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How consumers' perception and information processing affect their acceptance of genetically modified foods in China: a risk communication perspective

Qiaozhe Guo, Nengzhi Yao**,** Weiwei Zhu*

Qiaozhe Guo, School of Accounting, Hebei GEO University, Hebei, China, 050031. Email: qiaozheguo@gmail.com

Nengzhi Yao, Durham University Business School, Durham, U.K. DH1 3LB. Email: nengzhi.yao@durham.ac.uk

Weiwei Zhu*, Associate professor, School of Marxism, Hefei University of Technology, No.96, Tunxi Road Baohe District, Hefei, Anhui, 230009, P.R.China. Email: zwwhfut@hfut.edu.cn

*is the Corresponding author

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ABSTRACT

This study aims to explore the roles of consumers' risk and benefit perception and food information processes in predicting their acceptance of genetically modified food. We integrate the protective action decision and heuristic systematic models to develop a conceptual model to predict customers' purchase intention. We conducted a survey questionnaire with measures adapted from existing Likert scales. We used a sample of 573 respondents from Shandong Province, China, comprising people who had ever purchased genetically modified products. We tested our hypotheses using a structural equation model. Results suggest that perceived risk is a negative determinant of purchase intention, while perceived benefit is a positive factor of purchase intention. Moreover, perceived benefit is an important predictor of purchase intention. Perceived risk significantly affects information need, information seeking, and systematic processing. Perceived benefit has a positive relationship with information need and systematic processing. Information seeking is stimulated by information need and further predicts systematic processing. Our results suggest the effectiveness of the protective action decision and heuristic systematic models in predicting people's intention to purchase genetically modified food and highlight the importance of risk communications in this context.

Keywords: Genetically modified food; Risk perception; Information processing; Risk communication

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1. Introduction

Genetically modified foods (GMFs) are constructed from the raw materials of genetically modified organisms, which are organisms with new biological characteristics by gene recombination or genetic transformation (Lang, 2013; Rodŕguez-Entrena & Salazar-Ordóñez, 2013). Although interest in GMFs is growing, public opinions about them have elicited controversy not only in developing countries (Almeida & Massarani, 2018; Hakim et al., 2020; Zhu et al., 2018) but also in developed countries (Lusk et al., 2002; Lusk, Roosen & Fox, 2003). For example, Hakim et al. (2020) find that although a food-label policy was introduced in Brazil, it did not seem to have significantly changed people's negative attitudes toward GMFs. In developed countries, Lusk et al. (2002) suggest that students in Mississippi, the United States were more likely to accept GMFs from high-quality brands or stores to which they were loyal. A comparison study by Lusk and Rozen (2006) indicates that American consumers are twice as likely to accept GMFs as French consumers are. The different attitudes toward GMF mainly derive from people's views on their benefits and risks. Benefits include health, environmental, and economic benefits. Risks that are emphasized by detractors of GMFs include side effects such as threats to human health and the lives of their offspring and pollution of the surrounding environment (Chen & Li, 2007; Costa-Font & Mossialos, 2007). Owing to still-undergoing research, GMFs and relevant topics such as food safety have attracted wide public attention from common people and the government (Bawa & Anilakumar, 2013; Boccia, Covino, & Sarnacchiaro, 2018; Frewer et al., 2013; Zhang et al., 2018).

The public considers GMFs sensitive in the health safety aspect, possibly influencing their consumption of GMFs (Bardin, Perrissol, Facca, & Smeding, 2017; Hudson, Caplanova, & Novak, 2015; Klerck & Sweeney, 2007). In situations in which health may be at risk, people always need additional information that can help them assess the certainty, severity, and immediacy of the risk (Lindell & Perry, 2012; Hovick, Kahlor, & Liang, 2014). After information acquisition and processing, people will balance perceived risks and benefits to decide whether to buy GMFs (Costa-Font & Mossialos, 2007; Zhang et al., 2018). Most previous studies have explored GMFs from the perspective of biological technology improvement, societal trust, and public interest (Qaim & Zilberman, 2003; Frewer et al., 2004; Lang, 2013; Marques, Critchley, & Walshe, 2015). Previous research has also explored social amplification of media, consumer cognition, and consumer response (Frewer, Miles, & Marsh, 2002; Magnusson & Hursti, 2002; Zhang et al., 2018). However, the effects of consumer perception and information processing on purchase intention have not gained considerable scholarly attention in the GMF context. Therefore, this study aims to explore the role of consumer perception and risk information in influencing purchase intentions and whether and how these important antecedents influence consumers'

consumption of GMFs.

Specifically, this study aims to explore the antecedents of people's intentions to purchase GMFs in China from a risk communication perspective. The protective action decision model (PADM) explains how people's information-processing behaviors and self-perceptions affect their responses to external risky events and hazards (Lindell & Perry, 2012). The heuristic systematic model (HSM) is a communication model whereby people's attitudes can be changed through receiving and processing persuasive information (Trumbo & McComas, 2003). Both models emphasize the importance of information and communication and explain the cognitive process of how people make decisions when facing uncertainties. Given the common characteristics of these two models in predicting people's behavioral intentions, we introduce and integrate them into the context of people's attitudes toward GMFs. Therefore, from the risk communication perspective, we draw on PADM and HSM to construct a conceptual framework (Figure 1). This model emphasizes the importance of risk communication in making behavioral decisions. In other words, public psychological perception and information processing strategies are highly related to intention to accept GMFs. Our hypothetical model discussed the interrelationships among perceived risk, perceived benefit, information need, information-seeking intentions, systematic processing, and purchase intention. A questionnaire survey was conducted in Shandong Province, China, and a structural equation model (SEM) was used to test the hypothetical model.

2. Theoretical foundation and hypotheses

2.1. Theoretical foundation

PADM describes that people's exposure to risk information triggers their risk perception, and a perceived threat from the natural environment makes people consider reducing risk by taking protective action (Lindell & Perry, 2012; Heath, Lee, Palenchar, & Lemon, 2017). In this model, people's perception is stimulated by the interactions of external information related to risk and their comprehension based on prior personal experience (Lindell & Hwang, 2008). For example, once people perceive the existence of health risk from information about GMFs, they will take corresponding measures to protect themselves (e.g., resistance to GMFs). It is a PADM process from the reception of environmental and social contexts to psychology and risk-reduction behavior (Heath, Lee, Palenchar, & Lemon, 2017). However, PADM has a flaw: it emphasizes only the important role of information in behavior; no specific mechanism for explicit information exists (Johnson, 2005; Zhu, Wei, & Zhao, 2016).

The HSM fills the gap in information processing, which includes a dual-process model: systematic and heuristic strategies (Trumbo & McComas, 2003). Most people use the principle of least effort by processing messages heuristically, judging their

validity and making decisions to comply through the use of superficial cues (e.g., the length of the message, use of a trusted spokesperson, and use of statistical data) (Smith et al., 2017). By comparison, systematic processing involves a much more comprehensive effort to analyze and understand information. Systematic processing involves the careful and extensive evaluation of information, whereas heuristic processing entails the use of simple decision rules to form judgments (Trumbo, 2002). Compared with heuristic processing, the effect of systematic processing on attitude tends to be more permanent.

PADM does not consider information processing that may affect customers' risk responses (Johnson, 2005; Smerecnik et al. 2012), while HSM is a potential and valuable research paradigm used in risk information seeking and processing (Ryu & Kim, 2015; Yang, Aloe, & Feeley, 2014; Zhu, Wei, & Zhao, 2016). Therefore, the integration of PADM and HSM should provide a comprehensive model to discuss people's behavioral response. Considering the stability and credibility of information processing, this study has adopted systematic processing rather than heuristic processing. Based on PADM and HSM, several determinants of purchase intention are illustrated. Our research asserts that people's perceived risk and perceived benefit influence information need, further triggering information seeking and information processing. As a result, behavioral responses to GMFs are stimulated. The proposed constructs and hypotheses are discussed as follows.

2.2 Hypotheses development

Perceived risk

Perceived risk is a central variable in PADM that predicts people's behavioral responses in risk situations, which is measured by expectations about the likelihood of personal physical and social effects caused by hazard (Lindell & Perry, 2012). The research related to perceived risk in food security has undergone a prominent increase in recent decades. Jia, Jia, Hsee, and Shiv (2017) believe that perceived risk was important for fields ranging from psychology to public health. Frewer, Scholderer, and Bredahl (2003) find that public attitudes toward emerging technologies (for example, GMFs) are mainly driven by perceived risk and they affirmed that perceived risk is the core factor influencing individuals' behavioral intentions to adjust to various risks. Additionally, Klerck and Sweeney (2007) empirically confirm the significant effects of consumers' risk perception on consumer purchases in the context of genetically modified products. Existing literature seems to indicate a negative correlation between perceived risk and consumer behavior in food security. Based on the theoretical and empirical contributions of previous scholars, we believe that the more potential risks people perceive, the less willing they are to buy genetically modified products.

GMFs have attracted public attention. Even if the public knows almost nothing about new biotechnology, they still make judgments about degrees of insecurity (Zhu, Yao, Ma, & Wang, 2018), and they will be actively looking for related information (Lusk et al., 2004). According to HSM, when a customer realizes the existence of the risk of GMFs, they will seek information to prove their perception. Several studies have identified positive relationships among perceived risk, information need, and information-seeking behavior (Huurne & Gutteling, 2008). Lusk et al. (2004) study the effects of information need and information-seeking behavior about health risks of biotechnology on consumer acceptance of GMFs from experimental auctions in the United States. Previous research mainly focused on the effect of information on risk perception, ignoring that risk perception may lead to the tendency of personal information seeking and processing, especially in GMFs. Given the emergence of public information, this study offers a link between individual perception and information processing. Therefore, the hypotheses are as follows.

H1a: *People perceiving more risk about genetically modified foods have lower purchase intention.*

H1b: *Perceived risk has positive effects on information need.*

H1c: *Perceived risk has positive effects on information-seeking intentions.*

H1d: *Perceived risk has positive effects on information systematic processing.*

Perceived benefit

Behavioral intentions reflect the psychological tendency that is expressed by the balance of perceived risk and perceived benefit (Frewer, Scholderer, & Bredahl, 2003; Costa-Font & Mossialos, 2007). On the basis of the trade-off of risks and benefits, we know that the more a customer believes that the use of GMFs is beneficial (e.g., the nutritional value of GMFs, more types of foods to choose, or less environmental pollution) rather than risky (e.g., many health risks or an expensive price), the more favorable the purchase intention. Based on a meta-analysis of 26 studies, Bearth and Siegrist (2016) indicated that benefit perception and risk perception are vital for public acceptance of emerging food technologies. Moreover, the more influential role of perceived benefit than that of perceived risk has been shown by many previous studies (e.g. Frewer et al. 2011; Olsen, Grunert, & Sonne, 2010; Siegrist, 2008). Therefore, we expect that perceived benefit directly affects customers' purchase intention toward GMFs. However, the effects of perceived benefit in influencing information need, information seeking, and information processing in the GMF context are rarely studied in previous research. Similar to perceived risk, we suppose that perceived benefit drives consumers' information need, intention to seek information, and systematic processing regarding GMFs. Therefore, the hypotheses are as follows.

H2a: *People perceiving more benefits about genetically modified foods have higher levels of purchase intention.*

H2b: *Perceived benefit has a positive effect on information need.*

H2c: *Perceived benefit has a positive effect on information-seeking intentions.*

H2d: *Perceived benefit has a positive effect on systematic processing.*

Information need

Information need is the gap between people believing they need sufficient information to deal with risk and their current knowledge about the risk (Griffin, Dunwoody, & Neuwirth, 1999). The information reserves of each people are different because of different educational backgrounds and personal ability, which are used to make choices. When the lack of information emerged, information need will eventually affect information-seeking behavior (Hwang & Jeong, 2016). Considerable research has contributed to the relationship between information need and information seeking. The positive relationship between information insufficiency and information seeking was supported by Zhu, Yao, Ma, and Wang (2018) and by Zeng, Wei, Zhao, Zhu, and Gu (2017). However, very few studies have examined the relationship between information need and information seeking in the GMF context. When GMFs are too unusual to influence purchase decisions, the intention of information seeking will be stimulated. Therefore, the following hypothesis is developed.

H3: *Information need is positively related to information-seeking intentions.*

Systematic processing

The HSM formulation stipulates that a person's desire for accurate and sufficient information is a strong motivation for information processing (Johnson, 2005). By comparison, systematic processing involves a much more comprehensive effort to analyze and understand information compared with heuristic processing (Kim & Paek, 2009). Systematic processing tends to conduct more stable judgments and subsequent behavior than heuristic processing does (Trumbo & McComas, 2003). Therefore, using systematic processing to explore people's psychological and behavioral information to the consumption of GMFs is suitable.

Systematic processing not only depends on one's capacity to think comparatively and critically but also on the perceived relevant information (Zhu, Wei, & Zhao, 2016). Customers will make decisions by evaluating the message critically, thinking about the message, and integrating message-based information with existing knowledge. The usefulness and credibility of available information directly influence systematic processing. Griffin et al. (2008) prove that information insufficiency was a vital stimulant of people's use of systematical strategy to process information. Other

researchers also show that the relationship between information insufficiency and systematic processing is positive (Johnson, 2005; Zeng, Wei, Zhao, Zhu, & Gu, 2017). We apply the findings in the field of GMFs creatively. Therefore, the following hypotheses are formulated.

H4a: *Systematic processing is positively influenced by information need.*

H4b: *Systematic processing is positively influenced by information-seeking intentions.*

Purchase intention

Purchase intention is not only influenced by perceived risks and perceived benefits but also by information processing. The PADM helps explain people's information processing behavior and that information about relative events also acts as a predictor of behavioral intentions (Lindell & Perry, 2012). Griffin, Dunwoody, and Neuwirth (1999) extend information processing to behavioral intentions. They stated that the way that individuals process information would affect the stability of behavior over time. Other scholars have recently confirmed that systematic processing exerted a positive influence on individuals' behavioral responses (Griffin et al., 2008; Hovick, Kahlor, & Liang, 2014). As a result, in the GM context, previous studies indicate that systematic processing exerts a positive influence on behavioral intentions. Therefore, the last hypothesis is as follows:

H5: *Systematic processing has a positive influence on behavioral intention.*

3. Research methods

3.1. Sample and data collection

To test our hypotheses, we examined people in four communities of Jinan City, Shandong Province, China, and conducted a questionnaire survey to collect data by face-to-face interviews. We listed all alternative communities in Jinan and decided the number of research samples in each community according to population density. A draw was operated to select the surveyed communities. Before the formal survey, we conducted interviews with two government officers in food-safety departments and two managers from a GMF-manufacturing company to understand customers' general attitude to GMFs. We also studied relevant archival documents about the history and development of GMFs to understand the background. Based on a literature review, we designed an English-language version of the questionnaire composed of four parts because items on these constructs were developed in English in literature. Then, two independent translators translated the questions into Chinese following a back-translation process. We slightly modified and partially deleted the contents to adhere to Chinese language habits. We selected 10 citizens in two communities and conducted a pilot test using the earlier draft questionnaire (these responses were excluded in the final

sample). We refined the questionnaire according to their feedback and adjusted some items to be understandable in the Chinese context. Compared with an online survey, a face-to-face survey has the following advantages: increasing engagement and awareness by interviewees, reducing misunderstanding, and allowing spontaneous questions.

Survey questionnaires were distributed by our research members who had been trained with interview techniques. They were dispatched to pre-decided communities. Participants were recruited from communities in Jinan, Shandong. Specifically, after communicating with the manager of each community association (i.e., people in charge of the community), our research members were allowed to enter the community. They knocked on people's doors and conducted face-to-face surveys after obtaining their permission. To ensure that all participants were qualified for the survey, those who neither had knowledge of GMFs nor bought genetically modified products were excluded. For potential participants, research members asked them two questions: "Have you ever bought GMFs?" and "What is the Chinese government's attitude toward GMFs?". Only those who were GMF consumers and were able to give correct information about the attitude of the Chinese government (i.e., neutral and cautious) took part in the survey. The purpose of using these inclusion criteria was to improve data quality because only when people have basic knowledge of genetically modified products were they able to give effective responses. A similar method was used in prior research (e.g., Baptista, Rodrigues, & Sant'Ana, 2020). According to our research members, all people they examined were GMF consumers, although 14 people (among a total of 634 respondents) provided wrong answers about the government's attitude (with 1 saying "negative" and 13 saying "positive"). We asked every participant to fill out one questionnaire, and we gave the participants a small gift as a reward. Moreover, our research methodology was approved by the Code of Ethics of the World Medical Association. During the investigation, our research members explained the purpose of this survey to the participants and informed them of its anonymous nature before they began to fill out the questionnaire. Our research team members helped some participants with low educational levels understand the contents.

For the questionnaire content, we introduced the purpose of this study and thanked the respondents for their participation in the first part. In the second part, the scenario about the GMF project was described briefly to help unfamiliar participants understand it. In the third part, items were designed to measure the constructs. Finally, we investigated the participants' demographic characteristics.

We collected 620 questionnaires, among which 47 were invalid because of missing values on the main variables. A total of 573 valid questionnaires were returned. Table 1 shows the demographic profiles of respondents.

<Table 1 here>

3.2. Measurement

The questionnaire included 20 items on 6 different constructs, namely, information need, information-seeking intention, systematic processing, purchase intention, perceived risk, and perceived benefit, which were important in the analyses reported in this study. Each construct was measured with three to four items derived from previous theories and literature. All items were measured on five-point Likert scales. Constructs and measurement items were shown in Table 2. The endpoints of the scale were labeled "completely disagree" (1) and "completely agree" (5).

The plausibility of the postulated causal model was tested through SEM, which was suitable for the exploration and analysis of complex multivariate data. We used SEM to test our model. SEM is a statistical method designed to test how well a conceptual or theoretical model fits a data set. In consideration of the sample exceeding 200, covariance-based SEM was used in most situations (Boomsma & Hoogland, 2001). The analysis of moment structures (AMOS) program estimate parameters were determined by the maximum likelihood method. We used AMOS 22.0 to estimate the parameters in this study.

First, exploratory factor analysis was operated to extract the valid measurement items for information need, information-seeking intentions, systematic processing, purchase intention, perceived risk, and perceived benefit. Factor loadings need to be above 0.50. Second, a confirmatory factor analysis (CFA) was conducted for each latent variable to judge whether the hypothesized measurement model is satisfactory. Following Kline's recommendations, model fit was analyzed using $\chi 2/df$ (the value of the chi-square value divided by the degrees of freedom of the model) < 3, the Root Mean Square Error of Approximation (RMSEA) < 0.06, Standardized Root Mean Residual (SRMR) < 0.10, Tucker–Lewis Index (TLI) > 0.9, and Comparative Fit Index (CFI) > 0.90. Cronbach's alpha was conducted to evaluate the reliability of constructs.

<Table 2 here>

4. Results

4.1. Measurement model

The reliability and validity of the constructs were used to evaluate the hypothesized model. As shown in Table 3, Cronbach's alphas ranged from 0.827 to 0.963, which were greater than the threshold value of 0.70. Therefore, all constructs had acceptable reliability. We examined the convergent, discriminant, and content validities to validate our model. Content validity was evaluated by reviewing the literature. We examined the value of factor loadings, composite reliability, and average variance extracted (AVE)

to check the convergent validity. Except for IP1 and PB3 being close to 0.7, the CFA results (Table 3) show that most factor loadings are greater than 0.7, which is the threshold. The composite reliability ranged from 0.803 to 0.963, which was greater than the 0.7 benchmark value (Nunnally, 1994). Furthermore, the AVEs of all of the constructs were greater than the 0.5 benchmark value, which ranged from 0.581 to 0.868. These results indicate that our measurement model has good convergent validity. Discriminant validity should also be confirmed by comparing the relationship between the square root of the AVEs for all constructs and the correlations among constructs (Fornell & Larcker, 1981). As shown in Table 4, the square root of the AVEs of each construct is greater than the correlations among constructs, indicating the full discriminant validity of our measurement model. Thus, the validity of our study is supported. The model fit indicators ($\chi^2 = 339.427$, df = 152, χ^2 /df = 2.233; TLI = 0.976, CFI = 0.943; RMSEA = 0.046, SRMR = 0.045) indicated a good fit between the measurement model and the dataset. Therefore, our CFA results indicate that all of these conditions are satisfied. Moreover, indicator items within each measurement scale are closely associated with their underlying theoretical constructs.

<Table 3 here>
<Table 4 here>

4.2 Structural model

Figure 1 presents the analysis results. As shown in Figure 1, the estimated parameters include path coefficients (b), significance level (similar to the t value from the t-test), and explained variances (R^2). The results are as follows. Perceived risk has a significant influence on purchase intentions (H1a; b = −0.340, p < 0.001), information need (H1b; b = 0.379, p < 0.001), information-seeking intentions (H1c; b = 0.108, p = 0.001) and systematic processing (H1d; b = 0.118, p < 0.001). Therefore, H1a, H1b, H1c, and H1d are supported. The results also indicated that high levels of perceived benefit about GMFs usually gain high purchase intentions (H2a; b = 0.465, p < 0.001), information need (H2b; b = 0.205, p < 0.001) and systematic processing (H2d; b = 0.169, p < 0.001). However, the perceived risk and benefit are inconsistent with all hypotheses. H2c is not supported. Information need has a positive influence on systematic processing (H4a; b = 0.306, p < 0.001) and information-seeking intentions (H3; b = 0.289, p < 0.001). Therefore, H3 and H4a are supported. The result that systematic processing is significantly affected by information-seeking intentions (H4b; b = 0.447, p < 0.001) supports H4b. However, the direction of the relationship between systematic processing and purchase intentions is opposite that of the expectation. Therefore, H5 is not supported.

<Figure 1 Here>

5. Discussion

This study examines the determinants of people's purchase intention of GMFs from a risk communication perspective, emphasizing the importance of risk perception and information processing in decisions. We contribute to extant literature mainly by integrating PADM with HSM in the context of purchasing GMFs. According to Johnson (2005), the PADM does not consider that information processing may be a valuable research paradigm affecting customers' risk responses, and the HSM ignores the effects of risk information seeking and processing on behavior tendencies. Our study combines these models and offers a comprehensive decision-making process, suggesting that people's acceptance of GMFs is influenced by their psychological perception, information flow, and behavioral intention. We show how these factors motivate people's willingness to take action against or purchase the GMFs.

Specifically, our model suggests that a higher risk perception will lead to lower purchase intention, but perceived benefit has a negative relationship with purchase intention. These results are within our expectations because purchase intention is based on evaluating the risks and benefits of GMF consumption. When perceived benefits outweigh perceived risks, consumers will feel that buying behavior is desirable (Costa-Font & Mossialos, 2007). In other words, compared with people who have high benefit perception, people who are risk-neutral or risk-averse are less likely to purchase GMF. Moreover, we find that perceived risk and perceived benefit are significant predictors of information need and systematic processing. This finding suggests that people who perceive more risks and benefits about GMFs need more information and present the tendency to process information systematically. The findings are consistent with Huurne and Gutteling (2008) and Zhu, Yao, Ma and Wang (2018), who found that perceived risk is one of the determinants of information need and systematic processing. Another important finding is that systematic processing is a positive predictor of information-seeking intentions. In contrast to earlier findings that systematic processing was influenced by information-seeking intentions (Johnson, 2005; Zeng, Wei, Zhao, Zhu, & Gu, 2017), this study shows that information-seeking intention has a positive influence on systematic processing, which may be a novel for the GMF context, a context with high uncertainties of attitudes. Additionally, we find that information processing (i.e., systematic processing) is not a significant predictor of purchase attention in this context. This finding seems inconsistent with previous research exploring determinants of choices on other foods. A possible explanation for this inconsistency is that people's decisions in purchasing GMFs may depend on sufficient professional knowledge and information and most of them may do not possess systematic abilities in processing such information individually (Xu, Wu & Luan, 2020). Individuals tend to make few cognitive efforts, and they are more likely to follow

experts and authorities like governments to make decisions (Yang, Aloe, & Feeley, 2015). Overall, the empirical results suggest that the decision-making process on purchase intention described in the PADM and the HSM is suitable for the context.

This study also provides several practical implications. First, the government should universally provide considerable information and propagandize knowledge of GMFs among the public. Our results suggest that information plays an important role in shaping people's attitudes to GMFs. Governments can use timely and detailed news by such media tools as television, broadcast, and newspapers to transmit information. Moreover, our study emphasizes that GMF enterprises should focus on the determinants of people's purchase behavior, such as perceived risk and perceived benefit. If the enterprises expect to encourage customers to buy GMFs, they should change people's perceptions of risks or benefits, rather than merely by market means of price promotion. A specific measure is that companies provide precise information to customers to help them judge the influences of GMFs.

This study is not without limitations. First, the sample of the study was collected in one city. Purchase intention for GMF among citizens in different cities might be different. Therefore, the generalization of the results is limited. Moreover, some other factors that determine purchase intention, such as perceived knowledge and brand label, might not have been considered. Future endeavors should be undertaken to overcome these problems.

6. Conclusion

This study was motivated by gaining insights into the potential factors determining purchase intentions of GMFs in China. Based on the PADM and HSM, we developed a tentative framework to explore the directions and patterns of interrelationships among relevant factors from the view of health communication. Our study indicates that risk perception and benefit perception play a significant role in determining people's intention of purchasing GMFs and demand for GMF information. Although we find that people's information need positively relates to their information-seeking intention, systematic processing is not suggested to be a significant determinant of their purchasing intention of GMFs. Our study provides theoretical and practical implications by integrating PADM with HSM into the context of purchasing GMFs.

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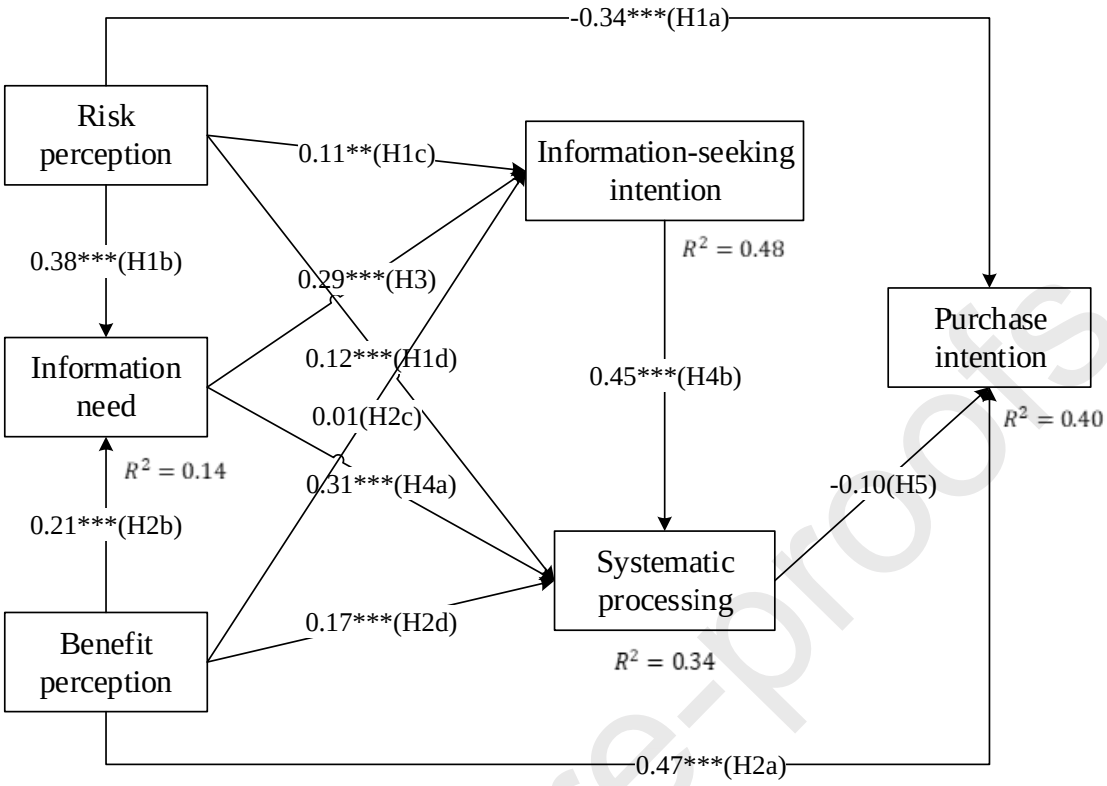

Fig. 1. Results of the structural model analysis.
Notes: **p<0.01, ***p<0.001.

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Table 1

Demographic profile.

	Frequency	Percentage (%)
Gender		
0.Male	264	46.1
1.Female	309	53.9
Age		
1. Under 18	20	3.5
2. 18–30	202	35.2
3. 31–40	177	30.9
4. 41–50	106	18.5
5. 51 and over	68	11.9
Education level		
1. Junior college or below	197	34.4
2. Bachelor degree	236	41.2
3. Master degree	140	24.4
Household income (yearly)		
1. Less than ¥60,000 ($8,802)	112	19.5
2.¥60,001–¥100,000($8,802–$14,670)	213	37.2
3.¥100,001–¥200,000($14,670–$29,341)	189	33.0
4.More than ¥200,000 ($29,341)	59	10.3

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Table 2

Constructs and measurement items.

Constructs	Measurement items	Source
Information need (IN)	I need more information related to the GMFs	Huurne & Gutteling (2008)
	I would like to know more information about the GMFs	
	I need information related to the construction of the GMFs issued by government sectors through multiple channels	
Information-seeking intentions (ISI)	I want to seek information about the GMFs	Huurne & Gutteling (2008)
	I have to seek more information about the GMFs	
	I follow the issues related to the GMFs through multiple channels	
Systematic processing (SP)	I associate the information about the GMFs with the information which I read or hear elsewhere	Smerecnik et al. (2012)
	I compare information about the GMFs with other information I know	
	I think about the importance of the information about GMFs to me	
	I think about the relationship between this information and my health	
Purchase intention (PI)	If I can buy GMFs on the market, I will buy GMFs	Kim et al. (2012)
	If I can buy GMFs on the market, I intend to buy GMFs	
	If I can buy GMFs on the market, I plan to buy GMFs	
	If I can buy GMFs on the market, I will try to buy GMFs	
Perceived risk (PR)	The consumption of GMFs brings threat to the health and life of me and my family	Costa-Font & Gil (2009)
	The consumption of GMFs brings threat to the health and life of the offspring	
	The consumption of GMFs may pollute the surrounding environment	
Perceived benefit (PB)	The GMFs improve the nutritional value of foods	Costa-Font & Gil (2009)
	The GMFs provide consumers with more types of things to choose	
	The consumption of GMFs may reduce environmental pollution	

Table 3

Confirmatory factor analysis results for measurement model.

Items	Predictor	Loading	Estimate	S.E.	C.R.	Composite reliability	Cronbach's alpha	AVE
IN	PN1	0.875	1.000			0.914	0.883	0.781
	PN2	0.926	1.023	0.033	31.186			
	PN3	0.848	0.925	0.035	26.635			
ISI	ISI1	0.844	1.000			0.886	0.912	0.722
	ISI2	0.908	1.044	0.041	25.724			
	ISI3	0.793	0.901	0.041	22.172			
SP	IP1	0.698	1.000			0.873	0.870	0.634
	IP2	0.792	1.168	0.066	17.812			
	IP3	0.911	1.299	0.081	16.076			
	IP4	0.770	1.114	0.077	14.564			
PI	PI1	0.925	1.000			0.963	0.963	0.868
	PI2	0.945	1.024	0.023	44.047			
	PI3	0.952	1.038	0.023	44.721			
	PI4	0.904	1.060	0.028	37.601			
PR	PR1	0.933	1.000			0.952	0.907	0.868
	PR2	0.945	1.013	0.024	42.963			
	PR3	0.917	0.976	0.025	38.848			
PB	PB1	0.754	1.000			0.803	0.827	0.581

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PB2	0.889	1.252	0.075	16.746
PB3	0.620	0.834	0.061	13.715

Note: Information need (IN); Information-seeking intentions (ISI); Systematic processing (SP); Purchase intention (PI); Perceived risk (PR); Perceived benefit (PB)

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Table 4

Means, standard deviation, correlation, and discriminant validity.

	M	SD	IN	ISI	SP	PI	PR	PB
Information need (IN)	4.26	0.83	**0.88**					
Information-seeking intentions (ISI)	3.60	1.02	0.56***	**0.85**				
Systematic processing (SP)	4.02	0.78	0.55***	0.51***	**0.80**			
Purchase intention (PI)	2.17	1.15	-0.17***	-0.12**	-0.12**	**0.93**		
Perceived risk (PR)	3.63	1.07	0.33***	0.32***	0.26***	-0.57***	**0.93**	
Perceived benefit (PB)	2.91	1.04	-0.08	-0.03	0.04	0.63***	-0.51***	**0.76**

Notes: S.D. means standard deviation.

The elements in the bold type are the square roots of AVEs. The off-diagonal elements are the correlations between constructs.

**p<0.01, ***p<0.001.

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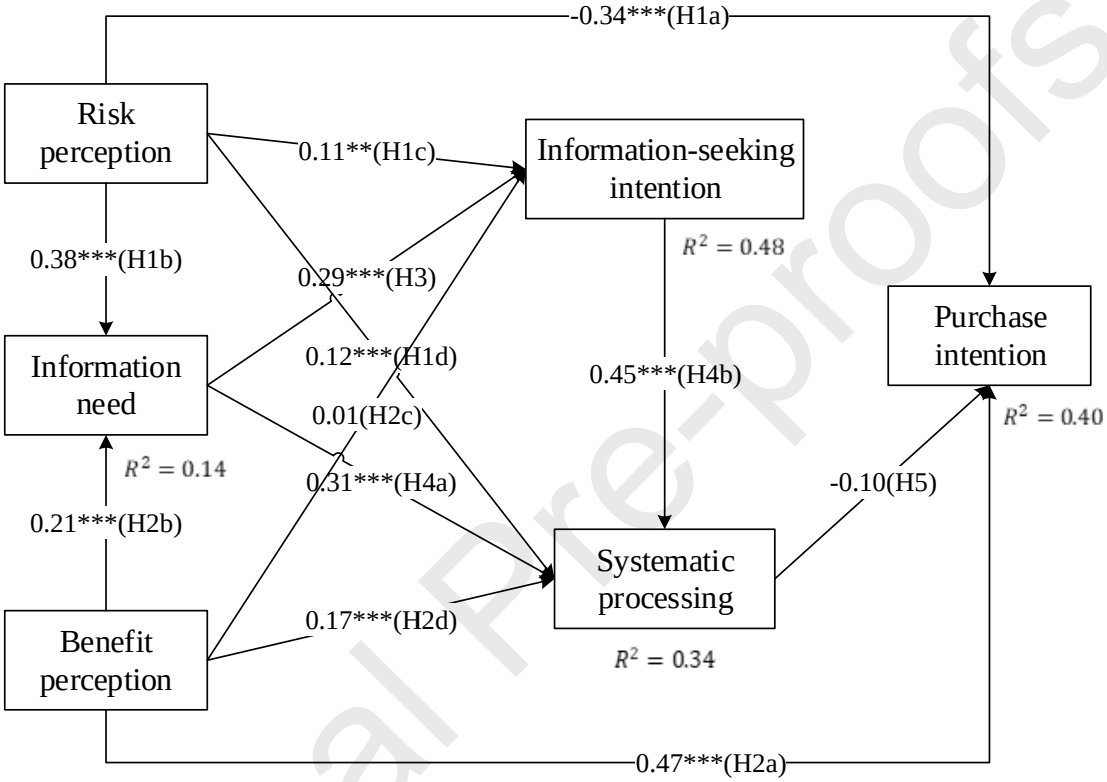
Graphical abstract

The research framework of food risk perception and acceptance of genetically modified food.



**p<0.01, ***p<0.001.

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Highlights

- Perceived risk negatively relates to the intention of purchasing genetically modified foods, whereas perceived benefit positively relates to the intention.
- Perceived risk and perceived benefit generally have positive relationships with information need, information seeking, and information processing.
- Risk communication is important for consumers' acceptance of genetically modified foods.

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Author contributions

Weiwei Zhu: Conceptualization, Methodology, Software, Data curation, Writing- Original draft preparation, Software, Validation.

Qiaozhe Guo: Data curation, Writing- Original draft preparation.

Nengzhi Yao: Visualization, Investigation, Supervision, Writing- Reviewing & Editing.

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Declarations of interest: none.

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