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The Impact of Product Package Information on Consumer Behavior toward Genetically Modified Foods

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***Abstract*—**Genetically modified (GM) technology in food production continued to generate controversies. Consumers were concerned with the GM foods about the healthy and environmental risks. While consumers' acceptance was a critical factor affecting how widely this technology be used. According to the research review, consumers' lack of information was one of the reasons to explain consumers' low acceptance toward GM foods. The objective for this study wanted to find out would informative product package affect consumers' behavior toward GM foods. An experiment was designed to investigate consumer behavior toward different product package information. The results indicated that the product package information influenced consumer product trust toward GM foods. Compared with the traceability production system information, the information about the GM rice was approved by authorized organizations could increase consumers product trust in GM foods. Consumers in Taiwan saw the information provided by authorized organizations more credible than other information.

***Keywords*—**product package information, genetically modified food, consumer product trust, risk perception, benefit perception.

I. Introduction

SINCE the first introduction of Genetically-modified (GM) crops on the market in mid-1990, GM crops had continued to generate controversies. Though the GM crops could be more productive and offer functional health to reduce world hunger and the need for pesticides use. The debate continued to go on about GM crops in many countries. The opponents pointed out the related risks, including the impact on human health, ethics and environment [1]-[3].Because of these controversies, some countries holding objective to GM crops.

However, advocates had the different views. The members in the United States National Research Council pointed out compared with the conventional foods, all the ingredients in the GM foods were traceable and the genetic codes all had been selected. Hence the impact of GM foods on human health can be anticipated by scientists [4]. Some scientists viewed GM foods the same as conventional foods, and tried to convince the consumers that there was no more risk associated with GM foods than with conventional foods [5].

Under the different point of views, majority of consumers had negative attitude toward GM foods. According to the study resulted from Taiwan Institute of Economic Research (TIER), over 60 percent of the consumers had perceived risk about the technology [6]. And over 40 to 80 percent consumers in the US, China and England, expressed their distrust attitude toward gene-technology [7]. In general European consumers regarded GM foods as unnatural and risky foods [8]. Consumers were willing to pay premiums for 'GM-free' produces over foods with GM ingredients to avoid risk [9], [10]. A meta-analysis of 25 studies about GM foods showed that consumers in different countries on average placed 42% to 23% higher value for non-GM food compared with GM food [11].

Consumer risk perception toward GM crops may be due mainly to consumers having limited information and were uncertain about the safety or quality of food [12].Moreover, though GM crops currently available on the international market had undergone risk assessments, consumers were still very cautious regarding statements in support of GM crops by scientists and governments [13].

Therefore, an effective communication strategy should be developed in order to improve the understanding of consumers about GM crops. Previous studies indicated that besides consumers' age, gender, social value, technology knowledge and trust, shortage of appropriate information was also one of the reasons for consumers to doubt about the appropriateness and safety regarding applying GM technology in agriculture production [14]-[16].

As reported, 73% consumers made their final purchase decision at the point of facing products, the product informant labeled on the product package has become critical to influence consumers' purchase decision [17]. As GM labeling had become the main regulation system to GM foods for many countries, consumer reaction to the GM labeling information was highly concerned by the industry sector and many academicians.

This study was intended to: 1) investigate the impact of various product messages labeled on the packages of the GM foods on consumer risk perception, benefit perception, and product trust to GM rice; 2) to compare the weights among the various product messages labeled on the packages of the GM foods regarding their impact on consumer risk perception, benefit perception, and product trust to GM rice.

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II. Literature review

Many studies had been conducted that the information on the product package of GM foods had an impact on consumers purchase decisions [18], [19]. The labeled presence of GM ingredients on the food package to consumers may be a cause of uncertainties such as the possible issues relating with human health, the ethics, the environment, or other concerns. Under this situation, consumers could not obtain sufficient information to resolve such uncertainties from the label [18]. Consumers felt the unknown risks from consuming GM foods which made consumers felt lack of control [20]. Because of that, consumers' attitudes towards GM foods were affected by their inclination to avoid risks.

The label of GM foods led consumers to different processing behavior of food stimuli compared to the products not labeled. When products were labeled as GM foods, consumers would adopt analytical processing of information [21]. The framing effects of GM food labeling (engineering, biotechnology, and genetic modification) also showed the effect on consumers. Consumers who were exposed "engineering" showed higher purchase intention compared with those who were exposed "biotechnology" and "genetic modification" labels. To consumers the "engineering" label also implying better quality [16], [22].

Though the GM label**s** would trigger consumers' risk perception toward the food, adequate information could reduce consumers' risk perception [20]. When facing GM foods, consumers wanted more information [18], [23], [24]. Majority of consumers wanted to have the information on the product package including contact information (e.g., website address), verification system information or the reason why GM techniques were being used on the product package of GM food which could make the product more credible [25]. Compared with other information to the American consumers, they viewed the label claims certified by the US Food and Drug Administration (FDA) as most credible [24].

The information about traceability and new detection methods for identifying GM foods had a positive effect on increasing consumers' personal control and perceived confidence [26]. As [27] used an experimental design to examine how label information may affect the acceptability of GM food for young consumers. The result indicated that when GM label was more informative ("GM corn approved by EU" compared with "product that contains genetically modified (GM) corn"), consumers' negative attitude decreased by 35 percentage units.

Despite the above mentioned risk of GM foods were concerned by most consumers, the benefits of GM foods were cared by consumers. The information about the benefit of GM technology could not only enhance consumers' benefit perception but the acceptance toward GM foods [28]. Consumers' attitude toward GM foods was mainly determined by the consumer's benefit perception compared to risk perception [14], [20]. The information on environmental benefits, health benefits and benefits to the third world all could increase consumers' purchase intention toward GM food [11].

Moreover, consumers distinguished between labeling claims. For some consumers what they cared were whether the benefits really fit their own needs. If the benefits were needed by consumers, it did not matter to consumers if there were GM ingredients in the foods they buy [29]-[31]. Compared with conventional foods and the information about the food price and prolonged shelf life of GM foods, consumers were more interested in the health or safety information of GM foods [32]. Studies had shown that consumers' attitude toward GM foods did not totally oppose, as long as they saw more benefits for their own need.

Trust also played a critical role affecting consumers' attitude toward GM food [33]. In Europe consumers regarded GM food as the unhealthy, unsafe and didn't trust the GM foods [13], [34]. If the government or the product manufacturer could offer sufficient information about GM technology on the product package, consumers could judge by themselves. When consumers saw the label claims certified by American government, they had higher trust in GM foods and took it as safety foods [24]. Research in the Europe also showed that when label was more informative and the label claims certified by government could enhance consumers' trust in GM foods [27].

Based on the literature presented, it could be reasonably expected that the product package information would have the impact on consumers' risk perception, benefit perception, and product trust toward GM food.

III. Math

Thirty-five participants recruited from the parks in Taipei Taiwan participated in the study voluntarily. To examine the impact of product package information on consumers' benefit perception risk perception and product trust, a between-subjects design was employed. In this study, GM rice was chosen to test the impact of product package information on consumer behavior. The reason why we choose GM rice was that rice was the staple food in Taiwan. Consumers couldn't avoid purchasing rice, so consumers would regard this as an important issue.

The experiment was conducted on March 20 and March 21, 2010. Four types of labels were assigned randomly to participants. After participants saw the real GM rice product, it took approximately 10-15 minutes for participants to complete self-administered questionnaires. Participants were told that the purpose of the study was to ascertain consumers' opinions about GM rice products and their product package information.

When participants entered the study, they were randomly assigned to one of four treatment groups.

(1) Treatment 1: basic product information (product name、nutritional label、contact information、health benefit (this GM rice is good for eyes care)) with the GM rice was approved by authorized organizations information.

(1) Treatment 2: basic product information (product name、nutritional label、contact information、health benefit (this GM rice is good for eyes care)) with GM rice had been issued with product liability insurance information.

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(3) Treatment 3: basic product information (product name、nutritional label、contact information、health benefit (this GM rice is good for eyes care)) with the GM rice is produced under a traceability production system information.

(4)Control group: basic product information (product name、nutritional label、contact information、health benefit (this GM rice is good for eyes care)).

IV. MEASUREMENT

Based upon previous studies on consumer behavior toward GM foods, consumers' perceived risk, perceived risk, and product trust were examined in this study [30], [39], [40].

Perceived risks were measured by three items such as "this GM rice could induce human allergic reaction," "this GM rice may be a threat to the health," "this GM rice is unsafe." These three items were aggregated to make an index to measure perceived product risk.

Perceived benefits were measured by four items such as "this GM rice is more health than conventional rice," "this GM rice is good for eyes care," "the taste of this GM rice is better than conventional rice," "the quality of this GM rice is higher than conventional rice." These four items were aggregated to make an index to measure perceived product benefit. And Perceived product trust was measured by three items such as "this GM rice would have bad impact," "I have confidence in this GM rice," "I think this GM rice is an natural product." These three items were aggregated to make an index to measure consumers' product trust. This items were measured on a 5-point Likert Scale, anchored from strongly disagree to strongly agree.

V.RESULT

Profile of samples

This statistical analysis gathered 46 valid questionnaires with information of gender, age, occupation, educational and family monthly income. From the total sample 39.1% of the participants were male and 60.9% were female. The age distribution was: 2.2% aged below 20 years old; 4.3% aged 20-24 years old; 28.3% aged 25-34 years old; 34.8% aged 35-44 years old; 15.2% aged 45-54 years old; 6.5% aged 55-64 years old; and 8.7% aged over 65 years.

Participants' occupations were as follows: commercial business, service industry (45.7%); housekeeping (17.4%); civil servant, military service and education (13.0%); agriculture, forestry, fishing and animal husbandry workers (2.2%); manufacturing (2.2%); retirement (4.3%) and others (13.0%).

The distribution of educational levels was: 10.9%, junior-high school; 23.9%, senior-high or vocational school; 58.7%, college or university undergraduate; 6.5%, graduate school.

About 28.3% of the participants reported that they had a family monthly income of less than NT$ (New Taiwanese dollar) 50,000; 41.3% had an income between NT$50,001 and NT$85,000; 21.7% between NT$85,001 and NT$120,000; 8.7% between NT$120,001 and NT$155,000.

The impact of product package information on consumer risk perception, benefit perception, and product trust to GM rice

The Analysis of Variation (ANOVA) was used to compare mean differences of consumer risk perception among four product package information. Respondents received the treatment 1(the GM rice was approved by authorized organizations information) showed lower perceived risk (M=7.0, SD=2.10) than did those received the treatment 4 (basic information) (M=8.33, SD=2.57), treatment 2 (this GM rice had been issued with product liability insurance information) (M=9.17, SD=2.29), and treatment 3 (this GM rice is produced under a traceability production system information) (M=9.55, SD=2.34). However, the mean difference of perceived risk among the different information was not statistically significant (P =0.065).

The mean difference of consumer benefit perception among four product package information was compared by ANOVA. Respondents received the treatment 4 (basic information) showed higher perceived benefit (M=13.17, SD=2.04) than did those received Treatment 1(the GM rice was approved by authorized organizations information) (M=13.00, SD=3.38), treatment 3 (this GM rice is produced under a traceability production system information) (M=12.09, SD=2.21), and treatment 2 (this GM rice had been issued with product liability insurance information) (M=12.00, SD=2.76). However, the mean difference of perceived risk among the different information was not statistically significant (P =0.613).

The mean difference of consumer product trust among four product package information was compared by ANOVA. Respondents received the treatment 1(the GM rice was approved by authorized organizations information) showed higher product trust (M=8.91, SD=2.02) than did those received the treatment 4 (basic information) (M=8.67, SD=1.87), treatment 2 (this GM rice had been issued with product liability insurance information) (M=8.58, SD=2.11), and treatment 3 (this GM rice is produced under a traceability production system information) (M=6.82, SD=1.25). The mean differences among the four product package information were statistically significant (P =0.042). *Post hoc* analysis, using Duncan, was found that treatment 3 was significant difference with other treatments. Respondents who received the treatment 3 had significant lower trust in GM rice than who received other treatments.

VI. CONCLUSION

Our results suggested that the product package information influenced consumer product trust toward GM foods. Consumers received four kinds of product package information (basic product information with the GM rice was approved by authorized organizations information, basic product

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information with GM rice had been issued with product liability insurance information, basic product information with the GM rice is produced under a traceability production system information, and basic product information) differently. In general, consumers had lower product trust toward product package information "basic product information with the GM rice is produced under traceability production system information" than "basic product information with the GM rice was approved by authorized organizations information," "basic product information with GM rice had been issued with product liability insurance information," and "basic product information."

Based on the results, we could assume that compared with the traceability production system information, the GM rice was approved by authorized organizations information could increase consumers product trust in GM foods. Furthermore, consumers seemed not to trust in traceability production system, because compared with basic product information the traceability production system information still got lower trust among consumers. This revealed that maybe consumers were unfamiliar with the traceability production system which started in 2004 in Taiwan. The traceability production system information would trigger consumer suspicions about the GM rice.

According to the result, although the impact of product package information on consumer risk perception and benefit perception were not statistically at .05 level, the overall pattern of product package information of consumers risk perception and benefit perception revealed that consumers who received the authorized organizations information showed lower perceived risk and higher perceived benefit than those who received other information.

Overall, the results indicated that product package information have the influence on consumers perception toward GM foods. Therefore, our government or GM product manufacturers could communication with consumers by providing suitable information on the product package. As the results, the product package information seemed to play an important role in shaping consumer perception. Most consumers liked the information provided by authorized organizations which could make the GM foods more credible.

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