

A multi-attribute model of Japanese consumer's purchase intention for GM foods

Multiatributivní model nákupních záměrů japonských spotřebitelů ve vztahu ke GM potravinám

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Abstract: This study illustrates that consumers' GM food purchase decision is determined by a set of correlated variables. The interrelationship among the GM food purchase decision determinants is examined conceptually and empirically with a multi-attribute model, describing this interrelationship. Consumers' attitudes toward subjects such as innovation, science & technology as well as their trust towards the government's regulatory system of food safety and GM food are strong indicators of the consumers' GM food purchase decision. Given the limited availability of GM foods in the market which leads to a lack of understanding and experience of GM foods, consumers' knowledge and their search for information on food label appear to be weaker determinants of the GM food purchase decision for consumers.

Key words: consumer purchase decision, genetically modified foods, Japan, multi-attribute model, structural equation modeling

Abstrakt: Studie ilustruje skutečnost, že nákupní záměry spotřebitele ve vztahu ke geneticky modifikovaným (GM) potravinám jsou determinovány soustavou vzájemně korelovaných proměnných. Vztah mezi determinantami ovlivňujícími rozhodnutí kupovat GM potraviny je zkoumán koncepčně a empiricky prostřednictvím multiatributivního modelu, který tento vztah popisuje. Postoje spotřebitelů k inovacím, vědě a technologiím, stejně jako jejich důvěra k vládnímu systému regulace a kontroly potravinové bezpečnosti a GM potravin jsou výraznými indikátory nákupních záměrů spotřebitelů ve vztahu ke GM potravinám. Vzhledem k omezené dostupnosti GM potravin na trhu, která vede k nedostatečnému pochopení a zkušenostem s těmito potravinami, znalosti spotřebitelů a jejich zájem hledat informace na etiketách potravin se jeví jako slabší determinanty rozhodování spotřebitelů o nákupu GM potravin.

Klíčová slova: nákupní záměr spotřebitele, geneticky modifikované potraviny, Japonsko, multiatributivní model

The Japanese consumer market attracts both domestic and foreign companies with its tremendous potential, yet it poses to be a difficult market to penetrate, and very few foreign products are ready for entering into the Japanese market (Melville 1999). The Japanese market has been characterized as an enigma to most foreign observers (Fields et al. 2000). Japanese consumers are generally more risk averse than their counterparts in the West (Melville 1999; Fields et al. 2000). On the Hofstede's Uncertainty Avoidance Index, the Japanese had one of the highest scores of all the societies that were studied (Hofstede 1980). Japanese consumers value long-established relationships (in personal, business, and consumer

interactions) which may reflect a desire to avoid risks (Synodinos 2001). In cultures high in uncertainty avoidance, individuals are less tolerant of ambiguity and establish "more formal rules, rejecting deviant ideas and behavior" (Hoecklin 1995, p. 31). This may have significant implications for the behavior of Japanese consumers.

In particular, Japan is recognized to be one of the most averse markets to genetically modified (GM) food (Hoban 1999; Macer and Chen Ng 2000; Chern et al. 2003; McCluskey et al. 2003). This has been exemplified by the heated debate and regulation over labeling and marketing of GM food in Japan. GM food has become one of the most controversial issues in

Japan in the recent years. Japanese consumers had relatively relaxed attitudes about the safety issue of GM food in early 1990s (Hoban 1996), however, the opposition to GM foods increased significantly due to the series of recent food scandals both in Japan and the oversea markets (Hino 2000). The public acceptance of biotechnology and its support for GM crops in Japan has worsened with the 'emotional' Japanese media coverage of the issue (Nishiura et al. 2002).

One of the important factors that influence the food demand in Japan is food safety issues. Japanese consumers are particularly known to be quality and style conscious. When buying food, they look for the cleanest, straightest fruits and vegetables, while they pay high prices for the luxury branded items and expensive new services. These consumers are likely to expect the highest quality standards for safety management of food products. After series of food safety scares including the BSE occurrence, the processed food contamination, dioxins in the imported vegetables and the mislabeling fraud, the Japanese consumer concerns for the food safety and for GM food have significantly increased. This negative attitude has been reported to affect the consumers' intention to buy the GM food products. Public attitudes toward the GM food became a major factor for some of the Japanese retailers to remove the GM products from their shelves.

Many studies report that the consumer and public acceptance of the GM foods is driven primarily by their perception of risks and benefits associated with these food products (Boccaletti and Moro 2000; Bredahl 2001; Baker and Burnham 2002; Burton and Pearse 2002). GM food is an innovative product which has untested opportunities and potential new risks. Most individuals do not possess a 'sufficient knowledge' on the risks and benefits of new and unfamiliar technologies such as the GM food (Gaskell et al. 2004; Costa-Font and Mossialo 2005). This nature of the GM food has resulted in some consumers having varying degrees of fear, uncertainty, and doubt regarding the safety of the GM food. Thus, the psychological risk perceptions are paramount in determining the consumer behavior regarding GM food (Frewer et al. 1995; Bredahl 1999). Consumers are also concerned about the potential unexpected damage to the environment, v destruction of biological diversity, and religious and ethical problems. While new GM foods are being continuously developed, many of them remain uncommercialized due to the uncertainties and the lack of consumer acceptance. Thus, the GM food marketing has attracted attention and triggered discussion both in academic and business publication as one of the most significant recent innovations in the food industry.

Japanese consumers have been reluctant to try the GM food despite the persistent marketing efforts of the GM food producers. The limited experience of Japanese consumers with the GM food to date and the highly salient nature of the subject (i.e. criticism and anxieties for the GM food created by the media and consumer/environmental groups) may lead to the attitude formation and decision making of Japanese consumers to be complex and closely related to personal values (Bredahl et al. 1998). This paper assesses the factors leading to v Japanese consumers' decision making for the GM food products. A thorough understanding of the Japanese consumers' choice for the GM food is particularly important as this is one of the world's largest and premium importers of food. A clear understanding of the determinants of the Japanese consumers' GM food choice may enable the marketers to build effective marketing strategies and to establish market position of the GM foods. To market and position the GM foods properly in a market which has a high level of resistance such as Japan, marketers and policy makers should know what triggers the consumers' interest in the GM foods and what are these products worth in the minds of consumers. Feasibility of successful marketing of the GM foods in Japan requires a clear understanding of the nature of the Japanese consumers' decision-making process regarding the GM food purchase and the main determinants of this process.

THEORETICAL FRAMEWORK

A number of researchers have explored various factors affecting v consumers' acceptance of GM foods (Burton and Pearse 2002; Veeman 2002; Chema et al. 2006; Labrecque et al. 2006). Several studies focused on the evaluations of risks and benefits of GM food that are perceived by consumers (Hoban et al. 1992; Frewer et al. 1996, 1997, 1999; Boccaletti and Moro 2000; Baker and Burnham 2001; Bredahl 2001; Burton and Pearse 2001). Some studies reported the importance of the consumers' attitudes, perceptions, and values associated with GM food and examined their effect on consumers' behavioral intentions to buy GM food (Sparks et al. 1995; Kuznesof and Ritson 1996; Bredahl 1999, 2001; Grunert et al. 2001; Cook et al. 2002). Attitude, defined as the disposition to evaluate an attitude object with some degree of favor or disfavor (Eagly and Chaiken 1993), is generally found to be the strongest predictor of the behavioral intention for GM food (Honkanen and Verplanken 2004). Bredahl (2001) argues that though the consumers' experience of GM is very limited, they still perceive such food

as very risky and their specific attitudes towards GM food are therefore likely to be based more on general attitudes, which are embedded in values. Thus, values may be the antecedents to attitudes.

For example, numerous studies have examined v consumers' preference for various hypothetical forms of genetically modified food products using different research methods such as v logistic regression, multivariate analysis, factor analysis. These studies primarily attempt to examine direct effects of the selected factors on the consumers' attitude and belief of GM foods and only limited studies have explored how the consumers' purchase intention is determined by analyzing the multiple relationships among a comprehensive range of determinants. Although these research streams have provided a considerable insight, they have not addressed the full width of the consumer choice behavior for GM foods. In particular, it is rare that the comprehensive cognitive and activity measures such as attitude, knowledge and value-search are introduced as the possible explanatory variables in analyzing their choice behavior for GM foods.

It has been claimed that when consumers deal with extremely complex objects that have simultaneous linkages with many logical factors and sets, their evaluations may be strongly affected by various extraneous concerns and cues (Campbell et al. 1976; Pardo et al. 2002). GM food can be categorized as one of these objects that have complex multiple linkages between the issues of food safety, environmental protection, animal welfare, socioeconomic benefits, trade and political aspects. Consequently, the consumer choices regarding GM food are likely to be a complex process that may be influenced by multiple factors. The multi-attribute model (Fishbein and Ajzen 1975) may

be an appropriate model to frame such a complex process of consumer behavior as it has been well recognized as an established framework for explaining v attitude, intention, and choice, and has been widely used in consumer research for its diagnostic value in explicating attitudes (Mittal 1988; Sheppard et al. 1988; Peterson and Wilson 1992; Agarwal and Malhotra 2005).

The conceptual model of this study is developed specifically to address the critical role of the consumers' cognitive, activity and individual characteristics constructs in determining their purchase intention of GM foods (Figure 1). Our research model proposes four constructs: *Attitude*, *Knowledge*, *Value-Search* and *Socio-Demographic Status* as the main determinants of the Japanese consumers' choice behavior for GM foods. *Attitude* and *Knowledge* are two cognitive constructs affecting consumers' decision making and actions. *Attitude* can be defined as a summarized evaluative judgment, based on cognitive beliefs and their evaluative aspect, ranging from acceptability to attraction (Agarwal and Malhotra 2005). *Knowledge* construct is the 'awareness' construct, ranging from the consumers' recognition regarding a particular subject which translates to an evaluative judgment. *Value-Search* is an 'activity' construct which represents the consumers' involvement in the marketing programs. *Socio-Demographic Status* is a non-cognitive construct which characterizes the consumers' profile and intrinsic nature. *Socio-Demographic Status* implicitly affects the consumers' mindsets, thus their decision-making process of the GM foods purchase. In the following section, the literature is reviewed to assess the relevance of the identified determinants of the proposed model and to establish the main hypotheses.

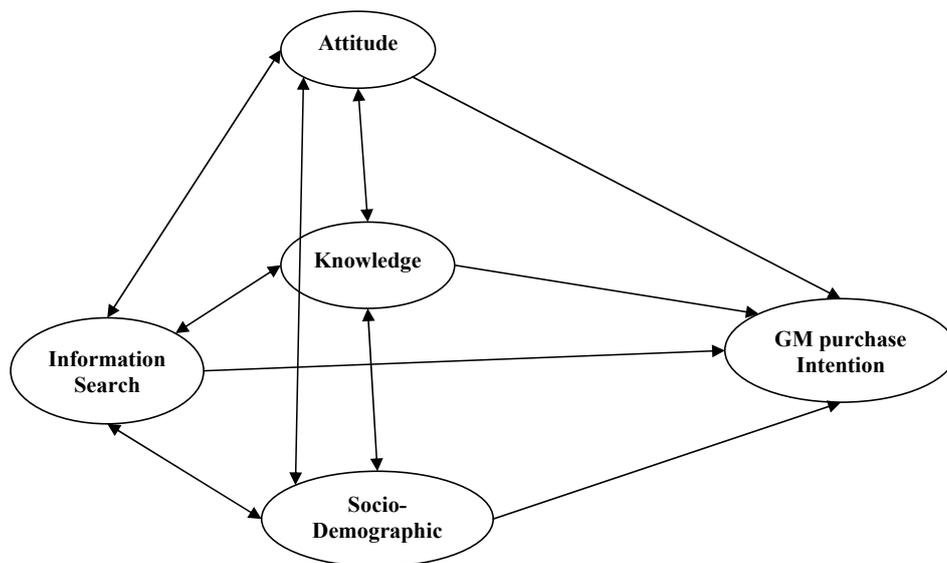


Figure 1. Causal model of the consumer GM purchase decision

Four main constructs of structural model

Japanese consumers' purchase decision of GM food is modeled as a series of inter-relationships between four main constructs: *Attitude*, *Knowledge*, *Value-Search* and *Socio-Demographic Status*. This section describes the relevance of four determinants affecting Japanese consumers' decision for the GM food purchase intention and presents the associated research hypotheses, based on the literature review of the past research.

Attitude construct

In recent years, there have been many studies, attempting to analyze the consumer perception toward GM foods in several countries. The studies have found that the consumers' preference for GM foods is driven by the held values and belief, which are underlying the motivation leading to their attitude to GM foods

(Kuznesof and Ritson 1996; Kerr 1999; Lahteenmaki et al. 2002). These studies suggest that the consumers' perceptions are influenced by their general attitude such as their overall attitude toward technology and innovativeness. Onyango et al. (2004) reports that the consumers' attitude towards the government ability to protect the consumer interest is an important factor affecting the consumer perception of GM foods. Due to the complexity of the uncertain choice situation surrounding GM foods, the trust towards the regulatory body emerges as a key variable that is often seen to reduce the complexity of decision making under uncertainty (Viclund 2003).

In this study, the *Attitude* construct refers to the consumers' general attitude towards technology, innovation and new food technology (Borre 1990; Hamstra 1991; Frewer and Shepherd 1994) and the trustworthiness of the government regulation (Frewer et al. 1996) which may have significant impacts on the consumers' attitude towards GM foods (Kuzensof and Ritson 1996; Kerr 1999; Lahteenmak et al. 2002).

Table 1. List of variables¹

Latent variables	Observed variables
Independent variables	
<i>Attitude</i> Construct	Importance of Science/Technology (SCI) Willingness to pay for new technology (NEW TECH) Acceptance of new food products (NEW FOOD) Trustworthiness of Japanese Government GMO regulation (GOV) Trustworthiness of the food safety system in Japan (SAFETY)
<i>Knowledge</i> Construct	Perception of self-knowledge level on GM food (KNOW LEVEL) Basic level of GM knowledge (LEVEL 1) Moderate level of GM knowledge (LEVEL2) Advanced level of GM knowledge (LEVEL 3)
<i>Value-Search</i> Construct	Check safety & quality certification/ grading (CERT) Check labels for protein & nutrition (NUTRI) Check labels for caloric content (CALORIE) Check for flyer information (SPECIAL) Compare prices actively (PRICE)
<i>Socio-Economic</i> Construct	Age (AGE) Annual Income (INC) Employment status (JOB) Size of Household (HOUSE) Education (EDU)
Dependent variable	
GM Purchase Decision Construct (<i>BUY GM</i>)	Willingness to purchase GM foods (WTB) Preferred level of price discount on GM foods (DISCOUNT)

¹The Likert scale used in the SEM model is: 1 = lowest level and 5 = highest level. The five latent variables, consisting of four independent variables and one dependent variable, are each constructed from the corresponding groups of observed variables on the right hand side of the table

Five scales are selected (Table 1) for measuring the consumers' general attitude towards GM foods. The more positive the consumers' attitude toward various subjects such as technology, innovation, government regulatory policy, the more the consumers are likely to purchase GM foods.

Hypothesis 1: Consumers' GM purchase decision is a positive function of the *Attitude* construct.

Knowledge construct

Consumers have a limited experience of GM foods and thus their perception of GM food is likely to be affected by their overall awareness and self-perceived knowledge of GM foods (Zimmerman et al. 1994; Bredahl 1999; Kerr 1999; Baker and Burnhum 2002; Lahteenmaki et al. 2002). Consumers face risk when a decision or action produces social and economic consequences that cannot be estimated with certainty (Zinkhan et al. 1987). Uncertainty associated with GM foods is perceived as a potential risk by consumers, but this risk perception can considerably decrease with the increasing level of understanding of the benefits derived from the GM food consumption such as 'tastier' (Frewer et al. 1996; Hamstra and Smink 1996; Lahteenmak et al. 2002) or 'cheaper' (Hamstra and Smink 1996; Bredahl 1999).

Consumers who believe that they have a high level of GM food knowledge are likely to feel more comfortable with assessing GM foods; and as their actual level of knowledge regarding GM food benefits increases, it is likely that consumers may intend to try GM food (Frewer et al. 1997). Consumers' risk perception of GM food may be inversely related to the level of their knowledge and understanding for GM foods (Frewer et al. 1996; Hamstra and Smink 1996; Bredahl 1999; Lahteenmaki et al. 2002) and consumers with a low level of the GM food knowledge and experience may increase the perceived risk, which reduces the likelihood of consuming GM food (Lusk and Coble 2005).

Hypothesis 2: Consumers' GM purchase decision is a positive function of the *Knowledge* construct.

Value-Search construct

The *Value-Search* construct refers to the consumers' search activities for information associated with the value of product. In other words, consumers are interested in obtaining the food label information such as the food safety and quality assurance, nutritional, calorie content and price that may be

highly associated with their interest in the GM food purchase (Kuznesof and Ritson 1996). Bredahl et al. (2002) argue that consumers' wish to personally exert control over their buying and consumption choice is an important factor on shaping the consumers' decision towards GM foods. **Consumers seek information in order to increase their utility by being able to make more satisfying purchase decisions and may seek the GM-related information to reduce or avoid the possible costs to their health or the environment** (Gao et al. 2005). Consumers use prices as important extrinsic cues and the indicator of the product quality or value (Yoo et al. 2000). Consumers who search for the information on food quality and price proactively may be the shoppers who prefer to personally exert control over their purchase and consumption choice and reduce the potential risk of GM foods from their action (Conchar et al 2004). These consumers may attempt to manage the risk related to foods by handling sufficient information to form the subjective probabilities of the potential risk of foods. However, in the case of GM foods, the existing information does not allow individuals to form objective risk estimates, thus risk perceptions are the result of the perception of uncertainty, and the quantitative estimates of risk perceptions in the context of single term might be meaningless (Costa-Font and Mossialo 2005).

This study proposes to use a multi-dimensional construct approach with a multi-attribute model to accommodate this issue. Consumers that actively search for the information on food safety and other quality attributes are likely to be highly risk-averse consumers who actively seek to manage risk. Consumers with a high aversion to the potential risk associated with GM foods are less likely to consume GM foods (Lusk and Coble 2005). Therefore, the attention consumers pay to these food quality and safety labels may be effective predictors of their level of the risk aversion for GM foods and their intention of the GM food purchase.

Hypothesis 3: Consumers' GM purchase decision is a negative function of the *Value-Search* construct.

Socio-Economic construct

The *Socio-Economic* construct is included in order to measure the effects of the individual difference on consumers' purchase decision and to enhance the predictability of behavioral intentions of consumers for GM foods. A number of studies show that the socio-economic variables are important determinants affecting the consumers' attitude toward GM foods (Hamstra and Smink 1996; Hoban 1996 a, b; Bredahl et al. 1998; Baker and Burham 2002; Mangusson and

Hursti 2002). Engel, Kollat and Blackwell's model stress the importance of the individual difference on the consumer's purchase decision (Engel et al. 1995). Individual difference factors such as the socio-economic variables are important in determining the consumers' purchase decision.

Hypothesis 4: Consumers' GM purchase decision is a negative function of the *Socio-Economic* construct.

In addition, the consumers' interest in accessing food safety information may differ according to whether or not the household includes members who are particularly vulnerable to food safety problems (Ge Gao et al. 2005). **In other words, socio-demographic factors may have a close relationship to the consumers' information seeking behavior.**

Development of the measurement model

In our research model, **nineteen independent observable variables and two dependent observable variables were selected and collected as the quantitative survey data.** Ajzen and Fishbein (2005) suggest that a more complete understanding attitudes as the causes of behavior could emerge from a combination of both the attitude toward a target and the attitude towards behavior. Therefore, we theorize that the Japanese consumers attitude towards the 'subjects' such as science/technology, the Japanese government GMO regulation and the food safety system as well as their attitude toward 'accepting' these subject matters in Japan are combined to see whether these influence their GM food choice decision.

Hypothesis 5: Consumers' trust in the government regulation and the food safety system; their attitude towards science & technology, innovativeness in food technology; consumers willingness to pay for innovation and to accept new food products are the function underlying the consumers' attitudes towards these objects.

Japanese consumers' perceived knowledge of GM foods is hypothesized to affect their GM food purchase decision. The *Knowledge* construct includes four attributes from the observed survey variables: the consumers' perceived level of their own GM knowledge, and three levels of the consumers' GM knowledge (basic level of GM knowledge, moderate level of GM knowledge and advanced level of GM knowledge).

Hypothesis 6: Consumers' perceived and actual level of knowledge regarding GM foods is the function underlying the consumers' knowledge on the GM subjects.

It is hypothesized that consumers who seek information on the product value such as food safety, quality

and other attributes are likely to be the risk-averse shoppers who attempt to manage risk by handling these product information.

Hypothesis 7: Consumers' active search for information on food labels such as safety certification, grade, nutrition, calories, and price is the function underlying the consumers' interest in information search.

Consumers perception of the GM food safety is assumed to be affected by the socio-demographic characteristics. Several previous studies suggest that the socio-economic characteristics influence the concern about the GM food safety (Boccaletti and Moro 2000; Li et al. 2002; Pardo et al. 2002; Hossain et al. 2003, 2004; McCluskey et al. 2003) and have potentially important implications for the Japanese consumers' GM food demand.

Hypothesis 8: Consumers' age, household size, income, education and employment are the functions underlying the consumers' socio-economic status.

Hypothesis 9: Four determinants of the consumer's GM purchase decision process are correlated to each other and simultaneously affect the dependent variable: the consumer GM purchase decision.

RESEARCH METHOD

Survey design

Several qualitative interviews were conducted with the Japanese **food industry representatives, academics, and housewives** to obtain appropriate information for the development of the survey design. From this stage, seven major factors were identified to be the primary drivers that were considered to be important in the choice of Japanese consumers (Table 1). **The original survey questionnaire was developed in English and translated into Japanese, pretested by Japanese academics and back-translated into English for the data analysis. All items were measured on 5 point Likert scale with the anchor of 1 = strongly disagree, 5 = strongly agree.**

Data collection

In total, **515 questionnaires were distributed to respondents in two sub-sample markets in Japan** in October 2003 and returned between the periods of November 2003 to February 2004. **The elimination of the incomplete responses left 202 survey responses for the analysis.** Although the sample size is relatively small, the rules of thumb suggested by Long (1997) for justifying the use of the maximum

likelihood estimation and the resulting significance tests are largely met (Verbeke et al. 2000). The first sub-sample market includes primarily mothers of the first-year university students in the Fuchu area which is located in the Tokyo area. The second sub-sample includes primarily mothers in the Osaka area, who are the parents of students in the Osaka University. These samples are selected since the preliminary qualitative interview suggested that most mothers in Japan do not work outside home and mothers do the great majority of food purchasing in Japan. Few single people live alone, and vice versa, most single people live with their family if they are not married, and the grandparents often live with the family as well, giving the mother a large role in food shopping.

Structural Equation Modeling (SEM) analysis

The selected observed variables were initially examined and verified to have a normal distribution. The skewness and kurtosis of the statistical distribution of the original 21 observed variables were tested in order to screen out those with non-normality. Table 1 presents a summary list of the observable variables that are included in the SEM analysis.

The empirical model (i.e. path diagram) based on *priori hypotheses* were formulated using the AMOS software and estimated using a maximum likelihood function. The value of the RMSEA was 0.07, indicating a reliable fit of the variables in the model. This goodness of the fit index pertaining to the empirical model is statistically significant.

The SEM allows us to determine the relative contribution of four constructs and of 19 observable variables to the Japanese consumers' GM food acceptance, which is indicated by path coefficients on the path diagram. These coefficients (i.e. path coefficients) can be interpreted as the relative importance of each path within the model and therefore the strength of relationships between the latent variables and

between each latent variable and the observed variables (Schumacker et al. 1996). Table 2 reports the standardized estimates of the model parameters. In interpreting the standardized coefficient estimates, it is important to understand that the sign and size of the coefficients are important. The estimated standardized SEM coefficients with a value of 0.50 are usually considered to have a 'large' effect, a value of 0.30 to have a 'medium' effect and a value of 0.10 to have a 'small' effect (Hatcher 2002).

RESULTS AND DISCUSSION

As hypothesized, the attitude construct is the most significant dimension for the consumers' GM purchase decision (Hypothesis 1). This indicates that as the consumer attitudes become more positive toward GM food, consumers are more likely to purchase more GM food. The consumers' GM purchase decision is positively related to the knowledge construct (Hypothesis 2), while it is negatively related to the information-search construct (Hypothesis 3) and the socio-economic construct (Hypothesis 4). The relationships of the knowledge and information-search constructs to the GM purchase decision were much weaker than the relationship of the socio-economic construct to the GM purchase decision. These findings suggest that lower socio-economic consumers are more likely to be willing to purchase GM foods; more knowledgeable consumers are more likely to buy GM foods. However, as the consumers pay more attention to food labels and search for information, they are less likely to purchase GM foods.

The relative size of coefficients on these constructs shows that the attitudinal domain of Japanese consumers is the largest determinant affecting their GM food purchase decision making process. The GM food knowledge and information search constructs, on the other hand, plays a smaller role in forming Japanese consumer decision making of GM food

Table 2. Estimation of covariance and correlation among the latent constructs

	Estimates of covariance	S.E. of covariance	Estimates of correlation
ATTITUDE & KNOW	0.002	0.02	0.013
SOCIO & INFO	0.09	0.15	0.06
ATTITUDE & SOCIO	-0.30***	0.10	-0.43
ATTITUDE & INFO	0.08	0.06	0.20
SOCIO & KNOW	-0.27***	0.07	-0.54
KNOW & INFO	-0.04	0.04	-0.13

*significant at 10% level, **significant at 5% level, ***significant at 1% level

choice. Limited knowledge and availability of information on GM foods may lead Japanese consumers to rely heavily on their personal values and attitudes towards the selected issues to determine the future purchase interest in GM foods.

When the correlation among the dimensions of four main constructs was specified in the structural model (Figure 1), the inter-correlations between the attitude and the socio-economic constructs, and between the knowledge and the socio-economic constructs, were significant (Hypothesis 9, Table 2). This suggests that the socio-economic profiles of consumers are strongly related with their attitudes and the knowledge level of GM foods. Coefficients for the measurement model, (i.e factor loadings) are reported in Table 3. Overall,

all four constructs appear to be significantly related to the majority of its observable variables (Hypothesis 5 to 8), supporting our hypotheses.

CONCLUSION

This study approximates the Japanese consumers' GM purchase decision process by modeling four main constructs of the SEM. This model illustrated the linkage between nineteen cognitive and socio-economic factors versus the consumer GM purchase decision through the mediating role of four dimensions. The results showed that the Japanese consumers' attitude is the most important determinant affecting

Table 3. Estimated parameters for structural equation model¹

	Estimated coefficients	Standard error	Standardized estimates
Major Constructs (Latent Variables)			
Attitudinal Construct	0.699	0.316	0.476**
Knowledge Construct	0.122	0.408	0.058
Socio-Economic Construct	-0.061	0.075	-0.154
Information Search Construct	-0.012	0.090	-0.017
Observed Variables			
Importance of Science/Technology ²	1.000	***	0.598***
Willingness to pay for new technology	0.568	0.228	0.299**
Acceptance of new food products	0.953	0.264	0.544***
Trustworthiness of Japanese Government GMO regulation	0.192	0.207	0.102
Trustworthiness of the food safety system in Japan	0.412	0.237	0.197*
Perception of GM Knowledge level	0.905	0.349	0.316***
Basic level of GM knowledge	0.697	0.203	0.498***
Moderate level of GM knowledge ²	1.000	***	0.639***
Advanced level of GM knowledge	0.221	0.132	0.189*
Age	0.847	0.036	0.967***
Annual Income	0.105	0.033	0.264***
Employment status ²	1.000	***	0.963***
Size of Household	0.522	0.050	0.688***
Education	0.208	0.049	0.344***
Check safety & quality certification/grading	0.567	0.164	0.417***
Check labels for protein & nutrition	0.853	0.223	0.653***
Check labels for caloric content ²	1.000	***	0.792***
Check for flyer information	0.069	0.123	0.056
Compare prices actively	0.042	0.122	0.035

*significant at 10% level, **significant at 5% level, ***significant at 1% level

¹The Likert scale used in the SEM model is: 1 = lowest level and 5 = highest level; ²these attributes normalized constants fixed at value of 1.00, which are required in estimating latent variables of SEM

their GM choice process. **The Japanese consumers' attitudes toward subjects such as innovation, science & technology as well as their trust towards the government's regulatory system of food safety and GM food were found to be a strong indicator of the consumers' GM food purchase decision. Japanese consumers who considered science, technology and innovation as important drivers in their economy were found to be more likely to accept new products such as GM foods. To enhance the understanding of Japanese consumers and market potentials for GM food in Japan, it may be necessary to explore further the extent of the Japanese consumers' interest in new technology, innovation and science. In addition, their attitude towards the overall quality of the food safety system in Japan was found to affect their interest in trying the innovative GM food products. This implies that it is imperative for the Japanese government to establish a sufficient trust and confidence in their food safety system to build the public trust which may translate into adopting new innovative products such as GM food.**

The socio-economic status of Japanese consumers was also found to be important in their choice making process for GM food. **This suggests that different consumer groups may have different preferences and tendency to accept GM food products, thus the marketers may need to develop segmented market penetration strategies which may target the specific consumer groups who may be more willing to try GM food.**

The Japanese consumers' self perceived level of knowledge on GM food was also found to affect their choice behavior. **When they consider themselves to be knowledgeable about GM food, they tend to be more likely to try it. This implicates the importance of the availability of information on GM food in the market which may reduce their fear of the untested new products due to the uncertainty and the limited knowledge. Currently, there is a limited availability of GM foods in Japanese market which may lead to the lack of understanding and experience of GM foods for Japanese consumers. This may contribute to the development of the negative attitude among Japanese consumers regarding GM food. The marketers may need to have collaborative efforts with the government in raising the public understanding of GM food regarding its benefits and the potential downside. When the GM information becomes more transparent, Japanese consumers may make their choices not based on fear and uncertainty, but more based on their personal values and preferences.**

Japanese consumers are considered to have a relatively high expectation and willingness to pay premium

for the high quality food products, and Japanese market is known to be a premium market for food exporting countries. **Yet, it is also considered to be one of the most challenging markets due to its high standards and expectations. Thus, international marketers may need to develop their marketing strategies and plans tactfully in entering the Japanese market. Marketers need to understand that the Japanese consumers' choice for food is more affected by their preference and value than by the competitive price. By providing a sound information on GM food and by investing into establishing a positive public consensus on GM food, it may increase the probability of the successful market adoption as Japanese consumers increase their understanding and knowledge about GM food. In order to pursue this marketing orientation, it is imperative that international marketers gain support from the Japanese government in enhancing the public knowledge and information on GM products.**

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