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Urban Residents' Green Agro-Food Consumption: Perceived Risk, Decision Behaviors, and Policy Implications in China

Jianying Xiao ^{1,2}, Qian Wang ^{1,*}, Jinjin Dai ^{1,2}, Bin Yang ^{1,2} and Long Li ^{1,2}

¹ School of Public Policy & Management, Digital Rural Service Research Center, China University of Mining and Technology, Xuzhou 221116, China

² The Research Center for Transition Development, Rural Revitalization of Resource-Based Cities in China, China University of Mining and Technology, Xuzhou 221116, China

* Correspondence: zhui2013@sina.com

Abstract: With the continuous improvement of living quality, food safety and healthy consumption awareness of urban residents have increased significantly. Green agricultural products marked as healthy, safe, and nutritious have become popular. At present, green agro-food is boosted by markets and policies in China, but consumers' trust is not optimistic. Based on the theory of perceived risk and planned behavior, this research constructs a model to analyze the decision-making of urban residents' green agricultural product consumption from the aspects of personal attitude, perceived risk, and subjective norm. Through a questionnaire survey of 329 residents in Tianjin, the empirical results show that: (1) Personal attitude and subjective norm positively affect residents' willingness to consume. (2) Perceived risk negatively affects residents' willingness to consume. (3) Functional risk has the highest impact, followed by time risk, financial risk, and psychological risk. In this regard, urban residents' consumption of green agro-food could be continuously explored and promoted from the aspects of traceability supervision, circulation efficiency, and product brand and publicity.

Keywords: green agro-food; perceived risk keyword; urban residents; consumption intention and behavior



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1. Introduction

Global demand for organic products has been growing continuously since the start of the 21st century. The data show that the total amount of organic agricultural land increased from 11 million hectares to 72.3 million hectares from 1999 to 2019 [1]. Affected by COVID-19, organic markets around the world become unprecedentedly prosperous. According to the survey data of the Swiss Institute of Organic Agriculture, the largest organic market in 2021 is the United States, accounting for 39 percent of the global market, followed by Germany, France, and China. According to experts, by 2025, the global organic market will reach USD 38.084 billion, with an average annual growth rate of 14.5 percent. Green crops in China account for about 8.03 percent of the planting area of agricultural products, and green agricultural products account for about 10 percent of the total agricultural products, which is far from meeting people's green consumption demand.

With the increasing attention of urban residents to food quality, green agro-food has increasingly become their consumption tendency, which also points out a way for the high-quality green agriculture to develop in China. The market formation requires a combination of supply and demand. The current supply of green agro-food in China is not satisfactory and cannot meet people's needs. The 14th Five-Year National Agricultural Green Development Plan and the report of the 20th National Congress of the Communist Party of China clearly put forward the promotion of agricultural green development. According to the data of the Ministry of Agriculture and Rural Affairs, by the end of August 2022, the total amount of green organic agro-food with geographical indications in China exceeded 63,000, an increase of 320 percent compared with 2012.

At present, there are still some problems in China's green agricultural products market, which affect its healthy development and the urban residents' consumption trust. First, the production and sales information of green agricultural products are asymmetric. Green agro-food varies in quality, which makes it difficult for residents to find a safe consumption channel, and high-quality green agro-food cannot be effectively supplied to consumers in need. Second, various product labels are complicated. The agro-food that is assuredly nutritious in the market mainly includes pollution-free agricultural products (checking for pesticide residue, nitrate content, and pathogenic microorganisms and other harmful and toxic substances), green food (with two levels of A and AA), organic agricultural products (with national standard 19630 [2] to guarantee quality), and geographical landmark agricultural products (with quality and safety standards for agricultural products), collectively known as "three products and one standard". These products have different positioning, different signs, and complex concepts of various standards, which lead to confusion for urban residents when purchasing green agro-food. Third, the reliability of green agro-food is low. Due to the lack of effective supervision, some ordinary agro-food has been packaged as green agro-food, which makes the quality of green agro-food uneven and affects residents' purchase confidence.

The existing research on green agro-food consumption is mainly based on subject analysis and multi-group analysis. The first ones are analyzing residents' willingness to purchase green agro-food by exploring the three systems of government, enterprises, and consumers. Bhardwaj (2017) conducted a comparative analysis of organic and non-organic food in India and found that it was crucial for the government to motivate farmers to shift from ordinary food to organic food [3]. Melovic's (2020) research showed that price-quality ratio, distribution barriers, and modern media as a promotional tool had the most significant impacts on consumers' views and attitudes towards existing market supply [4]. Consumer knowledge and health-consciousness will also affect purchase intention [5]. Secondly, some research was carried out from the multi-group analysis perspective. Scholars mainly study the transmission mechanism of green agricultural product decision-making by comparing consumers' willingness to purchase different products. For example, comparing the EU quality labeled products purchased with organic food [6], or comparing the perceived value of green food rice and green food apples [7]. In addition, perceived risk, as an individual's risk attitude and intuitive judgment, is also an important factor affecting consumers' decision-making. The impact of perceived risk on urban residents' green agro-food consumption has not been taken seriously.

2. Literature Review

Green agro-food is classified as organic food in the United States and Britain, as ecological food in Sweden, and as natural food in Japan. Relevant research dates back to the 1970s, but it was after the exposure of incidents such as excessive chemicals in processed foods that scholars really became concerned. In China, there have been studies on pollution-free and green agro-food since the 1990s. Research on green agro-food consumption mainly focuses on the following three aspects:

First, consumers' perceptions and attitudes toward green agro-food. With consumers' increased concern about food safety and health, demands for green agro-food are also growing. Green agro-food consumption in developed countries is significantly higher than that in developing countries. The green agricultural products market in India and other countries is still in early stages. For organic food, people's perceptions need to be improved, and the acceptance is relatively low [8]. Arumugam (2019) analyzed consumers' preferences for fresh organic produce in the mid-Atlantic region of the United States, and found that organic fresh fruits and vegetables in the region were generally more attractive [9]. Martina (2021) conducted a comparative analysis of consumers' attitudes towards the quality and benefits of organic agricultural products in the Czech Republic in 2016 and 2019, and concluded that the popularity of organic food was increasing, and a considerable proportion of consumers recognized that the quality of organic food was

better [10]. Consumers often have little trust in the institutions responsible for food safety and quality supervision. Iliriana et al. (2022) investigated consumers' attitudes towards green agro-food and concluded that health, certifications, and environmental issues are important influence factors [11].

Second, the influencing factors of green agro-food purchase intentions. They can be summarized as internal and external factors. The internal factors of green agro-food purchases mainly include consumer values, individual characteristics, lifestyle, health concepts, and environmental awareness. Grebitus (2016) analyzed the impacts of human values and personality on the demand for organic tomatoes [12]. The results showed that consumers with strong hedonism were more likely to have higher demand for organic food. Jose (2021) found that health was a practical factor in consumers' purchase of organic food, while fear of traditional food was an emotional factor [13]. In view of the fact that organic food marketing is still a new thing in developing countries, Fawzy et al. (2022) investigated the factors affecting Egyptian consumers' willingness to buy organic food, and the results showed that consumers' attitude and environmental concerns had the greatest impact [14]. The characteristics of external factors, product design, brand reputation, geographical culture, and shopping environment had important impacts on consumers' purchase intentions towards green agro-food. Some scholars have found that the design and package of green agro-food could not only convey environmental information and green pursuit, but also effectively enhance consumers' environmental awareness and purchase intention [15]. Sekha (2021) collected panel data among Indian consumers for research, and the results showed that brand reputation was positively correlated with purchase intention [16]. In addition, due to the influence of geographical differentiation, the same factors would play different roles. The study of American and Indian samples, using the jurisprudence model that predicts organic food attitudes and purchase intentions, showed that response efficacy and attitudes had greater impacts on American consumers' attitudes and willingness to buy organic food, while subjective norm and self-interest expression played greater roles among Indian consumers [17].

Third, the online purchase behavior of green agro-food. With the rapid development of e-commerce, online marketing of green agricultural products has a broad application prospect. Wojtynia et al. (2021) established the evaluation index system of online green agricultural product shopping based on the fuzzy analytic hierarchy process [18]. The research proposed that the physical display should be paid attention to in the online shopping service of green agro-food, and sensory attraction should be added to the interface design of shopping network. Moreover, we should maintain positive communication and exchange with consumers to achieve dynamic matching between service quality and customer needs. The epidemic had prompted online consumption to flourish, but information asymmetry and trust crisis had seriously affected consumers' confidence in the online shopping environment and inhibited consumers' purchase intentions [19]. Due to the seasonal, regional, time, and dispersion characteristics of agro-food, the development of green agricultural e-commerce was also facing difficulties. Ma (2022) constructed a binary logistic regression model to study the influencing factors of consumers' purchase intentions and behavior [20]. It was found that consumers' age, understanding of online agro-food, and monthly disposable income had significant positive impacts on consumption behavior, while the price of green agro-food and the frequency of online purchases had negative impacts on purchase behavior.

Consumers' experience of purchasing green agro-food has not always been satisfactory: unpredictable results might occur. Especially when the quality of agro-food cannot be identified, there is greater uncertainty, which means risk. It is necessary to explore the consumption decision of green agro-food from the perspective of perceived risk. Generally speaking, urban residents have high expectations for green agro-food, and the risks in the purchase process may have a greater impact on their decision-making. This paper combines perceived risk theory and planned behavior theory to explore the decision-making behavior of urban residents' green agro-food consumption.

3. Theoretical Analysis and Research Hypothesis

3.1. Theoretical Analysis Framework

Ajzen proposed the theory of planned behavior (TPB) in 1991, which was used to predict the behavior of individuals at a specific time and place. Based on the theory of rational behavior, the variable of perceived behavior control was added to the theory [21]. Ajzen believed that human behavior was the result of deliberate planning, thus establishing a relationship between personal attitude, subjective norm, perceived behavioral control, behavioral intention, and actual behavior. (1) Attitude refers to the stable psychological tendency of individuals to specific objects, which contains the behavioral tendency generated by individual subjective evaluation. (2) Subjective norm refers to the influence of social pressures on the individual's behavioral decision-making before taking action, especially the external pressure generated by people who have important impacts on the individual. (3) Perceived behavior control refers to the difficulties of taking actions and the benefits, costs, and risks of behaviors. It reflects experience and future projections. If someone holds a strong control belief that can promote behavior, then the person will have high perceived behavioral control. (4) Behavioral intention refers to the intention of an individual to take certain action. It is a state of preparation before taking action [22].

The theory holds that behavioral intention, as a mediating indicator, affects the generation of actual behavior. The stronger the behavioral intention, the greater the possibility of adopting some behavior accordingly. Behavioral intention is influenced by three factors: personal attitude, subjective norm, and perceived behavioral control. Among them, personal attitude and perceived behavioral control are the internal factors affecting behavioral intention, and subjective norm is the external factor affecting behavioral intention [23,24]. This paper argues that urban residents' willingness to consume green agro-food is mainly affected by personal attitude, subjective norm, and perceived behavioral control indicators, which in turn affect consumer behavior. There is uncertainty in the purchase of green agro-food. For rational consumers, perceived risk will affect consumption decision-making, which is a perceived behavior control indicator.

Perceived risk refers to recognizing and understanding the uncertainty of an event. American scholar Bauer first introduced risk into the field of marketing in 1960, pointing out that marketing should focus on the risk that consumers perceive subjectively [25]. He believed that perceived risk includes two elements: the uncertainty of decision-making results and the seriousness of wrong decision consequences. The outcome of any consumer purchase is uncertain, and some consumption results may be unpleasant. In the process of consumption behavior, consumers could only perceive some of the risks. The existence of risk will affect consumers' judgments.

Some scholars have analyzed the risk factors that need to be considered in the process of consumer purchase decision-making from multiple dimensions. Mitchell (1999) proposed a two-factor model, where risk means the uncertainty of loss and the harm of the result [26]. In 1973, Bettman divided perceived risk into inherent risk and processed risk. Inherent risk referred to the potential risk of a certain product category, perceived by consumers. The processed risk referred to the risk perceived by consumers when they choose a certain brand from the product categories. It contained the information of a specific brand. When consumers did not have any product information, the inherent risk and the processed risk were the same [27]. The six-dimensional risk measurement model proposed by Stone (1993) had gained more recognition and could explain 88.8% of perceived risks, including psychological risk, financial risk, physical risk, functional risk, time risk, and social risk [28]. The multidimensional theory of risk believed that dimensions of perceived risk would change when product and purchase situation changed, and the explanatory power of each dimension to the overall risk was also different in different situations.

This research integrates the theory of perceived risk (TPR) and the theory of planned behavior (TPB), and uses a structural equation model to analyze the influence of personal attitude (PA), subjective norm (SN), and perceived risk on urban residents' green agro-food consumption intention (CI) and behavior (CB) [22,25,28]. It is based on the mature

scales of Bettman and Stone. Considering the actual situation of green agricultural product consumption, the measurement dimensions of perceived risk are appropriately adjusted and divided into four dimensions: time risk (TR), functional risk (FCR), financial risk (FNR), and psychological risk (PR). The theoretical analysis framework is formed as Figure 1.

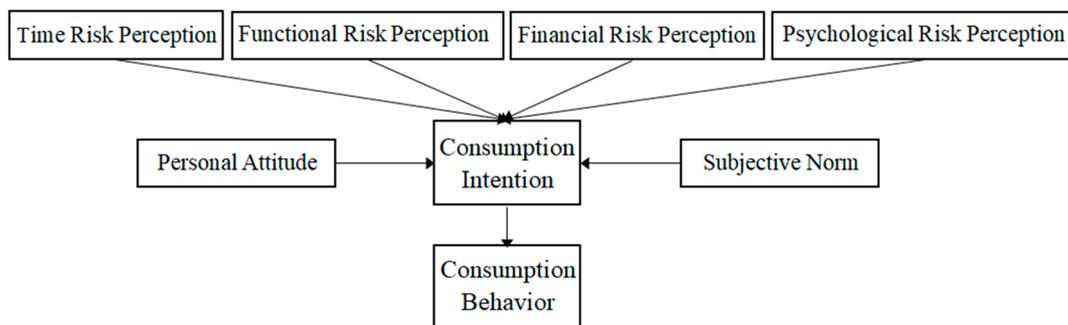


Figure 1. Theoretical analysis framework.

3.2. Research Hypothesis

People's conception of green consumption is deepening, and their awareness of green agro-food is also increasing. Many scholars have discussed the influence of consumers' recognition and attitude on green agro-food consumption behavior. Dumortier (2017) proposed that, in addition to attitudes, consumers' trust and organic production certification also affect purchase behavior [29]. Consumers had the highest willingness to purchase organic foods in pursuit of the goals related to social, personal and environmental benefits [30]. Thus, the following hypothesis is proposed:

H1. *Personal attitude has a positive impact on urban residents' consumption intention of green agro-food.*

Purchase behaviors of urban residents require time [31]. When the product is not satisfactory and needs to be returned, time cost will increase. Return and exchange of online consumption will increase time risk compared with offline consumption. The advantage of current online consumption is that it is not limited by time and space, but it is easily affected by factors such as logistics efficiency, delivery speed, and after-sales service. The purchase time might be extended. Therefore, the following hypothesis is proposed:

H2. *Time risk has a negative impact on urban residents' consumption intention of green agro-food.*

Consumers pay more attention to high quality, nutrition, and safety when purchasing green agro-food. Ming (2022) pointed out that consumers were pursuers of value maximization: the higher the value customers perceived, the more satisfied they would be [32]. Although green agro-food has labels, it does not guarantee the absolute trust of consumers. According to the survey of Maria et al. (2021), more than 60 percent of consumers believed that the information on food labels could not guarantee the traceability of the food chain and could not prevent food information fraud [33]. Therefore, the following hypothesis is proposed:

H3. *Functional risk has a negative impact on urban residents' consumption intentions of green agro-food.*

Due to the limitations and constraints of chemical fertilizers, pesticides, and other conditions, as well as the high standardization requirements of planting, the production and management costs of green agro-food are higher, so their prices are also higher than those of ordinary agro-food. The survey showed that the price of green agricultural products was 15–20 percent higher than that of ordinary agricultural products. It is uncertain whether high-priced green agro-food can be accepted by consumers. Mkhize (2020) proposed that even if there was a positive attitude towards organic products, participants would be

affected by issues such as price and availability [34]. The study of Yue et al. (2020) also confirmed that products' prices would significantly negatively affect residents' purchase probabilities: the lower the price, the better the purchase [35]. Therefore, the following hypothesis is proposed:

H4. *Financial risk has a negative impact on urban residents' consumption intentions of green agro-food.*

Psychological risk refers to consumers' self-emotional harm caused by decision-making errors, which is mainly reflected in the unpleasantness caused by consumption decision-making errors. Mortimer (2020) argued that, if product consumption undermined solidarity within a group, consumers would experience social risks, as well as psychological risks caused by negative emotions [36]. In the realization process of product functions, once a product for which there is a large gap between expectations and reality is purchased, consumers will have negative emotions such as disappointment and regret. Therefore, the following hypothesis is proposed:

H5. *Psychological risk has a negative impact on urban residents' consumption intentions of green agro-food.*

Subjective norm factors refer to the external pressure that consumers bear when they take certain actions. This factor affects the situation of consumers in a subtle way. Many consumers will pay attention to the purchase behaviors of friends in their social circle and will follow the trend to choose green agro-food. When individuals buy green agro-food, they will refer to the opinions and suggestions of their families or friends. In addition, online and supermarket advertising also has a certain impact on people's purchase of green agro-food. Zheng (2022) found that green advertising was more likely to affect consumers' willingness to pay a premium for green agro-food than for non-green advertising [37]. When people buy green agro-food, government incentives and preferential policies will also have non-negligible impacts on consumers' purchasing decisions. The research of Sun et al. (2022) showed that governments' relevant policies, publicity, and education played a great role in improving residents' awareness of green consumption [38]. Therefore, the following hypothesis is proposed:

H6. *Subjective norm has a positive impact on urban residents' consumption intentions of green agro-food.*

Green purchase intentions evolved from ordinary purchase intentions. They focus on the intrinsic motivation of consumers' environmental protection [39]. According to the theory of planned behavior, there is a positive correlation between consumption intentions and actual consumption behavior; that is, the stronger the behavior intention, the greater the possibility of taking action accordingly. At the same time, the relationship between intention and behavior will also change over time. During the interval between intention and behavior, some uncontrollable factors would affect the process of intention to behavior and the expected effect. These uncontrollable factors refer to personal attitude, perceived behavioral control, and subjective norm. Therefore, the following hypothesis is proposed:

H7. *Consumption intentions of green agro-food have a positive impact on the actual consumption behavior of urban residents.*

4. Materials and Methods

4.1. Variable Selection

According to the research hypothesis, combined with the review and collation of the existing research results, measurement indicators were selected (Table 1).

Personal attitude indicators. The psychological tendencies of urban residents to green agro-food were used to measure personal attitudes. Urban residents could obtain health, quality, and nutrition information about green agro-food through various channels. Their knowledge of green agro-food was increasing, thus forming a certain subjective impression.

According to Dumortier (2017), consumers' trust would affect their purchase frequency [28]. Accordingly, three observation indicators were set to measure urban residents' attitudes toward green agro-food (PA1–PA3).

Time risk indicators. At present, urban residents have fewer ways to buy green agricultural produce. The inconvenience of purchase will increase the purchase time of urban residents, leading to time risk. Riccardo et al. (2021) believed that the convenience of food access would have a significant impact on consumer behavior [40]. Under the influence of perceived risks, residents will make multi-channel efforts to search for the safety and quality information of green agro-food in order to purchase green agro-food that meet the psychological expectations. If not satisfied, return or exchange will increase time risk. Accordingly, three observation indicators were set up to measure the time perceived risk of urban residents on green agro-food (TR1–TR3).

Functional risk indicators. Residents buy green agro-food in order to obtain healthier and safer products, so they have strict requirements on the quality of green agro-food. Studies such as Wu (2015) and Ming (2022) have shown that consumers' perception of products' value would affect their green consumption behavior [32,41]. In addition, green agro-food is more nutritious and has better quality than ordinary agro-food. The value realization of their functions is also reflected in the comparison with ordinary agro-food. Based on this, three observation indicators were set to measure residents' perceived functional risk of green agro-food (FCR1–FCR3).

Financial risk indicators. Financial risk means that, the green agro-food expected by residents does not match the price. Prices of green agro-food are usually higher than that of ordinary ones. When urban residents are sensitive to the price of green agriculture products, their purchase behaviors would be inhibited. Referring to the research results of Mkhize and Ellis (2020) and Yue et al. (2020), three observation indicators were set to measure financial risks (FNR1–FNR3) [34,35].

Psychological risk indicators. Food safety incidents have occurred frequently in recent years. Once residents buy green agro-food that is counterfeit, inferior, or does not meet expectations, their emotions will be affected, and then psychological risks will increase accordingly. According to Mortimer (2020), if the product itself could not meet the demand, or the purchase behavior led to inconvenience, consumers would have negative emotions. Based on this, three observation indicators were set to measure the psychological risk of green agro-food (PR1–PR3) [36].

Subjective norm indicators. Subjective norm refers to the influence of external factors on consumers' green agro-food purchases, including behaviors of people around them, advertising, and policy encouragement. Zheng et al. (2022) and Sun et al. (2022) proposed that green advertising and government policies had certain impacts on consumer behaviors. Therefore, combined with the investigation, three observation indicators were set to measure the subjective norm (SN1–SN3) [37,38].

Consumption intention and consumption behavior indicators. Consumption intention means the possibility of consumers' choosing green agro-food according to their subjective intentions. Consumption behavior includes self-consumption and the influence on others' consumption. Consumption behavior is measured by indicators such as purchase experience and recommendation to others [42]. Accordingly, two observation indicators were set, respectively (CI1 and CI2, CB1 and CB2), for the measurement indicators consumption intention and consumption behavior.

Table 1. Indicator measurement items.

Measurement Indicator	Serial Number	Observation Indicator	Reference
Personal Attitude	PA1	I know green agro-food very well.	[29]
	PA2	I can identify the certification mark of green agro-food.	
	PA3	I think green agro-food is trustworthy.	

Table 1. Cont.

Measurement Indicator	Serial Number	Observation Indicator	Reference
Time Risk	TR1	Surrounding supermarkets and vegetable markets make it more difficult to buy green agro-food.	[40,43]
	TR2	Buying green produce may take me a lot of time searching.	
	TR3	Unsatisfied after purchase, it takes more time to return.	
Functional Risk	FCR1	I worry that there are still quality and safety problems in green agro-food.	[32,41]
	FCR2	I think there is no difference between the nutritional value of green agro-food and ordinary agro-food.	
	FCR3	I think there is no difference between the taste of green agro-food and ordinary agro-food.	
Financial Risk	FNR1	The price of green agro-food is much higher than I expected.	[34,35]
	FNR2	The price of green agro-food makes me more difficult to bear.	
	FNR3	I think green agro-food is not worth the high cost.	
Psychological Risk	PR1	If I buy fake green agro-food, I will feel very unhappy.	[36]
	PR2	I will be very disappointed if the purchased green agro-food fail to meet expectations.	
	PR3	I will regret that I did not buy other similar products because I bought green agro-food.	
Subjective Norm	SN1	If relatives and friends buy green agro-food, I will follow the purchase.	[37,38]
	SN2	The advertising of green agro-food will stimulate my desire to buy.	
	SN3	Government price subsidies will encourage me to buy green agro-food	
Consumption Intention	CI1	I would like to know more about green agro-food.	[42,44]
	CI2	Compared with ordinary agro-food, I will give priority to green agro-food.	
Consumption Behavior	CB1	I have bought green agro-food.	
	CB2	I have recommended others to buy green agro-food.	

4.2. Methods

The structural equation model method was used to study the perceived risk and of urban residents' consumption decision on green agro-food. A research model was constructed based on the discussion of personal attitude, perceived risk, subjective norm, and consumption intention and behavior [45]. Relationships between indicators were expressed by the following equations:

Measurement model equations:

$$X = \Lambda_X \xi + \delta \quad (1)$$

$$Y = \Lambda_Y \eta + \varepsilon \quad (2)$$

Structural model equation:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (3)$$

In the equations, ξ and η represent latent indicators SN, PA, TR, FCR, FNR, PR. X and Y represent 22 observational variables such as SN1, PA1, and FCR1. Goodness-of-fit tests are employed to estimate the overall fit of the hypothesized models. The corrected chi-square value (CMIN) is a primary measurement of model performance, which compares the covariance matrix in the model with the covariance matrix of the observed data [46].

For the test, the null hypothesis is that no differences exist between the correlation coefficient's matrix and the null matrix. The p value < 0.05 is therefore the widely used criterion for the rejection of the null hypothesis. In addition, several incremental and

absolute fit indices are advocated to be applied as alternatives to the chi-square. An absolute fitness index such as root mean square residual (RMR), root mean squared error of approximation (RMSEA); a value-added fitness index such as incremental fit index (IFI), the Tucker–Lewis index (TLI), a comparative fit index (CFI), and a simplicity fitness index such as the ratio of chi-squared to degrees of freedom (CMIN/DF) are commonly used [47].

Λ_X and Λ_Y are component matrixes for observational variables on latent variables, through which the linear combination relationship between a single latent variable and its observational indicators can be obtained. We use the coefficient matrix Γ to analyze how residents' green agro-food consumption intention would be influenced by SN, PA, TR, FCR, FNR, and PR; and how their consumption behaviors are influenced by CI. δ , ε , and ζ are the measurement error terms. Standardized coefficients are used to facilitate the interpretation of the relationships among variables. They describe the corresponding single response for a dependent variable when a given independent variable receives a single increased standard deviation. The maximum likelihood regression-based approach is employed to obtain the estimation results [48].

4.3. Study Area and Data Source

Tianjin was chosen as the study area in this paper. (Figure 2). Placed in the northeastern part of the North China Plain, Tianjin is located in the lower reaches of the Haihe River Basin, with Bohai Sea to the east and Yanshan Mountain to the north. At present, a total of 187 “Jinnong boutique” agricultural brands have been identified, among which four regional public brands such as Xiaozhan rice, Shawo Radish, Chadian Muscat Grape, and Baodi Yellow Loach are famous and have been selected into the catalogue of Chinese agricultural brands. Because Tianjin is close to the capital of Beijing in the west, it is also the “vegetable basket” of Beijing, especially for Hexiwu Town, which is 60 km from Tianjin to the south and 60 km from Beijing to the north. During the “14th Five-Year Plan” period in China, Tianjin will focus on building an upgraded version of modern urban agriculture, accelerating the modernization of rural industries, upgrading the new construction and high-standard farmland by 1 million acres, and building 800 green, high-quality, and safe agricultural product bases so as to ensure that the overall qualified rate of agricultural products' quality and safety remains above 98 percent.

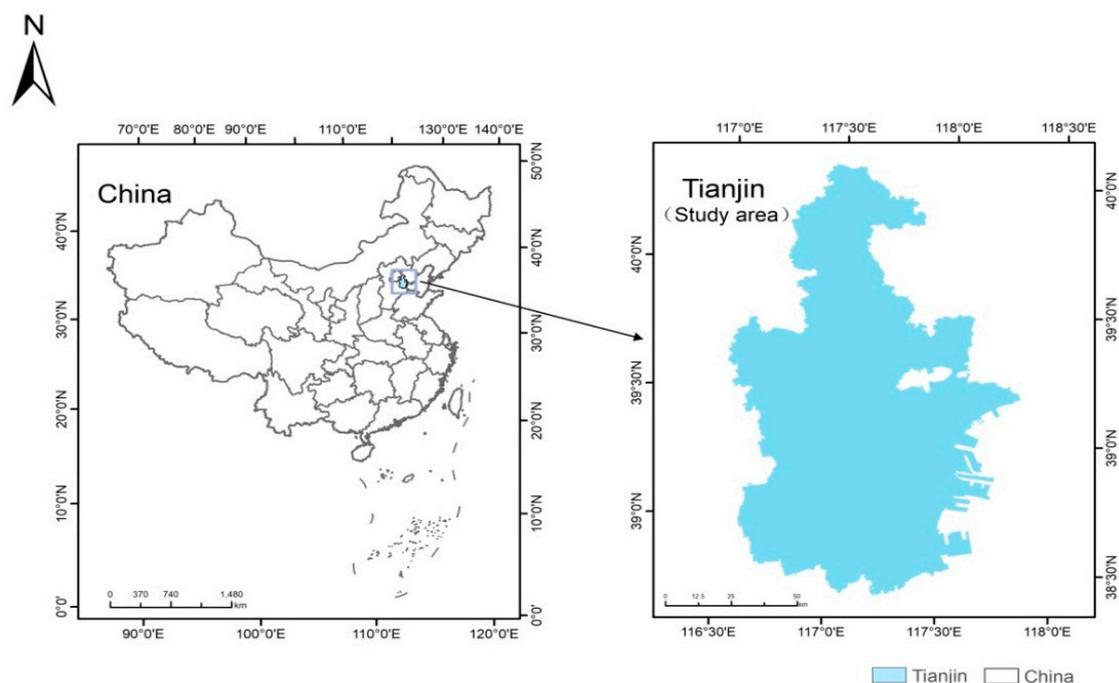


Figure 2. Location of Tianjin city in China.

Being one of the four municipalities in China, Tianjin is the largest open and commercial city in northern China. The region has a high level of economic development and a high income level for urban residents with leading consumer awareness. Thus, the green agricultural product consumption market is huge and residents' consumption capacities are high. According to the "2022 Tianjin National Economic and Social Development Statistical Bulletin", by the end of 2022, the total resident population of the city was 13.63 million, of which the urban resident population accounted for 85.11 percent; the per capita disposable income of residents in the city is 49,000 yuan, ranking fifth in the country.

Therefore, it is representative to take Tianjin as the research area. In this survey, the six districts in the main urban area of Tianjin were the main areas, supplemented by the other ten districts, and the questionnaire survey was conducted by random sampling. A total of 365 questionnaires were distributed in the survey, with a questionnaire recovery rate of 100 percent. After screening, 329 valid questionnaires were finally obtained; that is, the effective questionnaire recovery rate was 90.14 percent. Then, the effective data collection was sorted out to obtain the preliminary statistical information. The reliability and internal consistency of the samples were tested by the reliability test. Applicability of the samples to the research object was judged [47]. A Five-point Likert scale was used to measure the theoretical variables of behavior and the willingness of residents. The value of the behavioral variable of residents' consumption intentions and behavior was 0/1; 0 meant no consumption intention or behavior, and 1 meant having consumption intentions or behavior.

5. Results

5.1. Descriptive Statistics

Descriptive statistical analysis was performed from these six aspects of gender, age, education, occupation, income, and family income of the respondents. The results are shown in Table 2.

Table 2. Descriptive statistical analysis of samples.

Demographic Variable	Classification Item	Frequency	Percentage (%)
Gender	Man	153	46.5
	Woman	176	53.5
Age	Under 18 years old	17	5.2
	18–40 years	178	54.1
	41–60 years old	100	30.4
	Over 61 years old	34	10.3
Education	Junior High School and below	8	2.4
	High School (Secondary Vocational School)	90	27.4
	University (Tertiary)	189	57.4
	Postgraduate and above	42	12.8
Occupation	Civil Servant	50	15.2
	Institution Personnel	83	25.2
	Company Staff	118	35.7
	Migrant Worker	28	8.5
	Student	26	7.9
	Freelancer	24	7.2
	Other	0	0.0
Average Monthly Earnings	RMB 2000 and below	23	7.0
	RMB 2001–5000	84	25.5
	RMB 5001–8000	156	47.4
	More than RMB 8000	66	20.1
Average Monthly Household Earnings	RMB 5000 and below	11	3.3
	RMB 5001–10,000	171	52.0
	RMB 10,001–15,000	97	29.5
	More than RMB 15,000	50	15.2

There were 176 women being surveyed, accounting for 53.5 percent, and 153 men, accounting for 46.5 percent. Generally speaking, women pay more attention to the family catering structure than men. They have more decision-making power over the daily cost of family living. Considering that young people know better about how to eat healthy, they are more likely to be potential consumers of green agricultural products. Therefore, samples aging from 18 to 40 account for 54.1 percent. Those aged between 40 and 60 account for 30 percent. From the interview, green agricultural products are more favored by highly educated groups. People with a high school qualification account for 27.4 percent. Those with a university qualification account for 57.4 percent. A amount of 12.8 percent of the respondents have master's degrees. As for occupations, the largest proportion is company employees, accounting for 35.7 percent of the respondents, followed by institution personnel accounting for 25.2 percent, civil servants accounting for 15.2 percent, and others accounting for 23.9 percent. Considering the higher price of green agricultural products, income affects urban residents' consumption to a large extent. More than half of the respondents earn more than RMB 5000 monthly. Nearly half of the respondents have a monthly household income of more than RMB 10,000.

5.2. Test of Validity and Reliability

Amos 23.0 and SPSS 26.0 were used to test the reliability and validity of the questionnaire. As is shown in Table 3, values of Cronbach's alpha coefficients of personal attitude, time risk, functional risk, financial risk, psychological risk, subjective norm, consumption intention, and consumption behavior indicators ranged from 0.803 to 0.862, indicating good reliability. The combined reliability (CR) of each indicator is above 0.9, and the average variance extraction (AVE) is above 0.5, indicating good internal consistency and convergence validity.

Table 3. Reliability and validity test table.

Indicators	Number	Normalized Factor	Cronbach's Alpha	CR	AVE
Personal Attitude	PA1	0.777	0.823	0.926	0.608
	PA2	0.764			
	PA3	0.798			
Time Risk	TR1	0.753	0.803	0.909	0.577
	TR2	0.759			
	TR3	0.766			
Functional Risk	FCR1	0.721	0.813	0.916	0.594
	FCR2	0.815			
	FCR3	0.774			
Financial Risk	FNR1	0.805	0.836	0.936	0.630
	FNR2	0.800			
	FNR3	0.775			
Psychological Risk	PR1	0.915	0.855	0.944	0.672
	PR2	0.722			
	PR3	0.811			
Subjective Norm	SN1	0.751	0.806	0.909	0.584
	SN2	0.824			
	SN3	0.714			
Consumption Intention	CI1	0.788	0.813	0.955	0.681
	CI2	0.861			
Consumption Behavior	CB1	0.896	0.862	0.978	0.758
	CB2	0.845			

Abbreviations: CR, the combined reliability; AVE, the average variance extraction.

5.3. Model Test

According to the test results of the overall fitting degree of the modified model, the chi-square value is 76.451, which is not significant at the level of 0.05. Both the RMR value and RMSEA value reach the critical standard of less than 0.05, indicating that the model's absolute fitting effect conforms to the standard. Values of the model's goodness of fit index IFI, TLI, and CFI are all greater than 0.9, reaching the critical value of fitting, which indicates that the model's goodness of fit is good. The Parsimony index shows that the CMIN/DF value is 1.246, which falls within the range of $1 < NC < 3$ and the values of PNFI and PGFI are both greater than 0.05, reaching the critical value standard of fitting, indicating that the simplicity of fit is better.

AMOS 23.0 was used to test the model hypothesis. The results are shown in Table 4, with the path diagram shown in Figure 3. All the hypotheses passed the test. Specifically, indicators of personal attitude, subjective norm, time risk, functional risk, financial risk, and psychological risk directly affect urban residents' consumption intentions, with action coefficients of 0.145, 0.154, -0.201 , -0.286 , -0.191 , and -0.140 , respectively. These six factors indirectly affect urban residents' consumption behavior by influencing their intentions. The consumption intention directly affects their consumption behavior, and the effect coefficient is 0.306.

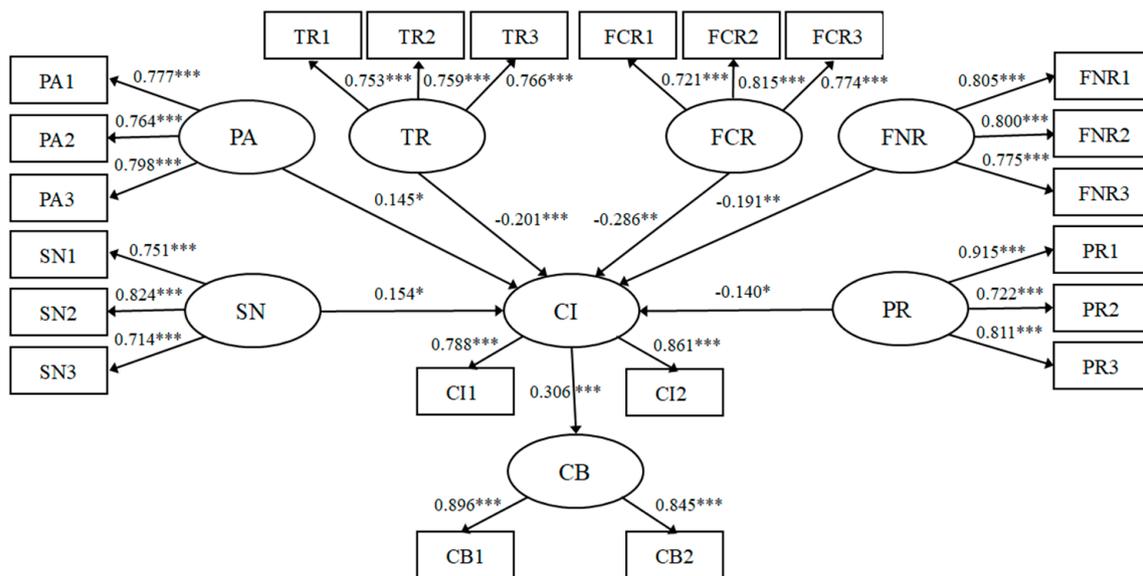


Figure 3. Structure and performance of the final modes for describing factors influencing residents' consumption intention and behavior. Abbreviations: SN, subjective norm; PA, personal attitude; TR, time risk; FCR, functional risk; FNR, financial risk; PR, psychological risk; CI, consumption intentions; CB, consumption behavior. *** means $p < 0.001$, ** means $p < 0.01$, * $p < 0.05$.

Table 4. Parameter estimation of structural equation model.

Hypothesis	Path	Standardized Estimation	Estimated Value	S.E.	C.R.	p	Results
H1	Consumption Intention <---Personal Attitude	0.145	0.119	0.052	2.278	**	True
H2	Consumption Intention <---Time Risk	-0.201	-0.177	0.065	-2.744	***	True
H3	Consumption Intention <---Functional Risk	-0.286	-0.253	0.055	-4.557	***	True

Table 4. Cont.

Hypothesis	Path	Standardized Estimation	Estimated Value	S.E.	C.R.	<i>p</i>	Results
H4	Consumption Intention <---Financial Risk	−0.191	−0.169	0.055	−3.073	***	True
H5	Consumption Intention <---Psychological Risk	−0.140	−0.120	0.057	−2.112	**	True
H6	Consumption Intention <---Subjective Norm	0.154	0.161	0.065	2.495	**	True
H7	Consumption Behavior <---Consumption Intention	0.306	0.389	0.086	4.542	***	True

*** $p < 0.001$, ** $p < 0.01$. Abbreviations: S.E., standard error; C.R., critical ratio.

6. Discussion and Policy Implications

6.1. Discussion

6.1.1. TPB Indicators Affecting Urban Residents' Consumption Intentions

Urban residents' personal attitude and subjective norm have positive impacts on their purchase intentions of green agro-food. As a high-quality and healthy product category, green agricultural products cater to the increasing pursuit of a better life for the majority of urban residents in China. Residents could judge the value, thus forming trust in green agricultural products [49]. If residents have a good understanding and recognition of the source and production process of the green agricultural products, then trust is formed, and stable consumption behaviors are more likely to be established. In the new era, the social environment advocates a green consumption model in line with sustainable development. People have a higher and higher sense of identity for green agro-food consumption. The spread of Internet media has accelerated the formation of this sense of identity. Urban residents also tend to follow the purchase behavior of people around them, so as to obtain a sense of group belonging to some extent.

6.1.2. TPR Indicators Affecting Urban Residents' Consumption Intentions

Empirical results show that the perceived risks such as functional risk, time risk, financial risk, and psychological risk have negative impacts on urban residents' consumption intention of green agro-food. Due to concerns about food safety, urban residents attach much more importance to the safety and nutrition of agro-food [50]. However, concerns about the realization of green agro-food functions make purchases uncertain. The key reason lies in the uncertainty of product quality.

At present, the green agro-food market is not perfect in China. There is a big gap between the demand and supply. In order to purchase the expected green agro-food, it is necessary for people to invest extra time and energy for safety and quality information through multiple channels, which is obviously not matching the fast pace of modern life. Therefore, the worry of time investment will affect residents' decision-making.

The price of green agro-food is higher than that of ordinary ones. Price-sensitive groups will be affected by high prices [33]. Urban residents have noticed the importance of food safety, but the overall concept of food consumption and dietary habit have not completely changed. When beyond the affordability of daily consumption, residents will turn to other alternative products and reduce green agro-food consumption.

Due to the pursuit of health and longevity, urban residents expect to buy high-quality green agro-food that is nutritious and healthy. If expectations and values are not realized, negative emotions such as disappointment and regret residents will arise. With the experience of being cheated, urban residents are afraid to buy fake green agro-food. Psychological rejection emerges easily. Therefore, the higher the psychological risk of urban residents to green agro-food, the lower the trust level, and then the lower the willingness to purchase.

6.1.3. Relationship between the Two Indicators: Purchase Intention and Behavior

Urban residents' purchase intentions of green agro-food have a positive impact on their purchase behaviors. Once consumers generate green purchase intentions in the actual consumption situation, they would find a way to try, and then actual purchase behavior appears. What we need to do is to provide convenient purchase channels, strengthen publicity, and enhance the pleasant consumption experience of residents.

6.2. Policy Implications

The value realization of green agro-food is an important link to integrate the economic, ecological, and social elements between urban and rural areas in China. It would kill two birds with one stone to improve the living quality of urban and rural residents and rural settlements. In order to meet urban residents' demand for green agro-food, improve their consumption experience, and reduce their perceived risk, countermeasures and suggestions are proposed in the following contents. This is of great significance to the sustainable development of global human society.

6.2.1. To Strengthen Traceability Supervision and Ensure Product Quality

Urban residents' perceived functional risk of green agro-food is an important indicator that influences their purchase intentions. This indicator is mainly reflected in quality safety and nutritional value. Therefore, we must ensure the safety and health quality of green agro-food and strictly guard the whole process line from farmland to dining table [51]. In terms of the green agro-food quality, the previous essentials input pattern should be replaced with environment-friendly planting methods in order to realize ecological planting. A simple, efficient, and authoritative certification mechanism for green agro-food should be built to improve product quality and credibility. To promote the international recognition of green agro-food, we should gradually promote the role of laboratories independent of government bodies in certification and quality control in the food market based on international standards. Green agro-food should be included in traceability management, and a whole-process traceability system for agricultural product quality and safety should be established to ensure high-quality output and safe circulation of green agro-food.

6.2.2. To Improve Circulation Efficiency and Facilitate Residents' Purchase

Although the development prospect of green agro-food market is good, the overall circulation efficiency is not high, which affects the convenience of urban residents' purchases and increases the time risk. Therefore, it is suggested to perfect the organization and technical system of green agro-food circulation. Additionally, we should improve the cold-chain logistic infrastructures and accelerate the research and application of fresh-keeping technology and storage equipment to realize targeted procurement between local supermarket chains and logistics parks, and to improve the efficiency and benefits of connecting production and green agro-food marketing [52]. Special sales zones should be set up to smooth purchasing channels and to improve the circulation efficiency of green agro-food continuously. The after-sales service should be strictly controlled to relieve residents' worries about green agro-food risks.

6.2.3. To Create Product Brand and Achieve High Quality and Fair Price

Price is an important factor affecting residents' purchase intention of green agro-food. Branding is an effective way to achieve high quality and fair prices of green agro-food, and a golden billboard to attract consumers [34,35]. It is suggested to combine regional characteristics to build green agro-food brands. Standardization and industrialization are ways to enhance green agro-food's core competitiveness. The production process of green agro-food could be displayed through a digital intelligence platform to continuously improve the brand reputation, so as to improve residents' recognition and acceptance. All this will help to meet urban residents' diversified green food needs, so that both urban and rural residents can share the ecological well-being.

6.3. Method Limitations

This study, to the best of our knowledge, is academically novel by providing a new perspective to learn urban residents' green agro-food consumption decisions and constructing an improved model with the theory of perceived risk and planned behavior, which not only brings a fresh case into the theories, but also adds a new explanation for urban residents' green agro-food consumption. Despite these innovations, it is still limited, mainly reflecting on the data. A random survey of 329 residents basically meets the research needs of the paper, but for the total population of Tianjin city, it is not an advantage. Relevant studies will further collate relevant data for improvement. Issues about the international practice of testing and certifying the quality of food products and the role of laboratories independent of government bodies in the food market based on international standards also should be discussed in detail in the future research.

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