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Application of an integrated framework to examine Chinese consumers' purchase intention toward genetically modified food

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ABSTRACT

The commercial application of transgenic technology in the food industry has become a crucial topic worldwide. This study aims to achieve the following objectives: (i) to examine consumers' purchase intention toward genetically modified (GM) food by using benefit-risk analysis (BRA); (ii) to examine consumers' purchase intention toward GM food based on the theory of planned behavior (TPB); and (iii) to determine which framework or theory significantly influences the interpretation of purchase intention toward GM food under an integrated framework incorporating the BRA and the TPB. An online survey was conducted among 408 qualified samples who were analysed through structural equation modeling. The result analysis leads to the following conclusions: (i) under the BRA framework, Chinese consumers rely on their positive attitude toward GM food to increase purchase intention and their perceived risks to decrease purchase intention. Moreover, consumers' trust increases their perceived benefits offered by GM food and decrease their perceived risks; (ii) under the TPB framework, attitude toward GM technology is the most significant predictor of purchase intention toward GM food, followed by perceived behavioral control and subjective norms; and (iii) under the integrated framework, although most of the results in the single framework of the BRA or the TPB are supported, the BRA provides better interpretation than the TPB. In addition, several mediating effects are found in the context of purchase intention toward GM food.

1. Introduction

Genetically modified (GM) technology has been rapidly and steadily developed over the past two decades worldwide (Bredahl, 2001; Chen & Li, 2007; Costa-Font, Gil, & Traill, 2008; Costa-Font & Gil, 2009; Lang, 2013; Li, Peng, Hallerman, & Wu, 2014; Rodŕguez-Entrena & Salazar-Ordóñez, 2013). The global plantation area of GM crops started from 1.7 million hectares in 1996 and reached 185.1 million hectares in 2016, distributed in 26 countries and regions (James, 2016). These figures have indicated the importance of GM crops in terms of supply. However, consumers' attitude toward GM food varies considerably in different countries and individuals in terms of demand (Rodŕguez-Entrena & Salazar-Ordóñez, 2013).

Different countries maintain different attitudes toward GM food. Particularly, public acceptance toward GM food in Japan and the European Union (EU) is low. By contrast, public acceptance toward GM food in the United States (US) and many other developing countries is relatively high (Ceccoli & Hixon, 2012; Christoph, Bruhn, & Roosen, 2008; Frewer, van der Lans, & Fischer, 2013; Gaskell, Bauer, & Allum, 1999; Hudson, Caplanova, & Novak, 2015). According to the surveys of Chinese researchers, the level of public awareness toward GM food was from low to high. For instance, Lv and Ma (2012) conducted a survey entitled Chinese Public and Biotechnology in 2003, 2006, and 2009. The level of public awareness toward GM agricultural products was "low" in 2003 (16%), "moderate" in 2006 (57%), and "high" in 2009 (90%). The surveys of Wang (2003) and Zhong and Ding (2004) corroborated that the proportion of the public who were aware of GM food were 48% and 43%, respectively. Huang, Hu, Meijl, and Tongeren (2004) verified that two-thirds of urban residents have heard of GM food. These results echoed the findings of Lv and Ma (2012). In addition, Chinese consumers' attitude toward GM food began to focus on the risks (Liu, 2010; Ma, 2013).

Different individuals have different attitudes toward GM food. Pratt (1964) argued that risk-taking behavior relies not only on risk perception but also on risk preference. Lusk and Coble (2005) and Petrolia (2016) verified that consumers' choice of risky food is a function of risk preference and depends upon the interactions between risk preference and risk perception. Different consumers have different risk

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preferences. Risk-averse individuals are less likely to accept and consume GM food compared with risk-seeking individuals (Lusk & Coble, 2005). Consumers' risk perception of GM food is not one dimensional (Costa-Font et al., 2008). Several studies, such as those of Gaskell, Allum, and Stares (2003), Schenk, Fischer, and Frewer (2008), Miebly, Sandøe, and Lassen (2012), and Rzymski and Królczyk (2016) asserted that consumers' attitude toward GM technology depends on the purpose of its application. For instance, favorable attributes (e.g., medical benefits and nutritional enhancement) have a significantly positive influence on South Korean consumers' attitude toward GM technology (Kim, 2012). Rzymski and Królczyk (2016) elucidated that the applications of transgenic technology in the fields of medicine and pharmacy are slightly supported by Polish consumers. Furthermore, previous studies (e.g., Cox, Cox, & Zimet, 2006; Cox, Cox, & Mantel, 2010; Philips & Hallman, 2013) have confirmed that consumers regarded risks from GM food as either a range of benefits to be gained or a set of losses to be avoided.

China is one of the first countries to carry out commercial cultivation of GM crops. Its commercial plantation area is the eighth largest worldwide, followed by the US, Brazil, Argentina, Canada, India, Paraguay, and Pakistan (James, 2016). In 1997, China approved the commercialization of *Bt* cotton (Huang et al., 2004). Subsequently, seven GM crops (i.e., cotton, papaya, petunia, sweet pepper, tomato, rice, and corn) involved in 10 events have been approved by the Ministry of Agriculture for commercial planting (Li et al., 2014). Only insect-resistant *Bt* cotton and virus-resistant papaya have been extensively grown in China (James, 2012). However, dozens of GM crop varieties, covering five commercialized GM crops (canola, cotton, soybean, corn, and sugarbeet), have been approved for import as processing materials or feed use in China since 2004 (Li et al., 2014; US Department of Agriculture (USDA), Foreign Agriculture Service (FAS), 2012). Currently, many food products contain GM ingredients that are not secret in the Chinese market. Similar to many other developing countries, China must decide on how GM technology and its applications can be developed (Huang et al., 2004; Wang, Huang, & Liu, 2013). The reactions of potential consumers are fundamental for the development of new food products (Rodŕguez-Entrena & Salazar-Ordóñez, 2013). Given that China is the most populous country, Chinese consumers' attitude and purchase intention toward GM food will largely influence the commercialization and promotion of GM food worldwide.

This study has several purposes. First, this study aims to examine consumers' purchase intention toward GM food by using the benefits-risks analysis (BRA). Second, this study aims to examine consumers' purchase intention toward GM food based on the theory of planned behavior (TPB). Third, this study aims to determine which framework or theory significantly influences the interpretation of purchase intention toward GM food under an integrated framework incorporating the BRA and the TPB.

2. Theoretical framework and research hypotheses

2.1. Theoretical framework

Food is essential for people's daily life. Food contains the necessary and beneficial nutrients and some potentially "bad" ingredients (Chen & Li, 2007). The BRA is a new framework used to examine purchase intention toward GM food. This framework argues that consumers make decisions by comparing the risks and benefits in a given situation and addressing the acceptability of risks (Tijhuis, de Jong, & Pohjola, 2012; Ueland, Gunnlaugsdottir, & Holm, 2012; Verhagen, Tijhuis, & Gunnlaugsdottir, 2012). Traditionally, the assessment of perceived benefits and that of perceived risks are separate. By contrast, the BRA integrates the perceived benefits and risks within one framework (Verhagen et al., 2012; Zhang, Zhang, & Wang, 2015). Consumers reject GM food because the perceived risks associated with the food are higher than those associated with traditional food (Frewer, Lassen, & Kettlitz, 2004). A certain degree of risks is allowed when consumers perceive that GM food brings considerable benefits (Bredahl, Grunert, & Frewer, 1998). The BRA has been extensively used to examine consumers' purchase intention toward GM food (e.g., Chen & Li, 2007; Costa-Font & Gil, 2009; Ghoochani, Ghanian, Baradaran, & Azadi, 2017; Hudson et al., 2015; Prati, Pietrantoni, & Zani, 2012; Rodŕguez-Entrena & Salazar-Ordóñez, 2013; Rodŕguez-Entrena, Salazar-Ordóñez, & Sayadi, 2013; Traill, Yee, & Lusk, 2006).

Understanding the key factors of behavior has become an important goal of sociologists and decision-makers (Chen & Li, 2007; Zhang, Luan, Shao, & Xu, 2016). Ajzen (1991) TPB is the development of the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The limitation of the original model (i.e., people have incomplete control in dealing with behaviors) should be addressed (Ajzen, 1991). The theory argues that attitude, perceived behavioral control, and subjective norms influence consumer behavior. This theory has been extensively applied to many fields of human behavioral research in the past 25 years and has received supports from a large number of empirical studies. Furthermore, the TPB has been accepted by researchers on GM food consumption (e.g., Ghoochani et al., 2017; Kim, 2014; Kim, Jang, & Kim, 2014; Patch, Tapsell, & Williams, 2005; Saba & Vassallo, 2002; Sparks, Shepherd, & Frewer, 1995) and has become one of the most important behavioral decision models.

The literature on the purchase intention toward GM food is growing. However, thus far, studies that systematically examine and assess the factors that influence purchase intention toward GM food are limited. Most studies typically involve independently empirical evidence or theoretical explanations of the data only (Costa-Font et al., 2008). Bredahl et al. (1998) proposed three models, namely, attitude model, behavioral model, and attitude change model, which are important for studying purchase intention toward GM food. Costa-Font et al. (2008) updated and upgraded the attitude model developed by Bredahl et al. (1998), providing an overall picture of the consumer decision process towards GM food. In the new model, the factors that influence purchase intention toward GM food included information, knowledge of product and process, individual attributes and values, attitude, consumers' perception of risk and benefit, trust, and price. Using structural equation modeling (SEM), Prati et al. (2012) developed an integrated psychosocial model in which the TPB was the starting point. In the model, trust and perceived benefits and risks were the additional explanatory factors. The results validated several significant associations between the intention to consume GM food and determinants, such as trust, subject norms, attitude, perceived control, perceived benefits, and perceived risks. The present study responds to the calls of Costa-Font et al. (2008) and Prati et al. (2012) by proposing an integrated framework to systematically examine Chinese consumers' purchase intention toward GM food. Fig. 1 illustrates the proposed model that contains multiple functions. First, the purchase intention toward GM food could be examined independently on the basis of the BRA or the TPB. Second, the framework or theory that significantly influences the interpretation of purchase intention toward GM food can be determined under an integrated framework that incorporates the BRA and the TPB.

2.2. Research hypotheses

2.2.1. Trust

Theoretical and empirical studies assert that trust does not directly influence consumer intention toward GM food (Chen & Li, 2007; Costa-Font & Gil, 2009; Prati et al., 2012). Food supply, to a certain extent, has the characteristics similar to those of public goods, and the "scattered" consumers cannot bear the high cost of information collection and safety supervision. These conditions suggest that the government should play a leading role. In daily life, the public makes their own judgment that is occasionally based on the expert assessments of new products. The majority of the public does not have enough professional knowledge (Hu, Adamowicz, & Veeman, 2009), and thus, cannot rely