM soybean as compared to younger. Similarly, consumers who are governor/state enterprise officers and private business/store employees are associated with the probability not to purchase GM soybean milk, as compared with students.

In the analysis of the effects of consumers' characteristics and attitudes on the probability of paying for soybean milk with Non-GM labeling, the result showed that the key factor that has impact on probability of paying for soybean milk with Non-GM labeling is consumer who is willing to pay less for soybean milk with GM labeling than without GM labeling, implying a higher probability of paying less for soybean milk with Non-GM labeling, and a lower probability of paying the same for soybean milk with Non-GM labeling. Similarly, a negative attitude towards a long-term health hazard from GM food consumption indicated a higher probability of paying less for soybean milk with Non-GM labeling, and a lower probability of paying the same for soybean milk with Non-GM labeling. Conversely, a positive attitude towards GM crop production, namely that it reduces chemical use and make a better environment, indicated a higher probability of paying less and paying the same for soybean milk with Non-GM labeling, but a lower probability of paying higher for soybean milk with Non-GM labeling. This result is consistent with the study by Baker

and Burnham (2001) where attitude variables performed better as explanatory variables than socio-demographic variables.

Recommendations

The empirical findings provide useful guides to recommend producers and policy makers to identify their strategies and policies. The first part of GM food acceptance demonstrates that consumers are more willing to purchase GM food when it is cheaper than the conventional option. This implies that price is an important factor for consumers' purchasing decisions. In this context, a decrease in GM food price would lead to an increase in the consumption of such products and would benefit food suppliers. Likewise, negative attitudes toward GM food (such as consumption risks and environmental effect) are found to play an important role in shaping the non-acceptance of GM food. Hence, an effective communication of the benefits of GM food to consumers is needed to improve their understanding. This could lead to higher acceptance of GM food.

Another interesting finding of our analysis is that there are no evidence for a higher willingness to pay for soybean milk with Non-GM labeling, implying that consumers do not value this product attribute. As Non-GM food producers are not able to sell such products at a price that is higher than the conventional level, this suggests that investing in the Non-GM labeling will create higher transaction cost, but may not be profitable for Non-GM food producers.

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APPENDICES

Appendix A

Notification of the Ministry of Public Health

(No. 251) B.E. 2545 (2002)

(Unofficial)

Notification of the Ministry of Public Health

(No. 251) B.E. 2545 (2002)

Re: Labelling of Food Obtained Through Certain Techniques of

Genetic Modification / Genetic Engineering.

To provide information to the consumer concerning food obtained through certain techniques of Genetic Modification/ Genetic Engineering.

By the virtue of provisions of Section 5 and Section 6(10) of the Food Act B.E. 2522 (1979), in which contain provisions in relation to the restriction of Rights and Liberties of the Persons, in respect of which Section 29 and in conjunction with Section 35, Section 48 and Section 50 of the Constitution of the Kingdom of Thailand so permit by virtue of provisions of law; the Minister of Public Health hereby issues the notification as follows:

Clause 1. Soybean and soybean products, corn and corn products, which obtained through certain techniques of Genetic Modification / Genetic Engineering, shall be subjected to labeling.

Clause 2. The food under Clause 1 means soybean and soybean products, corn and corn products, as listed in the attachment of this notification, which contain recombinant DNA or protein resulting from gene technology from 5 percent up of each top three main ingredients in terms of the ration of weight they occupy, and each weight ration accounts for five or more percent of the total.

Clause 3. The label of food under Clause 1 shall:

3.1 be subjected to the notification of the Ministry of Public Health of certain products.

3.2 be subjected to the notification of the Ministry of Public Health (No. 194) B.E. 2543 (2000), Re: Labels, dated 19th September B.E. 2543 (2000), with the exception of Clause 3(1) name of foods and Clause 3(5) name of ingredients shall be as follows:

(a) For food which contains only one main ingredient, its label should provide the statement of "Genetically Modified" in conjunction with, or in close proximity to, the name of foods under Clause 1 such as "Genetically Modified Corn", "Tofu produced from Genetically Modified Soybean", etc.

(b) For multi-ingredient foods, its label should provide the statement of "Genetically Modified" in conjunction with, or in close proximity to, or under the names of top three main ingredients of foods, such as "Genetically Modified Corn Starch"

The above statements shall be in clearly and readable manner displayed which the sizes of lettering and spaces shall be in good proportion to areas of the labels.

Clause 4. The statements in Clause 3 shall not apply for small producers who produce and directly sell to consumers.

"Small producers" refer to the small producers who produce and directly sell to consumers in a restricted area and also could provide information directly to consumers.

Clause 5. To protect the consumers from misleading of labelling, following statements including "Free from Genetically Modified Food" or "Non Genetically Modified Food" or "Do Not Contain Constituents of Genetically Modified Food" or "Segregated Genetically Modified Constituent" or any other similar statements shall be prohibited.

Clause 6. This notification shall come into force after the lapse of one year from the day following date of its publication in the Government Gazette.

Notified on 8th April 2001.

Signed Sudarat Keyurabhun
(Mrs. Sudarat Keyurabhun)
Minister of Public Health

Source: Food and Drug Administration. 2001 Notification of the Ministry of Public Health: (No. 251) B.E. 2545 (2002), Re: Labelling of Food Obtained Through Certain Techniques of Genetic Modification / Genetic Engineering. online www.fda.moph.go.th , retrieved October 2009

Appendix B

Annex to the notification of the Ministry of Public Health No. 251 B.E. 2545 (2002)

Annex to the notification of the Ministry of Public Health No. 251 B.E. 2545 (2002)
Re: Labelling of Food Obtained Through Certain Techniques of
Genetic Modification/ Genetic Engineering.

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1. Soybean
2. Cooked soybean
3. Roasted soybean
4. Canned or bottled or retort pouch soybean
5. Natto (fermented soybean)
6. Soybean paste
7. Tofu (soybean curd) and fried tofu
8. Dried soybean curd, soybean refuse, yabu
9. Soybean milk
10. Soybean flour
11. Food containing item 1 to 10 as a main ingredient
12. Food containing soybean protein as a main ingredient
13. Food containing green soybean as a main ingredient
14. Food containing soybean sprouts as a main ingredient
15. Corn
16. Popcorn
17. Frozen or chilled corn
18. Canned or bottled or retort pouch corn
19. Corn flour / corn starch
20. Corn snack
21. Food containing item 15 to 20 as a main ingredient
22. Food containing corn grits as a main ingredient

Source: Food and Drug Administration. 2001 Annex to the notification of the Ministry of Public Health No. 251 B.E. 2545 (2002), Re: Labelling of Food Obtained Through Certain Techniques of Genetic Modification / Genetic Engineering. online www.fda.moph.go.th , retrieved October 2009

Appendix C

Questionnaire

แบบสอบถาม

เรื่อง	การประเมินมูลค่าทางเศรษฐศาสตร์ของข้อมูลและกฎการแสดงฉลาก นมถั่วเหลืองที่ผ่านการดัดแปรพันธุกรรม (GMO) ของผู้ซื้อในเขตกรุงเทพมหานคร
โครงการ	วิทยานิพนธ์วิทยาศาสตร์มหาบัณฑิต (เศรษฐศาสตร์เกษตร)
ผู้วิจัย	นางสาวสโรบล เครือหลี นิสิตปริญญาโท สาขาเศรษฐศาสตร์เกษตร ภาควิชาเศรษฐศาสตร์เกษตรและทรัพยากร คณะเศรษฐศาสตร์ มหาวิทยาลัยเกษตรศาสตร์
วัตถุประสงค์	เพื่อต้องการวัดระดับความรู้ ความคิดเห็น และความเต็มใจจ่ายของผู้บริโภคที่มีต่อข้อมูลและกฎการแสดงฉลากนมถั่วเหลืองที่ผ่านการดัดแปรพันธุกรรม (GMO)
คำชี้แจง	โปรดทำเครื่องหมายถูก (√) ในช่องว่างที่ท่านเลือก

GMO หมายถึง สินค้าที่ผ่านการดัดแปรพันธุกรรม, สินค้าที่ผ่านการตัดแต่งพันธุกรรม, สินค้าที่ผ่านการดัดแปลงพันธุกรรม หรือสินค้าแปลงพันธุ์

Non-GMO หมายถึง สินค้าที่ไม่ผ่านการดัดแปรพันธุกรรม, สินค้าที่ไม่ผ่านการตัดแต่งพันธุกรรม, สินค้าที่ไม่ผ่านการดัดแปลงพันธุกรรม หรือสินค้าไม่ผ่านการแปลงพันธุ์

ถั่วเหลือง GMO หมายถึง ถั่วเหลืองที่มีคุณสมบัติทางกายภาพ ทางเคมี และส่วนประกอบทางโภชนาการเหมือนกับถั่วเหลืองปกติทุกอย่าง แต่เกิดจากการถ่ายทอดสารพันธุกรรม (ยีน) จากสิ่งมีชีวิตอื่น เพื่อให้มีคุณสมบัติตามที่มนุษย์ต้องการ

ส่วนที่ 1 ความเต็มใจจ่ายต่อฉลากนมถั่วเหลือง

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ท่านเลือก)

1. สำหรับผลิตภัณฑ์นมถั่วเหลืองบรรจุกล่อง ท่านคิดว่าการแสดง **"ฉลากนมถั่วเหลืองซึ่งผลิตจากถั่วเหลืองที่ไม่ผ่านการดัดแปรพันธุกรรม" (นมถั่วเหลือง Non-GM)** เป็นเรื่องที่สำคัญหรือไม่

☐ 1 สำคัญ *(โปรดระบุสาเหตุจากตัวเลือกเพียงข้อเดียว)*

- ☐ เป็นสิทธิของผู้บริโภคที่จะทราบว่าอาหารที่ตนซื้อนั้นมีที่มาอย่างไรบ้าง
- ☐ ทำให้ผู้บริโภคมีโอกาสในการเลือกซื้อมากขึ้น
- ☐ เพื่อเป็นการให้ข้อมูลแก่ผู้บริโภคกลุ่มที่ต้องการหลีกเลี่ยงอาหาร GMO
- ☐ เพื่อเป็นการสนับสนุนผู้ผลิตถั่วเหลือง Non-GMO ในประเทศ
- ☐ อื่น ๆ โปรดระบุ ..... A1.1___

☐ 2 ไม่สำคัญ *(โปรดระบุสาเหตุจากตัวเลือกเพียงข้อเดียว)*

- ☐ ทำ/ให้ผู้บริโภคเกิดความสับสน
- ☐ เป็นเหตุให้ผู้ผลิตสามารถอวดอ้างได้ว่าสินค้าของตนเป็น Non-GMO
- ☐ เกิดการได้เปรียบเสียเปรียบระหว่างผู้ผลิตรายเล็กและรายใหญ่
- ☐ ราคานมถั่วเหลืองจะเพิ่มสูงขึ้น
- ☐ อื่น ๆ โปรดระบุ ..... A1.2___

2. **<u>สมมติว่าการดำเนินนโยบายแสดงฉลาก “นมถั่วเหลือง Non-GMO” เกิดขึ้นจริง ท่านยินดีที่จะจ่ายเงินเพื่อเป็นค่าแสดงฉลากเท่าไร</u>** *โปรดพิจารณาข้อมูลในแฟ้มภาพเพื่อประกอบการตัดสินใจ และระบุราคาสำหรับนมถั่วเหลืองกล่องที่1-5* ***<u>เมื่อเปรียบเทียบกับกล่องอ้างอิง</u>*** *(โปรดดูฉลากหน้าต่อไป)*

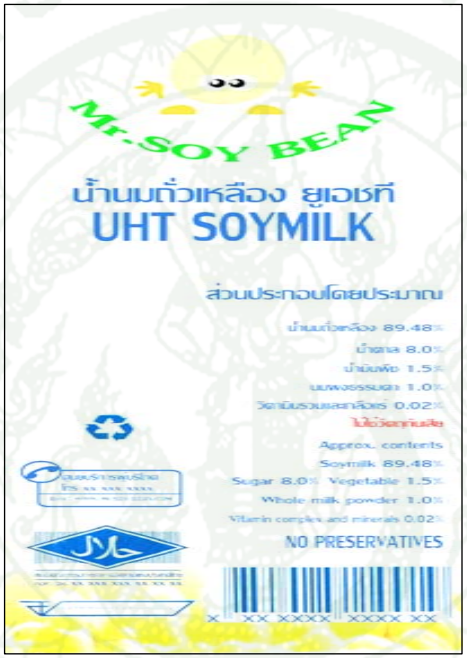

Figure 2.0

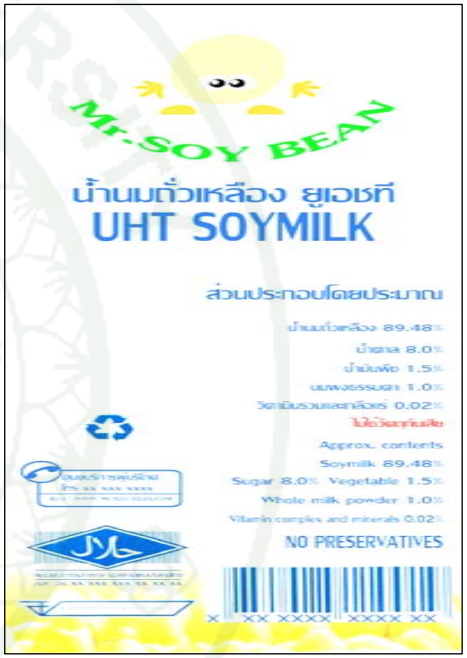

Figure 2.1

คุณสมบัติ	กล่องอ้างอิง	กล่องที่ 1
1. การปนเปื้อนถั่วเหลือง GMO	ไม่ปนเปื้อน	ปนเปื้อน
2. สัดส่วนการปนเปื้อนถั่วเหลือง GMO	0%	< 5%
3. การแสดงข้อความเกี่ยวกับ GMO	ไม่แสดง	ไม่แสดง
4. ข้อความที่ปรากฏในฉลาก	-	-
5. ราคา (บาท)	10	

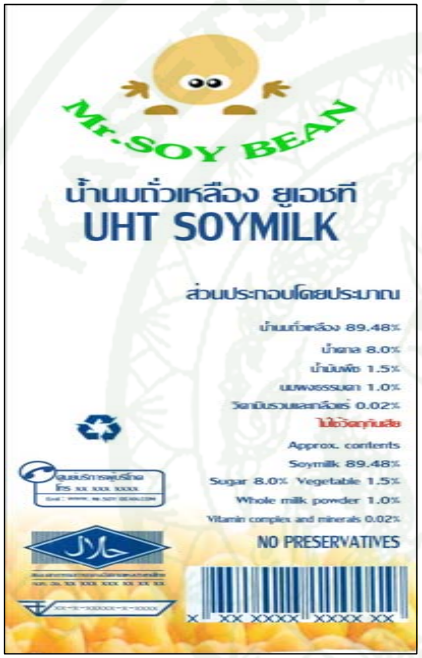

Figure 2.0

Figure 2.2

Figures 2.3

คุณสมบัติ	กล่องอ้างอิง	กล่องที่ 2	กล่องที่ 3
1. การปนเปื้อนถั่วเหลือง GMO	ไม่ปนเปื้อน	ปนเปื้อน	ปนเปื้อน
2. สัดส่วนการปนเปื้อนถั่วเหลือง GMO	0%	< 5%	≥ 5%
3. การแสดงข้อความเกี่ยวกับ GMO	ไม่แสดง	แสดง	แสดง
4. ข้อความที่ปรากฏในฉลาก	-	GMO (อาหารดัดแปรพันธุกรรม)	GMO (อาหารดัดแปรพันธุกรรม)
5. ราคา (บาท)	10		

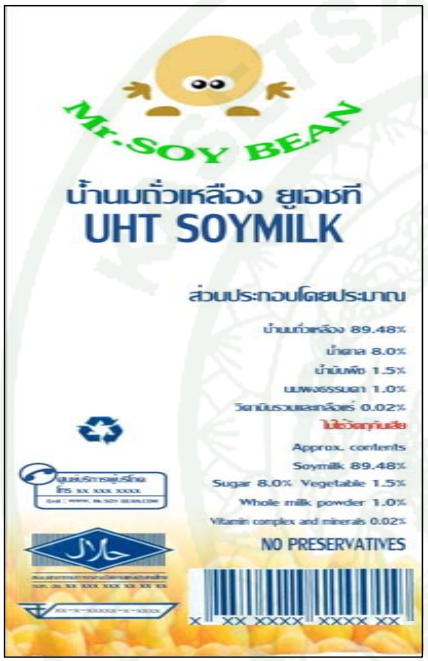

Figure 2.0

Figure 2.4

Figure 2.5

คุณสมบัติ	กล่องอ้างอิง	กล่องที่ 4	กล่องที่ 5
1. การปนเปื้อนถั่วเหลือง GMO	ไม่ปนเปื้อน	ไม่ปนเปื้อน	ปนเปื้อน
2. สัดส่วนการปนเปื้อนถั่วเหลือง GMO	0%	0%	<5%
3. การแสดงข้อความเกี่ยวกับ GMO	ไม่แสดง	แสดง	แสดง
4. ข้อความที่ปรากฏในฉลาก	-	Non-GMO (ไม่ใช่อาหารดัดแปรพันธุกรรม)	Non-GMO (ไม่ใช่อาหารดัดแปรพันธุกรรม)
5. ราคา (บาท)	10		

<u>ส่วนที่ 2 พฤติกรรมการซื้อนมถั่วเหลืองเพื่อการบริโภค</u>

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ท่านเลือก)

1. เหตุผลที่ท่านซื้อนมถั่วเหลืองแบบบรรจุ**<u>กล่อง</u>**หรือ**<u>ขวด</u>** เพื่อการบริโภค (**<u>ยกเว้น</u>**นมถั่วเหลืองที่จำหน่าย

   ในถุงพลาสติก) *(ตอบเพียง 1 ข้อ)*

   - ☐ ชอบรับประทานนมถั่วเหลือง
   - ☐ ไม่ชอบ / ไม่สามารถรับประทานนมวัวได้
   - ☐ บริโภคตามเทศกาล เช่น เทศกาลกินเจ
   - ☐ อื่นๆ โปรดระบุ…….. B1___

2. สถานที่ที่ซื้อนมถั่วเหลือง**<u>บ่อยที่สุด</u>** *(ตอบเพียง 1 ข้อ)*

   - ☐ ร้านขายของชำ / แผงลอยทั่วไปในตลาดสด
   - ☐ ซุปเปอร์มาร์เกต / ไฮเปอร์มาร์เกต
   - ☐ ร้านรถเข็น หาบเร่ แผงลอย
   - ☐ อื่นๆ โปรดระบุ…… B2___

3. ความถี่ในการซื้อนมถั่วเหลืองเพื่อบริโภค

   - ☐ ทุกวัน
   - ☐ สัปดาห์ละ 4-6 ครั้ง
   - ☐ สัปดาห์ละ 2-3 ครั้ง
   - ☐ สัปดาห์ละครั้ง
   - ☐ เดือนละ 2-3 ครั้ง
   - ☐ อื่นๆ โปรดระบุ…… B3___

4. ลักษณะบรรจุภัณฑ์ของนมถั่วเหลืองที่ท่านซื้อ**<u>บ่อยที่สุด</u>** *(ตอบเพียง 1 ข้อ)*

   - ☐ ถุงพลาสติกไม่ระบุยี่ห้อ
   - ☐ บรรจุกล่อง (กรุณาระบุขนาด)

     ☐125 มล. ☐200 มล. ☐250 มล. ☐300 มล. ☐500 มล. ☐1,000 มล.

   - ☐ บรรจุขวด (กรุณาระบุขนาด)

     ☐210 มล. ☐280 มล. ☐300 มล. B4___

ส่วนที่ 3 ความรู้ทั่วไปเกี่ยวกับการดัดแปรพันธุกรรม (GMO)

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ท่านเลือก)

ข้อความ	ถูก	ผิด	
1. สารพันธุกรรม (ยีน) ในสิ่งมีชีวิต เป็นตัวกำหนดลักษณะต่างๆ ทางพันธุกรรมที่สามารถถ่ายทอดไปยังลูกหลานได้ เช่น สีผิว สีตา ความสูง เป็นต้น			C1____
2. GMO เป็นคำย่อมาจาก Genetically Modified Organisms			C2____
3. สิ่งมีชีวิตที่ผ่านการดัดแปรพันธุกรรม (GMO) อาจเป็น พืช สัตว์ หรือจุลินทรีย์ก็ได้			C3____
4. GMO ต้องอาศัยเทคนิคการตัดต่อพันธุกรรม ซึ่งกระทำโดยมนุษย์เท่านั้น			C4____
5. เทคนิคการตัดต่อพันธุกรรม คือ การนำสารพันธุกรรม (ยีน) จากสิ่งมีชีวิตชนิดหนึ่งใส่เข้าไปในสิ่งมีชีวิตอีกชนิดหนึ่งโดยอาศัยวิธีพันธุวิศวกรรม			C5____
6. การผสมข้ามสายพันธุ์ระหว่างพืชกับสัตว์ ไม่สามารถเกิดขึ้นตามธรรมชาติได้ แต่สามารถทำได้ด้วยเทคนิคการตัดต่อพันธุกรรม			C6____
7. การปรับปรุงพันธุ์ตามธรรมชาติต้องใช้เวลานานกว่าจะคัดเลือกจนได้สายพันธุ์ที่ดีที่สุด แต่การดัดแปรพันธุกรรมใช้เวลาสั้นกว่าและสามารถเจาะจงสายพันธุ์ที่ต้องการได้			C7____
8. ผลิตภัณฑ์อาหาร GMO หมายถึง ผลิตภัณฑ์อาหารที่ได้จากสิ่งมีชีวิตที่ผ่านการดัดแปรพันธุกรรมทั้งพืชและสัตว์ ซึ่งอาจอยู่ในรูปผลิตภัณฑ์อาหารที่ใช้บริโภคโดยตรง หรือเป็นส่วนประกอบของอาหาร			C8____
9. เมื่อท่านบริโภคพืชหรือสัตว์ หมายถึง ท่านบริโภคสารพันธุกรรม (ยีน) จากพืชหรือสัตว์เหล่านั้นเข้าไปด้วย			C9____
10. เทคนิคการตัดต่อพันธุกรรมสามารถนำมาใช้ประโยชน์ในทางการแพทย์ได้ เช่น ผลิตยา หรือ วัคซีน เป็นต้น			C10____

<u>ส่วนที่ 4 ความคิดเห็นเกี่ยวกับผลกระทบในแง่ต่าง ๆของการดัดแปรพันธุกรรม (GMO)</u>

4.1 การคิดเห็นเกี่ยวกับผลกระทบของการบริโภคอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO)ต่อผู้บริโภค

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุด)

ผลกระทบของการบริโภคอาหาร GMO	**ไม่เห็นด้วยอย่างยิ่ง** (1)	**ไม่เห็นด้วย** (2)	**ไม่มีความเห็น** (3)	**เห็นด้วย** (4)	**เห็นด้วยอย่างยิ่ง** (5)	
1. ก่อให้เกิดโรคภูมิแพ้						D1.1___
2. อาจทำให้เกิดการต้านยาปฏิชีวนะ						D1.2___
3. ก่อให้เกิดผลเสียต่อสุขภาพในระยะยาว						D1.3___
4. คุณค่าทางโภชนาการของอาหารอาจลดลง						D1.4___
5. ทำให้โครงสร้างพันธุกรรมของมนุษย์เปลี่ยนแปลง						D1.5___
6. สามารถบริโภคอาหารที่มีคุณลักษณะดีกว่าอาหารตามธรรมชาติ เช่น แตงโมไร้เมล็ด เป็นต้น						D1.6___
7. สามารถบริโภคอาหารที่ปราศจากยาฆ่าแมลงหรือยาปราบศัตรูพืช						D1.7___
8. สามารถบริโภคอาหารที่มีความสดและเก็บรักษาได้ยาวนานขึ้น						D1.8___

ผลกระทบของการบริโภคอาหาร GMO	ไม่เห็นด้วยอย่างยิ่ง (1)	ไม่เห็นด้วย (2)	ไม่มีความเห็น (3)	เห็นด้วย (4)	เห็นด้วยอย่างยิ่ง (5)
9. สามารถบริโภคอาหารที่มีราคาถูก เนื่องจากเทคโนโลยีการดัดแปรพันธุกรรมช่วยลดต้นทุนการผลิต					

D1.9___

4.2 ความคิดเห็นเกี่ยวกับผลกระทบของการปลูกพืชดัดแปรพันธุกรรม (GMO)

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุด)

ผลกระทบของการปลูกพืชดัดแปรพันธุกรรม (GMO)	**ไม่เห็นด้วยอย่างยิ่ง** (1)	**ไม่เห็นด้วย** (2)	**ไม่มีความเห็น** (3)	**เห็นด้วย** (4)	**เห็นด้วยอย่างยิ่ง** (5)	
1. ทำให้ระบบนิเวศน์เสียสมดุล เช่น ปริมาณแมลงลดลง เป็นต้น						D2.1___
2. ส่งผลต่อความหลากหลายทางชีวภาพ เช่น การเกิดขึ้นของพืชสายพันธุ์ใหม่และการลดลงของพืชสายพันธุ์ดั้งเดิม เป็นต้น						D2.2___
3. ช่วยลดปัญหามลพิษเพราะเกษตรกรใช้สารเคมีลดลง						D2.3__
4. อาจมีการแพร่กระจายของพืชที่ผ่านการดัดแปรพันธุกรรม (GMO) ไปสู่พืชธรรมชาติ						D2.4__
5. ช่วยอนุรักษ์พันธุ์พืชหรือพันธุ์สัตว์ที่หายากหรือใกล้สูญพันธุ์ให้ขยายพันธุ์ได้เร็วขึ้น						D2.5__
6. สามารถแก้ไขปัญหาการผลิตของเกษตรกร เช่น ข้าวทนเค็ม เป็นต้น						D2.6__

4.3 ความคิดเห็นเกี่ยวกับการแสดงฉลากอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO)

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุด)

ท่านเห็นด้วยกับข้อความนี้หรือไม่	**ไม่เห็นด้วยอย่างยิ่ง** (1)	**ไม่เห็นด้วย** (2)	**ไม่มีความเห็น** (3)	**เห็นด้วย** (4)	**เห็นด้วยอย่างยิ่ง** (5)	
1. ควรอนุญาตให้มีการแสดงฉลากผลิตภัณฑ์อาหารที่ไม่ผ่านการดัดแปรพันธุกรรม (ฉลาก Non-GMO) (ปัจจุบันไม่อนุญาตให้มีการแสดงฉลากสินค้าปลอดสารพันธุกรรม)						D3.1__
2. ข้อบังคับการแสดงฉลากสินค้าดัดแปรพันธุกรรมควรครอบคลุมผลิตภัณฑ์อาหาร GMO ประเภทอื่นๆด้วย เช่น ผลิตภัณฑ์อาหารที่ผลิตจากมันฝรั่ง GMO เป็นต้น (ปัจจุบันกำหนดให้ผลิตภัณฑ์อาหารที่ผลิตจากถั่วเหลืองและข้าวโพด GMO เท่านั้นที่ต้องแสดงฉลาก)						D3.2__
3. ควรแก้ไขกฎการแสดงฉลากผลิตภัณฑ์อาหาร GMO โดยต้องแสดงฉลากระบุสัดส่วนการปนเปื้อน เช่น 2% หรือ 4% (ปัจจุบันไม่กำหนดให้แสดงสัดส่วนการปนเปื้อน)						D3.3__
4. ควรมีข้อบังคับการแสดงฉลากสำหรับผลิตภัณฑ์อาหารแปรรูป GMO ที่นำเข้าจากต่างประเทศ						D3.4__

4.3 การคิดเห็นเกี่ยวกับการแสดงฉลากอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO) (ต่อ)

(กรุณาทำเครื่องหมายถูก (√)ในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุด)

ท่านเห็นด้วยกับข้อความนี้หรือไม่	**ไม่เห็นด้วยอย่างยิ่ง** (1)	**ไม่เห็นด้วย** (2)	**ไม่มีความเห็น** (3)	**เห็นด้วย** (4)	**เห็นด้วยอย่างยิ่ง** (5)	
5. รัฐบาลควรประชาสัมพันธ์และเผยแพร่ข้อมูลเรื่องข้อบังคับเกี่ยวกับฉลากอาหารที่ผ่านการดัดแปรพันธุกรรมให้มากขึ้น						D3.5__

<u>ส่วนที่ 5 ความตระหนักต่อการแสดงฉลากอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO)</u>

(กรุณาทำเครื่องหมายถูก (√) ในช่องที่ท่านเลือก)

ท่านทราบเกี่ยวกับข้อความด้านล่างนี้หรือไม่	**ทราบ**	**ไม่ทราบ**	
1. กระทรวงสาธารณสุขบังคับใช้กฎหมายติดฉลากอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO) ตั้งแต่ 11 พฤษภาคม พ.ศ. 2546			E1.1___
2. ผลิตภัณฑ์อาหารที่มีส่วนประกอบซึ่งผ่านการดัดแปรพันธุกรรม (GMO) มากกว่า5% ใน3 ส่วนประกอบหลัก และแต่ละส่วนประกอบดังกล่าวมีปริมาณตั้งแต่ 5% ของน้ำหนักผลิตภัณฑ์**<u>ต้องติดฉลาก</u>**ให้ผู้บริโภคทราบ			E1.2___
3. **<u>เฉพาะ</u>**ผลิตภัณฑ์อาหารที่ผลิตจาก**<u>ถั่วเหลืองและข้าวโพด</u>**ที่ผ่านการดัดแปรพันธุกรรม (GMO) อยู่ในกฎเกณฑ์ที่ต้องแสดงฉลาก			E1.3___
4. กฎหมายแสดงฉลากอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO) **<u>ไม่ใช้</u>**บังคับกับผู้ผลิตรายย่อยที่จำหน่ายอาหารแก่ผู้บริโภคโดยตรง เช่น รถเข็น หาบเร่ แผงลอย ฯลฯ			E1.4___
5. ประเทศไทย**<u>ไม่อนุญาต</u>**ให้แสดงฉลากข้อความ **<u>'ไม่ใช่อาหารดัดแปรพันธุกรรม'</u>** หรือ <u>'Non-GMO'</u>			E1.5___

<u>ส่วนที่ 6 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม</u>

1. เพศ ☐ หญิง ☐ ชาย F1___

2. อายุ..... ปี F2___

3. อาชีพปัจจุบันของท่าน

☐ นักเรียน / นักศึกษา ☐ รับจ้างทั่วไป

☐ รับราชการ / รัฐวิสาหกิจ ☐ พนักงานบริษัท / ร้านค้า

☐ พ่อบ้าน / แม่บ้าน ☐ ข้าราชการบำนาญ

☐ ค้าขาย / ธุรกิจส่วนตัว ☐ อื่นๆ โปรดระบุ..... F3___

4. ระดับการศึกษาขั้นสุดท้ายของท่าน

☐ ไม่ได้ศึกษา ☐ ปริญญาตรี

☐ ประถมศึกษา ☐ ปริญญาโท

☐ มัธยมศึกษาตอนต้น ☐ ปริญญาเอก

☐ มัธยมศึกษาตอนปลาย / ปวช. ☐ อื่นๆ โปรดระบุ..... F4___

☐ อนุปริญญา / ปวส.

5. รายได้ปัจจุบันของท่าน (บาท/เดือน)

☐ รายได้ต่ำกว่า 10,000 บาท

☐ รายได้ระหว่าง 10,000-20,000 บาท

☐ รายได้ระหว่าง 20,000-30,000 บาท

☐ รายได้ระหว่าง 30,000-40,000 บาท

☐ รายได้ระหว่าง 40,000-50,000 บาท

☐ รายได้มากกว่า 50,000 บาท F5___

6. ท่านนับถือศาสนาอะไร

☐ พุทธ ☐ พราหมณ์ - ฮินดู

☐ อิสลาม ☐ ซิกข์

☐ คริสต์ ☐ อื่นๆ โปรดระบุ..... F6___

7. ท่านรับรู้ข้อมูลข่าวสารเกี่ยวกับอาหารที่ผ่านการดัดแปรพันธุกรรม (GMO) จากแหล่งใด **มากที่สุด**

(ตอบได้มากกว่า 1 ข้อ)

☐ โทรทัศน์ ☐ สิ่งพิมพ์ต่างๆ เช่น หนังสือพิมพ์, แผ่นพับ, วารสาร

☐ วิทยุ ☐ อาจารย์, นักวิชาการ, ผู้เชี่ยวชาญ

☐ สื่ออินเตอร์เน็ต (Internet) ☐ การรณรงค์ขององค์กรอิสระ เช่น กรีนพีซ

☐ หลักสูตรการศึกษา ☐ อื่นๆ โปรดระบุ……..

F7___

8. ท่านอ่านฉลากข้อมูลผลิตภัณฑ์อาหาร ก่อนที่จะตัดสินใจซื้อ**บ่อยครั้งแค่ไหน**

☐ อ่านทุกครั้งที่ซื้อ

☐ อ่านบ้างบางครั้ง

☐ อ่านเฉพาะครั้งแรกที่ซื้อผลิตภัณฑ์ใหม่

☐ ไม่เคยอ่านเลย

F8___

9. ในการอ่านฉลากข้อมูลผลิตภัณฑ์อาหาร ท่านให้ความสำคัญกับข้อมูลประเภทใด**มากที่สุด**

(ตอบเพียง 3 ข้อ โดยใส่หมายเลข 1 ถึง 3ในช่องว่าง และกำหนดให้ 1 หมายถึงให้ความสำคัญมากที่สุด,

2 และ 3 หมายถึงให้ ความสำคัญรองลงมาตามลำดับ)

☐ วันผลิต / วันหมดอายุ ☐ เครื่องหมาย อย.

☐ ส่วนประกอบ / ส่วนผสม ☐ คุณค่าทางโภชนาการ

☐ ยี่ห้อ / บริษัทผู้ผลิต ☐ จำนวนพลังงาน / แคลอรี

☐ ปลอดสารเคมี ☐ ไม่ผ่านการดัดแปรพันธุกรรม (GMO)

☐ อาหารอินทรีย์ (Organic Food) ☐ ประเทศต้นกำเนิด

☐ ปริมาตร ☐ อื่นๆ โปรดระบุ……

F9___

☐ ราคา

10. หากท่านทราบว่าผลิตภัณฑ์อาหารที่ท่านกำลังจะซื้อเป็น**ผลิตภัณฑ์ที่มีส่วนประกอบที่ผ่านการดัดแปรพันธุกรรม (GMO)** ท่านจะซื้อผลิตภัณฑ์นั้นหรือไม่

☐ ซื้อ ☐ ไม่ซื้อ

ขอบคุณที่ท่านให้ความร่วมมือในการตอบแบบสอบถาม

วัน/เดือน/ปี ที่สัมภาษณ์ …… สถานที่สัมภาษณ์……...

BIOGRAPHICAL DATA

NAME	Ms. Sarobol Krualee
DATE OF BIRTH	July 29, 1984
PLACE OF BIRHT	Krabi, Thailand
EDUCATION	2003-2006: Bachelor of Science (Agricultural Economics) Kasetsart University, Bangkok, Thailand.