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A new interpretation of the AISAS model: An empirical analysis of Chinese consumers' perceptions of the food traceability system for aquatic and edible bird's nest products

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ABSTRACT

Consumer behavior has changed due to the COVID-19 pandemic; however, the extent to which the traditional Attention, Interest, Search, Action, and Share (AISAS) consumer behavior model has been affected by the pandemic is underexplored. Simultaneously, food safety issues urgently require stronger protection due to the increasing demand for consumer health. This study aims to determine how the adoption of food traceability systems (FTS) influences consumer behavior and proposes a new interpretation of the AISAS model. Our findings confirm the validity of our model and provide theoretical support for the relationship between "trust" and "trace" in consumer behavior.

Keywords*: SEM; swiftlet nest; food safety; healthcare product; daily necessities.*

1 Introduction[1]

There is growing concern about the impact of the COVID-19 pandemic. The pandemic has caused long-term shocks to multiple systems (Górnicka et al., 2020) and continues to impact nations and economies globally. On the production side, primary producers also face the risk of reduced profit margins, decreased demand, and limited market access due to the economic impact of the pandemic (Balkan et al., 2022). In terms of daily life, the pandemic has caused a significant amount of uncertainty. Regular food choices and eating habits have been completely disrupted. During the pandemic, consumers sought products with functional ingredients or of higher quality due to supply disruptions and mistrust in institutions, leading to panic buying. Fear influenced consumers' choices during the lockdown period, leading to changes in consumer behavior (Gómez-Corona et al., 2021). Walaszczyk et al. (2022) revealed that surveys tracking consumer sentiment during the pandemic reported shifts in consumer behavior. These shifts included avoiding food from certain countries, preferring local products, and paying more attention to product labels. These indicate that the traditional consumer behavior model is evolving into a different shape. (Walaszczyk et al., 2022) assert that the pandemic has emphasized the need to shift to more sustainable food production and consumption models. This has challenged companies to make strategic changes for sustainability and to rethink the existing consumer behavior model and its role in business and marketing strategies to maintain the viability of consumer groups. Therefore, given the shift in consumer food consumption behavior, we must consider whether the consumer behavior model needs to change. To meet the changes in consumer choices, a new consumer behavior model is needed to provide more targeted marketing strategies.

The consumer behavior model focuses on the consumer's decision-making process. The model is used by marketing and advertising practitioners to explore how to effectively engage consumers at each stage. The Howard-Sheth model describes the sequential buying process steps as need recognition, information search (internal and external), alternative evaluation, purchase, post-purchase review, and divestment (Barry and Howard, 1990). AIDA (Attention- Interest- Desire- Action) was the first hierarchy of effects model in marketing, proposed by Lewis (Barry and Howard, 1990). Based on this model, Hall (1924) proposed the linear classic AIDMA (Attention-Interest-Desire-Memory-Action) model. Since then, the AIDMA model has been widely used by traditional media advertisers. To address the needs of consumers in the Web 2.0 era, Dentsu, a Japanese advertising company, observed that consumers' approach to accessing marketing information had shifted from passively receiving information to actively seeking it. In response, the advertising company proposed the new AISAS (Attention-Interest-Search-Action-Share) model (Zhongguo et al., 2019).

The traditional AIDA model and AIDMA model are direct linear effect sequences that illustrate the fundamental framework of how advertising operates. These two linear models reflect the behavioral phases that potential customers go through after receiving advertisements and are widely used in advertising marketing. However, whether it is the AIDA model or the AIDMA model, the flow of information is unidirectional, and consumers can only passively receive advertising messages. However, in the Internet era, consumers proactively search for and share information, and participate in information exchange interactions. Therefore, the AIDMA model is not as effective in the Internet era. Compared with the traditional AIDA or AIDMA models, the AISAS model is considered more suitable for explaining consumer behaviors in the Internet era. The "search" and "share" in the AISAS model highlight the shift in consumer behavior from passive receivers of information to proactive individuals who engage with the information providers. This shift mirrors the media usage habits and consumption behaviors of the Internet generation. Therefore, the AISAS model is widely used in marketing activities in the Internet era.

The pandemic has also contributed to consumers' fear-related discussions of food. Food and food packaging contaminated by COVID-19 pose a risk of viral transmission under certain conditions (Bai et al., 2021). Consumer panic has created abnormal market patterns (Schmidt et al., 2021), especially in the cold chain industry, where circumstances have become more severe (Bai et al., 2021). Faced with this dilemma, some researchers have proposed the idea of using Food Traceability Systems (FTS) to improve trust and safety in food production processes (Galanakis et al., 2021).

FTS relieves consumers' fears, provides information about the entire food supply chain, and guarantees food safety. For example, consumers of halal chicken products use the FTS system to verify that the chicken slaughterhouse adheres to the halal assurance system in its halal-critical processes (Akbar et al., 2022). Food traceability helps consumers recognize the "from farm to table" chain and provides information on food

[1] Abbreviations: FA, awareness of food traceability system; HC, concern for health; IPD, impact of the pandemic

contamination when food product recalls occur (Choe et al., 2009; van Rijswijk et al., 2008). Consumer demand for food traceability has significantly increased over the past decade (Zhang et al., 2021).

To the best of our knowledge, few studies have integrated FTS with post-pandemic consumer behavior. Therefore, our first research question aims to empirically analyze whether the changes in consumer behavior during the COVID-19 era lead to a new interpretation of the AISAS model. Specifically, we examine the impact of FTS on shifts in consumer behavior in China following the COVID-19 pandemic and develop a new model in response.

Moreover, considering that the pandemic has heightened consumers' health-related needs, our second research question explores whether there is a distinction between consumer behavior toward general products and products that promote good health and whether companies need to tailor their marketing strategies accordingly in the future. Specifically, we compare essential goods and dietary supplement products. We discuss the changes in consumer behavioral characteristics regarding these different types of products, and the influencing factors.

2 Literature review

2.1 The AISAS model

Due to the increasing influence of Internet technology on consumer behavior, the AISAS model was developed in 2004 as a simplified representation of this new form of consumer behavior. The AISAS model examines consumers' product attention, related Internet searches, purchase behavior, and opinion-sharing with others (Figure 1; Dentsu Inc., 2006).

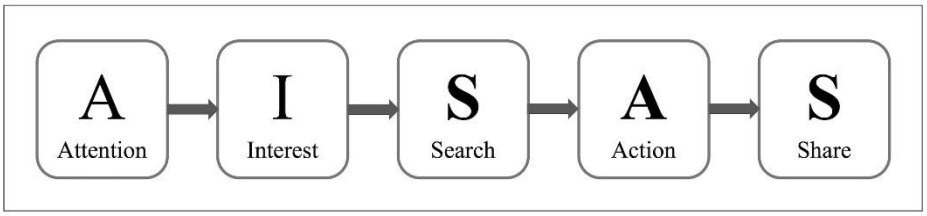

Figure 1. AISAS (Attention, Interest, Search, Action, Share) model.

The AISAS model is considered more suitable than the Attention, Interest, Desire, Action (AIDA) or Attention, Interest, Desire, Memory, Action (AIDMA) models for explaining consumer behavior in the Internet era (Xue et al., 2021). Several studies have recognized the importance of the AISAS model, including Sumerta et al. (2019), who used the AISAS model to discuss changes in online consumer behavior, and C. Xu et al. (2017), who implied that the AISAS model is used to improve marketing strategies. Meanwhile, Javed et al. (2021) demonstrated that the AISAS model is extendable in specific areas when discussing complex online social experiences.

Therefore, it is theoretically feasible to discuss whether changes in consumer behavior in the COVID-19 era lead to new interpretations of the AISAS model. In the context of the pandemic, consumers' concern for food safety and health has been a topic of discussion. Whether it is reading labels, practicing green consumption, or selecting locally produced products, consumers evaluate the product before they take an "action" deciding whether to make a purchase. This implies that consumers are not in a deterministic environment during the "search-action" process. Trust, on the other hand, is an expectation that exists in an uncertain environment (Bhattacharya, Devinney, and Pillutla, 1998) and motivates consumers to make a purchase decision. Therefore, we prioritize "trust" over "action" as a key characteristic of consumer behavior in the pandemic era. However, trust is not created out of thin air; consumers evaluate information in the process of "search," and FTS systems are an effective tool for increasing consumer trust by providing opportunities for two-way communication along the food chain (Coff et al., 2008) and helping consumers confirm food safety and nutrition. Commodities are identified using commodity labels, typically in the form of traceability QR codes. Traceability is achieved through labeling, where the information provided is no longer just a symbolic representation. This fills in the gaps of labeling and demonstrates the reliability of the labeled information. The way consumers perceive labels is categorized into effortful search and accidental exposure. This is divided into consumers who are interested in the nutrition label and actively seek it out, and those who read the nutrition label information when they come across it unintentionally, rather than actively searching for it. When consumers engage in effortful searching, the information is subsequently processed in greater depth, increasing the likelihood of the information actually impacting food choices (Grunert and Wills, 2007). Whether it is intentional searching or accidental exposure, consumers' information-seeking behavior still rests on reading label information. However, the traceability QR

code on the label cannot directly display food safety certification, such as ISO 22000, in the form of a logo. In other words, the label itself cannot directly contain traceability information. Consumers trace commodity information after scanning the traceability QR code. However, consumers do not necessarily trace commodity information when they look at the traceability label. For example, consumers may not have tools to scan the QR code, and, at the same time, commodity traceability is not yet fully adopted. Therefore, it is necessary to distinguish consumers' trace behavior from "search" behavior for this study. Thus, we propose a new version of the AISAS model (i.e., Attention, Interest, Search, Trace, Trust, Action, Share [AISTTAS]) incorporating this element as a basis for the future extension of other behavioral models.

2.2 FTS

FTS aids businesses in improving food safety and quality (Zhao et al., 2019), enhancing greater food transparency (Aldrighetti et al., 2021), and increasing customer purchase intention (Choe et al., 2009). Xu and Wu (2010) concluded that the factors influencing Chinese consumers' willingness to pay for traceable food include their overall satisfaction with food safety and their awareness of FTS. Chinese consumers believe that traceability improves food safety; therefore, they are willing to pay for traceable food. Accordingly, Chinese consumers' demand for the traceability of food products has increased in recent years (Zhang et al., 2021). Studies have implied that consumers' willingness to pay for food traceability is affected by their knowledge of this process (R. Liu et al., 2019). However, Chinese consumers lack good knowledge of traceability, and traceable products are not well-known (R. Liu et al., 2019).

In China, the Food Safety Law (FSL) was enacted in 2015, with 118 local policies in place to enhance government inspections and financial participation in food safety (Qian et al., 2020). Meanwhile, the Chinese government established a series of regulations to control the spread of COVID-19 in 2020 (Bai et al., 2021). While previous studies have focused on the factors that influence consumers' perceptions and attitudes toward FTS and their willingness to pay for traceable food, traceability as part of the consumer behavior process remains underexplored. Therefore, we believe that China offers a valuable case study for predicting consumer behavior modeling approaches during the COVID-19 era.

Moreover, our study is the first to incorporate the concept of "trace" into a consumer behavior model and empirically analyze it. While consumers are willing to pay for traceable food, their willingness to do so varies depending on their level of trust in the government's supervision of food safety and labeling (R. Liu et al., 2019). Meanwhile, consumer trust is a key prerequisite for establishing a market for premium goods (Nuttavuthisit and Thøgersen, 2017). Choe et al. (2009) revealed that in the FTS context, there is less perceived uncertainty due to the reduced fear of seller opportunism resulting from increased trust and reduced information asymmetry resulting from enhanced product diagnosticity, informativeness, and trustworthiness. Consequently, food traceability behavior increases consumer trust, promoting informed decision-making. Thus, in our proposed model, we placed consumer "trust" behavior after "trace" behavior.

3 Hypotheses development

3.1 Search and trace

Consumers search for appropriate product information before purchasing to reduce purchase decision uncertainty (Humphreys et al., 2021). As per the AISAS model, when customers are interested in a product or brand, they search the Internet for relevant information, influencing their purchase behavior (Tseng and Wei, 2020). Therefore, we defined consumer search behavior in terms of searching for product information. This information search activity is classified as internal or external (Peterson and Merino, 2003). External search behavior uses external sources, such as the Internet, to seek information. An online search is the most essential way to collect information corresponding with the motivation behind a consumer's purchase decision (Huang and Lin, 2021).

The information gained during this search process influences a consumer's purchase decisions and plays a vital role in the process of acquiring items (Singh and Jang, 2022). Similarly, FTS increases consumers' purchase intention by enabling them to "trace" information after "searching" for it. Therefore, a consumer "traces" the information before taking "action." Product quality is commonly considered in an information search and often features standardized nomenclature (Bei et al., 2004). Consumers typically go directly to their favorite purchasing site and search for useful information on that platform (Huang and Lin, 2021).

Consumers do not have defined buying intentions at this point, and their search behavior is extensive. Therefore, their "search" for information occurs before the information becomes "traceable." Accordingly, we posit the following:

H1. Search behavior has a positive relationship with trace.

3.2 Trace and trust

Consumer trust is important when acquiring and consuming food (Truong et al., 2021). We believe that trust represents confidence and minimizes perceived uncertainty. Food traceability enhances confidence and reduces concerns about sellers' opportunism in the FTS context. Consumer trust in food helps to decrease risk and complexity regarding food purchase decisions in unpredictable conditions (Roosen et al., 2015). Therefore, we consider "purchase action" as the process between decision-making and purchase completion. Accordingly, we posit that:

H2. Trace has a positive relationship with trust behavior.

3.3 Trust and action

Before making a purchase, a consumer assesses the risk and undergoes a process of gaining trust in the platform (Martínez-López et al., 2021). Therefore, "trust" leads to "purchase action." In the decision-making process, trust is a crucial driver of purchase intention and action (Choe et al., 2009), while purchase intention is heavily influenced by trust (Lu et al., 2016). Trust plays a major moderating role in improving purchase behavior (Sultan et al., 2020) and is vital in the food procurement decision-making process (Giampietri et al., 2018). Meanwhile, consumers are prepared to pay for traceable food, but their valuations vary. Therefore, "trust" occurs before "purchase action." Consumer trust then increases with their knowledge of food traceability, which facilitates their decision-making. Thus, we propose that:

H3. Trust behavior has a positive relationship with action behavior.

3.4 Effect of concern for health (HC) on consumer behavior and awareness of FTS (FA)

Health consciousness leads to positive consumer attitudes (Tandon et al., 2021) that influence purchase decisions (Wang and Tsai, 2019). HC has become a key component in consumer decision-making. (Asif et al., 2018) revealed that HC influences purchase behavior and is a significant predictor of food purchase intention. Moreover, HC enhances consumer trust, has a significant positive effect on perceived risk (Siegrist et al., 2022), and influences purchase intention (Paul and Rana, 2012). Hereafter, we implicate purchase intention as purchase interest. Liu et al. (2013) asserted that HC has a stronger effect on Chinese consumers' food purchasing behavior than their food safety concerns. Meanwhile, HC facilitates consumer behavior (Tandon et al., 2021). Hence, consumer behavior is influenced by HC (Amit Kumar, 2021). Therefore, we posit that:

H4a. HC has a positive relationship with attention.
H4b HC has a positive relationship with interest.
H4c. HC has a positive relationship with trust.
H4d. HC has a positive relationship with action.

Consumers make purchase decisions based on food health and safety (Yue et al., 2017), and consumer perceptions of food safety certifications significantly impact their willingness to pay (Qian et al., 2020). Implementing FTS improves safety and protects consumer health while increasing consumer confidence, which facilitates their decision-making (Lopes et al., 2020). Perceived health benefits are another important aspect of food traceability (van Rijswijk et al., 2008). Zhang et al. (2021) showed a correlation between consumer demand for traceability and potential health risks. Therefore, we posit the following:

H5. HC has a positive relationship with FA.

3.5 Effect of FA on consumer behavior

A traceability system is beneficial for consumers. FTS ensures food safety (Zhao et al., 2019), reduces risk, improves production trust (Truong et al., 2021), promotes consumer purchase decisions, and influences consumer purchase behavior. Consumers' traceable perceptions of food safety and nutrition influence their perceptions of associated health benefits, which, in turn, impact their repurchase intention (Wang and Tsai, 2019). Prescott et al. (2002) showed that consumers feel safer when there is an FTS, implying that the positive perceptions of FTS increase consumer product trust. In the food industry, traceability has become a priority to ensure product safety, determine food choices, and assess the origins of food and its health and safety aspects (Wang and Tsai, 2019). The implementation of FTS improves food safety, protects consumer health, and increases consumer confidence, thus creating positive consumer attitudes (Lopes et al., 2020). FTS

implementation further mitigates uncertainty and strengthens consumer purchase intention (Choe et al., 2009). Therefore, we posit that:

H6a. FA has a positive relationship with attention.
H6b. FA has a positive relationship with interest.
H6c. FA has a positive relationship with trace.
H6d. FA has a positive relationship with trust.
H6e. FA has a positive relationship with action.
H6f. FA has a positive relationship with share.

3.6 Impact of the pandemic (IPD) on HC, FA, and consumer behavior

The pandemic resulted in panic buying (Schmidt et al., 2021). At the same time, the preference for locally produced products and the purchase of high-quality products (Gómez-Corona et al., 2021) implies that the pandemic has led to an increase in consumers' health concerns (Górnicka et al., 2020), and a greater concern for nutrition and food safety when purchasing goods. Therefore, IPD has heightened consumers' attention and interest in products, leading them to be more discerning in their search and purchase of essential goods. Simultaneously, IPD has contributed to increased online consumption (Bai et al., 2021) and has increased opportunities for consumers to interact online. Therefore, fear and anxiety associated with uncertainty and instability has driven behavioral change (Gómez-Corona et al., 2021). In the cold chain sector, consumers are skeptical about whether food safety is guaranteed (Bai et al., 2021). Meanwhile, Schmidt et al. (2021) assert that the perceived COVID-19 threat level is negatively correlated with purchase frequency. Therefore, IPD leads to a decrease in consumer trust and an increase in the demand for traceability of goods. Accordingly, we posit the following:

H7. The IPD has a positive relationship with HC.
H8a. The IPD has a positive relationship with attention.
H8b. The IPD has a positive relationship with interest.
H8c. The IPD has a positive relationship with search.
H8d. The IPD has a positive relationship with trace.
H8e. The IPD has a positive relationship with action.
H8f. The IPD has a positive relationship with share.

The COVID-19 pandemic caused panic buying (Schmidt et al., 2021), and heightened fear and anxiety among consumers regarding food safety (Gómez-Corona et al., 2021). To address these concerns, some researchers propose the use of FTS to improve trust and safety in food production processes (Galanakis et al., 2021). Meanwhile, Chinese authorities have issued a series of guidelines, including the promotion of FTS, to protect food workers from COVID-19, prevent cross-contamination throughout the food chain, avoid potential viral contact with consumers, and improve food hygiene and hygiene measures (Qian et al., 2020). Accordingly, we posit the following:

H9. The IPD has a positive relationship with FA.

4. Methodology

4.1 Questionnaire design

We created an online questionnaire based on our proposed AISTTAS model (see Figure 2) using questions from a pre-validated scale. The AISAS model was assessed using a three-item scale, as validated by Wei and Lu (2013). We selected six items on HC based on Amit Kumar's approach (2021), and as validated by (Michaelidou and Hassan, 2008). We refer to Ellison et al. (2021) to quantify the concept of the COVID-19 pandemic. In our structural design, we adhere to the approach proposed by Qian et al. (2020) due to the limited discussion on traceability system cognition. The questionnaire contained four sections: items on personal information (section one); daily living following the pandemic (section two); and a survey about health awareness, the IPD, and the FTS (section three). The fourth section focused on the study's model design and included items on consumption behavior.

To compare the consumption behavior of nutritional supplements and daily meal intake, we used edible bird's nests (EBN) to represent healthcare products and aquatic products (AQU) to represent daily necessities. AQU products are diverse in terms of their type and form, and consumers easily include them in their daily food choices (Nguyen et al., 2015). Moreover, the aquatic food industry was impacted by the pandemic; therefore, it deserves attention as a cold chain industry (Liu et al., 2020).

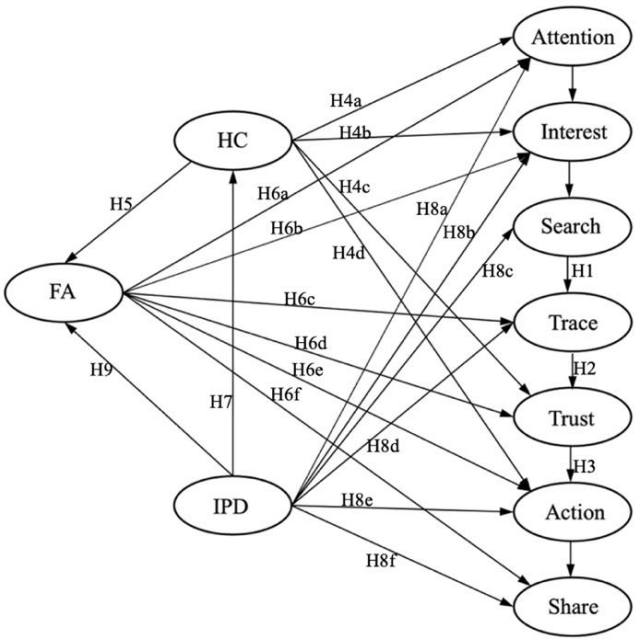

Figure 2. Conceptual model.

Note: HC = Concern for Health, FA = Awareness of FTS, IPD = Impact of Pandemic

China is the world's largest consumer of EBN, and Chinese consumers consider EBN their first choice as a nutritional supplement (El Sheikha, 2021). To ensure the safety and quality of EBN products, Chinese authorities have introduced regulations for importing EBN with a traceability code and logging the information into the Food Traceability System (FTS) Platform. In recent years, most of the food industry has experienced turbulence due to the impact of the pandemic (Panzone et al., 2021). However, since the lockdown of the city, EBN sales have risen instead of falling (Orîndaru et al., 2021). The pandemic has prompted the selection of EBN products. Therefore, EBN is representative of a traceable healthcare product. All items were assessed using a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). We conducted a pretest with 50 respondents; based on the findings, we made minor changes to the questionnaire content to increase its comprehension.

4.2 Sampling and data collection

The survey started on March 17, 2022, and the period of data gathering lasted one week. To evaluate the latest developments in Chinese consumer behavior, a survey was conducted in mainland China to individuals aged 20 to 59 who have purchased both EBN and AQU products. In our questionnaire, we added a trap question. The questionnaire was carried out through WeChat by an authorized survey organization, which also offered questions to WeChat users who were able to confirm their identities before participating. All members who have been verified must present identification documents and their legal names. The survey company dropped the questionnaire to all eligible members and algorithmically screened the unqualified responses till a sample of 1000 was completed.

This questionnaire was reviewed by the Ethics Committee before the survey began (Reference number R3-1: Ethics Committee of Faculty of Environmental Science, Nagasaki University). Before answering the questions, the respondents clicked to confirm that they had perused a description of the questionnaire's material; subsequently, the questionnaire officially began. Respondents received points from the survey company upon completion of the questionnaire, which could be used in exchange for goods. The respondents' age and regional dispersion data were based on Chinese census data. The ratio of males and females in each region was 50%. The age quotas were: 20–29 years (24%), 30–39 years (28%), 40–49 years (26%), and 50–59 years (22%). The quotas of the population were selected from four economic regions: Eastern (41%), Central (27%), Western (25%), and Northeast (7%). Among them, 500 respondents viewed photographs of EBN products and answered questions regarding their consumption habits (EBN group). The other 500 viewed photographs of AQU products and responded to questions on their consumption habits (AQU group). Both groups' quota requirements were in line with the sample population.

5 Results

5.1 Description of the sample

Overall, 1000 questionnaires were validated. Table 1 shows that the respondents' average age is 42 years, and their average income is 8,464 yuan. Approximately 80% of the respondents are married, and more than 50% of the households consist of 3-member families. Among the married respondents, 76% have children. Approximately 25% of the respondents have a family member who is planning to become pregnant or is in the process of becoming pregnant. Most of the respondents (74%) have a college degree.

Table 1.
Characteristics of Respondents (n=1000)

Categories	Frequency	Percentage (%)	Categories	Frequency	Percentage (%)
Age			**How much do you know about the food traceability system?**		
Mean	42		I have no idea about it	5	1%
Marital Status			I don't know much about it	80	8%
Unmarried	202	20.2%	Normal/It's hard to explain	250	25%
Married	793	79.3%	I know it	560	56%
Household size			I know it quite well	105	11%
3	612	61.2%	**Type of bird's nest product you have bought**		
4	203	20.3%	Dried Swallow's Nest	602	20.4%
≥5	126	12.6%	Freshly Stewed Swallow's Nest	653	22.1%
Do you have children?			ready-to-eat Swallow's Nest	310	10.5%
Yes	760	76.0%	Instant Swallow's Nest	767	26.0%
No	240	24.0%	Healthy drinks with bird's nest	309	10.5%
What are your and your family's current fertility plans?			**How about your current subjectively assessed health condition?**		
No plans for now	748	74.8%	Very bad	6	0.6%
Pregnancy Preparation	216	21.6%	Bad	97	9.7%
Pregnancy in progress	36	3.6%	Neither bad nor good	332	33.2%
Personal monthly disposable income status			Good	498	49.8%
Mean	8464		Very good	67	6.7%
Education			**Are you taking dietary supplements now?**		
Technological Educational Institute	159	15.9%	Yes	834	83.4%
University	743	74.3%	No	166	16.6%
Master/PhD	64	6.4%	**If yes, how often do you take supplements?**		
Job			Once per day	449	44.9%
Middle management	298	29.8%	Once per 2-3 days	235	23.5%
General Staff	251	25.1%	Once per week	89	8.9%
Professional and technical staff	97	9.7%			
Please select the 3 items you care most about when shopping for aquatic products now			**Please select the 3 items you care most about when shopping for edible bird's nest products now**		
Food Safety	729	24.3%	Food Safety	594	19.8%
Quality certification	487	16.2%	Quality certification	476	15.9%
Nutritional Value	408	13.6%	Nutritional Value	446	14.9%
Traceability information	250	8.3%	Counterfeit	291	9.7%
Price	231	7.7%	Traceability information	261	8.7%

When shopping for AQU products, the respondents are most concerned about food safety (24.3%), quality certifications (16.23%), and nutritional value (13.60%). Concern about price is low (7.70%). When shopping for

EBN products, respondents are most concerned about food safety (19.80%), quality certification (15.87%), nutritional value (14.87%), and the authenticity of EBN products (9.70%). Concern about food traceability information was 8.3% and 8.7%, respectively. More than 88% of respondents report being more concerned about their health post pandemic, and 83% worry about the food safety of cold chain products post pandemic. Regarding nutrient intake, most respondents are in good (49.8%) or fair (33.2%) health. Meanwhile, 83% of the participants are taking nutritional supplements, typically once daily (44.9%); over 50% indicate some level of knowledge about FTS (56%).

5.2 Data analysis

To suit our goal of conducting theory development research using the extant AISAS consumer behavior model theories, we used partial least squares structural equation modeling (PLS-SEM). Structural equation modeling (SEM), which allows authors to test complete theories and concepts, has become a quasi-standard in marketing research (Babin et al., 2008; Hulland, 1999). PLS-SEM handles reflective and formative measurements almost infinitely and is adapted to complex models (Chin, 1998). PLS-SEM only requires that constructs be structurally related to each other. Therefore, PLS-SEM offers more flexibility when it comes to formative measurements (Hair et al., 2012). Our theoretical model was tested using Smart PLS 3 and R (SEMinR and Lavaan package). During the hypotheses testing, we utilized bootstrapping with 5000 subsamples following (Hair Jr et al., 2014).

5.2.1 Common method bias

Exploratory factor analysis without rotation found that a single component explained 39% of the total variance, below the required 50% indicating that dataset bias is not a problem. The variance inflation factor (VIF) value of each construct was between 1.000–3.114, which was less than 3.3, confirming there was no serious common method bias in this study (Kock, 2017). We further checked for exceptionally higher correlations ($r > 0.90$) between variables; the results suggested that no high correlations existed among the constructs. Consequently, common method bias was not an issue in our study.

5.2.2 Model measurement results

Table 2 shows the results of the convergent and discriminant validity tests. Cronbach's alpha (CA) values greater than 0.70 imply that each construct has a high level of internal consistency (Hair et al., 2009). The study measures' composite reliability (CR) values exceed 0.80, demonstrating internal consistency and convergent validity (Fornell and Larcker, 1981). Convergent validity is confirmed when the study measures' average variance explained (AVE) values are greater than 0.50 and smaller than the corresponding CR values. The inter-correlations between the constructs are less than the square root of the constructs' AVE values, showing discriminant validity. When the value of square root mean residual (SRMR) is less than 0.1, a model has a good fit (Hu and Bentler, 1998); the SRMR value of our model is 0.046 for the saturated model and 0.099 for the estimated model. The RMS-theta values are less than 0.12 (RMS-Theta = 0.111), suggesting that the model has a good fit (Dijkstra and Henseler, 2015)

We ensured convergent validity by examining the outer loadings (factor loadings) of the items in each construct (Appendix 1). An outer loading of > 0.70 is acceptable, and values of < 0.40 should always be eliminated (Hair et al., 2014). The results indicate an outer loading of 0.642 (c8) for the self-reported item "I follow the media for information on COVID-19" within the IPD construct, 0.660 (v1) for "I reflect on my health a lot" in the HC construct, and 0.683(z4) for "I would like to see complete tracking information in the FTS" in the FA construct; these values are lower than those for other items. However, all item loadings are statistically significant (t-value > 1.96; Hair et al., 2014). Overall, the predictive validity and model fit indices are satisfactory.

5.2.3 Structural model results

The path coefficients results confirm that H1, H2, H3, H4a, H4c, H5, H6a, H6c, H6d, H6f, H7, H8a, H8b, H8c, H8d, H8e, and H9 are supported (Table 3). Therefore, HC is positively correlated with FA ($\beta = 0.408$; $p < .001$), while IPD is positively associated with HC ($\beta = 0.790$; $p < .001$) and FA ($\beta = 0.395$; $p < .001$).

Regarding the consumer behavior model, HC is positively correlated with attention ($\beta = 0.171$; $p < .01$) and trust ($\beta = 0.093$; $p < .05$). FA is positively correlated with attention ($\beta = 0.293$; $p < .001$), trace ($\beta = 0.162$; $p < .001$), trust ($\beta = 0.187$; $p < .001$), and share ($\beta = 0.143$; $p< .05$), search ($\beta = 0.116$; $p < .001$), trace ($\beta = 0.137$; $p < .001$), and action ($\beta = 0.110$; $p < .01$). Search is positively correlated with trace ($\beta = 0.546$; $p < .001$), trace is positively correlated with trust ($\beta = 0.534$; $p < .001$), and trust is positively correlated with action ($\beta = 0.721$; $p < .001$).

Table 2.
Results of convergent and discriminant validity tests

	CA	CR	AVE	1	2	3	4	5	6	7	8	9	10
FA	0.847	0.887	0.568	0.753									
HC	0.828	0.875	0.539	0.720	0.734								
IPD	0.849	0.885	0.525	0.717	0.790	0.725							
Attention	0.848	0.908	0.766	0.523	0.499	0.494	0.875						
Interest	0.834	0.900	0.751	0.490	0.475	0.483	0.845	0.866					
Search	0.766	0.865	0.682	0.421	0.429	0.432	0.715	0.710	0.826				
Trace	0.830	0.898	0.746	0.490	0.453	0.489	0.705	0.709	0.673	0.864			
Trust	0.787	0.876	0.702	0.516	0.470	0.464	0.770	0.786	0.681	0.668	0.838		
Action	0.837	0.902	0.754	0.493	0.470	0.483	0.790	0.813	0.715	0.706	0.797	0.868	
Share	0.846	0.907	0.764	0.421	0.430	0.443	0.660	0.677	0.676	0.633	0.720	0.731	0.874

Note: HC=Concern for Health, FA=Awareness of FTS, IPD=Impact of Pandemic

CA, Cronbach's α; CR, Construct Reliability; AVE, Average Variance Extracted; Diagonal values represent the square root of the AVE.

The results show that HC is positively correlated with attention (β = 0.228; p < .01) and trust (β = 0.133; p < .05) in the AQU group, but not in the EBN group. FA is positively correlated with action (β = 0.073; p < .05) in the AQU group, but not in the EBN group. IPD is positively correlated with product attention (β = 0.255; p < .01) and product interest (β = 0.093; p < .05) in the EBN group, but not the AQU group.

We then compared the model results for the AQU and EBN groups (Table 4). The ability of "trace" to explain "trust" is higher in the AQU group (0.508) than in the EBN group (0.478). The model fit is better for the AQU group (SRMR 0.096) than the EBN group (SRMR 0.105). This may be because the AQU group has some specific characteristics in terms of model fit that make the model fit better in this group. On the other hand, the EBN group may have higher variability in the data, meaning that the data points in this group may be more diverse or dispersed compared to the AQU group. This increased variability may result in relatively high SRMR values for the EBN group, thus affecting the fit of Model.

Our blindfolded test result (Q^2 = 0.235) exceeds the threshold value of 0, indicating that each model has an acceptable predictive quality, which corresponds with the suggestions of (Geisser, 1975). The determination coefficient is in the 0–1 range, showing the nominal, explanatory, and predictive validity of the structural model. Figure 3 shows that HC and IPD explain 57% of the variance of FA and IPD explains 62% of the variance of HC; both results are statistically significant.

6 Discussion and implications

Our new model is valid for use in the food industry, will aid businesses' decision-making based on consumer characteristics, and provide a new theoretical basis for other consumer behavior models. Further, we studied and predicted the potential of FTS in the Chinese consumer population. Further efforts will be made to ensure food safety to improve consumer trust in the future.

6.1 Theoretical implications

Our AISTTAS model has a satisfactory fit, indicating that the model's structure is consistent with our data characteristics. Our data are representative of Chinese consumers' demographic characteristics, while the generalizability of the model in other countries requires further validation. However, even without the influence of the pandemic, consumer demand for traceable products has increased (Lopes et al., 2020), a process that the pandemic has only accelerated.

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Table 3.
Hypothesis test results

		All n=1000				EBN group n=500				AQU group n=500			
Causal hypothesis		β-values	t-values		Result	β-values	t-values		Result	β-values	t-values		Result
H1	Search -> Trace	0.546	13.029	***	accepted	0.591	10.942	***	accepted	0.500	7.792	***	accepted
H2	Trace -> Trust	0.534	11.854	***	accepted	0.545	9.118	***	accepted	0.520	7.890	***	accepted
H3	Trust -> Action	0.721	25.662	***	accepted	0.746	21.195	***	accepted	0.689	15.624	***	accepted
H4a	HC -> Attention	0.171	3.104	**	accepted	0.105	1.405	n.s.		0.228	2.850	**	accepted
H4b	HC -> Interest	0.010	0.295	n.s.		-0.043	0.931	n.s.		0.063	1.287	n.s.	
H4c	HC -> Trust	0.093	2.206	*	accepted	0.051	0.873	n.s.		0.133	2.299	*	accepted
H4d	HC -> Action	0.030	0.830	n.s.		0.022	0.447	n.s.		0.048	0.903	n.s.	
H5	HC -> FA	0.408	11.762	***	accepted	0.375	7.041	***	accepted	0.437	9.449	***	accepted
H6a	FA -> Attention	0.293	5.484	***	accepted	0.200	2.972	**	accepted	0.368	4.372	***	accepted
H6b	FA -> Interest	0.016	0.591	n.s.		0.042	1.027	n.s.		-0.011	0.306	n.s.	
H6c	FA -> Trace	0.162	4.222	***	accepted	0.157	2.866	**	accepted	0.178	3.318	***	accepted
H6d	FA -> Trust	0.187	4.028	***	accepted	0.211	3.709	***	accepted	0.168	2.349	**	accepted
H6e	FA -> Action	0.021	0.630	n.s.		-0.036	0.745	n.s.		0.073	1.725	*	accepted
H6f	FA -> Share	0.143	3.931	***	accepted	0.101	2.035	*	accepted	0.183	3.424	***	accepted
H7	IPD -> HC	0.790	41.476	***	accepted	0.797	29.399	***	accepted	0.786	30.106	***	accepted
H8a	IPD -> Attention	0.149	2.563	**	accepted	0.255	3.026	**	accepted	0.070	0.872	n.s.	
H8b	IPD -> Interest	0.071	2.295	*	accepted	0.093	2.071	*	accepted	0.051	1.125	n.s.	
H8c	IPD -> Search	0.116	3.837	***	accepted	0.127	3.124	**	accepted	0.110	2.339	*	accepted
H8d	IPD -> Trace	0.137	3.400	***	accepted	0.102	1.698	*	accepted	0.165	3.184	**	accepted
H8e	IPD -> Action	0.110	2.961	**	accepted	0.130	2.211	*	accepted	0.094	1.960	*	accepted
H8f	IPD -> Share	0.027	0.758	n.s.		0.042	0.894	n.s.		0.022	0.432	n.s.	
H9	IPD -> FA	0.395	11.261	***	accepted	0.446	8.463	***	accepted	0.349	7.323	***	accepted
*** significant at p < 0.001; ** significant at p < 0.01; * significant at p < 0.05; n.s.: not significant.													
Note: HC=Concern for Health, FA=Awareness of FTS, IPD=Impact of Pandemic													

Table 4.
Group Comparison

		n=1000	n=500	n=500
Index		Model	AQU group	EBN group
PLS-SEM analysis in smartPLS				
R square	Interest	0.719	0.724	0.718
	Search	0.514	0.513	0.519
	Trace	0.514	0.504	0.531
	Trust	0.497	0.508	0.478
	Action	0.651	0.661	0.649
	Share	0.555	0.547	0.566
Saturated Model	SRMR	0.046	0.049	0.051
	Chi-Square	4300.830	2533.882	2689.892
	NFI	0.826	0.799	0.796
Estimated Model	SRMR	0.099	0.096	0.105
	Chi-Square	5315.546	3033.334	3215.601
	NFI	0.785	0.761	0.756

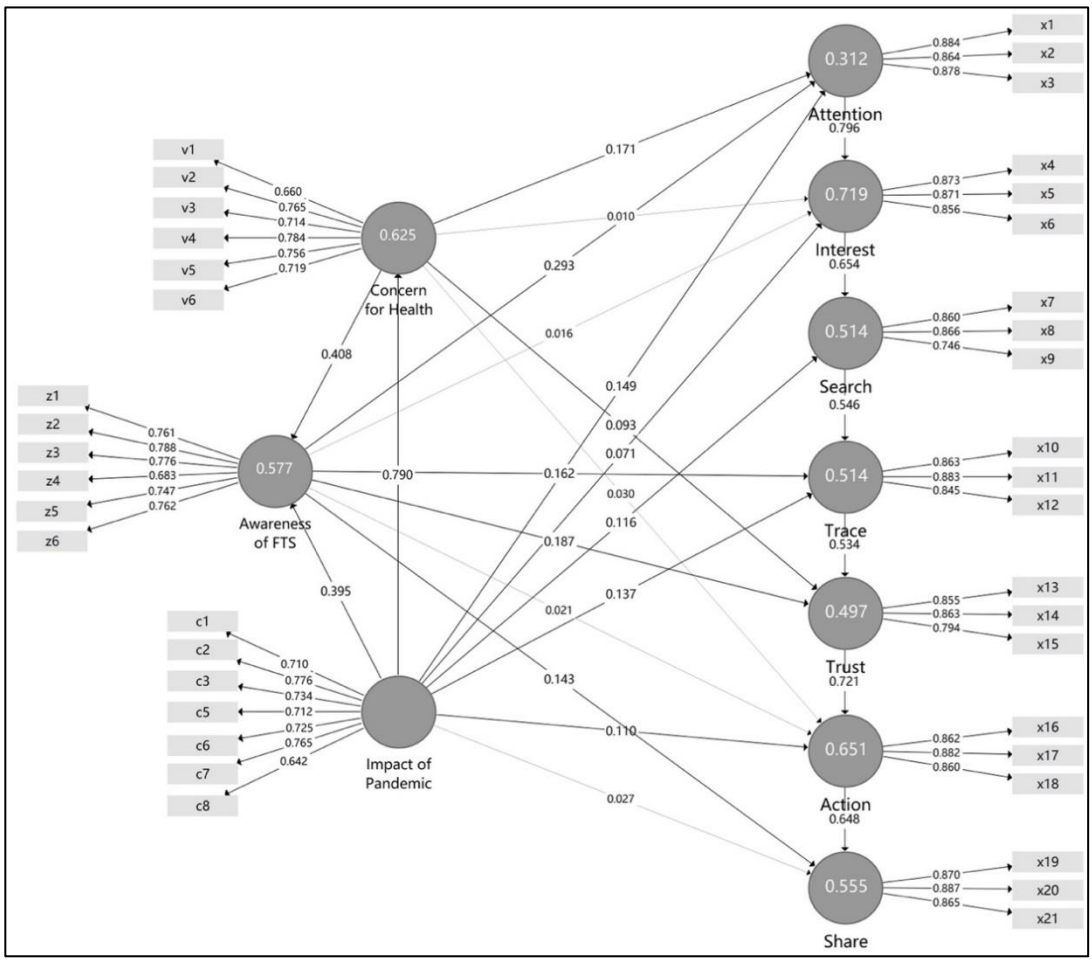

Figure 3. The structural model with outer loadings and path coefficients

The process of consumer behavior "Search -> Trace -> Trust -> Action" has been theoretically supported. Once again, we have confirmed the relationship between FA, HC, and IPD. Consistent with Galanakis et al.'s findings (2021), the IPD has a positive relationship with FA. However, a part of the results in influencing consumer behavior differs from earlier studies. Although Lopes et al. (2020) showed that implementing FTS facilitates their decision-making, the path "FA -> Action" is not significant. Moreover, contrary to the findings from previous studies (Asif et al., 2018; Wang and Tsai, 2019), HC also fails to promote consumer purchasing behavior. This is due to the instability of the pandemic era (Gómez-Corona et al., 2021) and that the factors influencing consumer purchasing behavior change. Also, the path "HC -> Interest" is not significant. This suggests that purchase intention cannot be directly interpreted as consumer interest, and more detailed definitions of consumer interest are needed. The effect of HC on product action was also insignificant. However, previous studies have shown that HC enhances consumption behavior (Kumar, 2021), while consumption uncertainty has been well documented during the COVID-19 era (Gómez-Corona et al., 2021). Therefore, further testing of this result is needed in the future.

We divided the respondents into two groups (AQU and EBN) to examine consumer behavior regarding these products. For AQU products, trace behavior explained trust behavior more than for EBN products. For EBN products, search behavior explains trace behavior more effectively. This shows that trace behavior enhances trust in daily necessities more than in nutritional products, whereas search behavior enhances trace behavior in relation to nutritional products more than in daily necessities. This finding is similar to the earlier finding that trust directly influences consumers' purchase intention regarding short-chain food (Giampietri et al., 2018). Short food supply chains involve direct sales of food from producers (or farmers) to end consumers, often bypassing middlemen and wholesalers. This enables consumers to purchase fresh, locally produced food directly. Therefore, in the B to C model, enhancing consumer trust is a crucial aspect.

Regarding the better model fit results for the AQU group than the EBN group, this is because consumers purchase essential foods more frequently than nutritional supplements, so consumption habits are more likely to be fixed. However, there was no clear evidence that the frequency of purchasing different products affected the model fit results.

Previous research (Xu and Wu, 2010) implied that FA significantly affects purchase decisions. However, increased FA had a facilitative effect on purchase decisions for AQU products but not EBN products. All EBN products on the market are legally registered with the FTS (El Sheikha, 2021); therefore, regardless of the level of consumer FA, this will not affect the traceability of the purchased EBN products themselves.

6.2 Practical implications

Our AISTTAS model offers new marketing ideas that could benefit the sustainable development of the cold chain industry and is applicable to general strategies related to essential goods and dietary supplement products. For companies, improving traceability systems to build consumer trust ensures product quality and demonstrates compliance with COVID-19 precautions (Iftekhar and Cui, 2021). When consumers increase their level of awareness of FTS and understand the health, quality, safety, and control characteristics of food through corporate communications. This leads to increased trust and confidence in food (van Rijswijk et al., 2008). This creates a "perception–trace–trust" connection between companies and consumers as a result.

Further, we summarize the characteristics of AQU and EBN product consumers. The results for these two groups imply that companies need to approach different product types differently and create more targeted marketing strategies based on models with distinct product segments.

We found that the three factors that mattered most when making purchase decisions about AQU and EBN products were food safety, quality certifications, and nutritional value. The concerns were consistent for both products. However, the data distribution revealed that the concern for food safety was significantly higher for AQU products (24.3%) than for EBN products (19.8%). The results revealed concerns about price (7.7%) for AQU products and counterfeiting (9.7%) for EBN products, which were consistent with the characteristics of the two products. Therefore, decision-makers must consider the price factor when dealing with essential products and product authenticity (But et al., 2013) when handling dietary supplement products.

The structural model results showed a facilitative effect of HC on FA, which is consistent with prior studies (Liu et al., 2020; Lopes et al., 2020). We also reaffirmed the positive impact of IPD on promoting HC. We further confirmed the contribution of the pandemic to FA, thereby establishing a relationship between the IPD, HC, and FA.

Although we confirmed the validity of our AISTTAS model, the individual pathway results were not all consistent with those of previous studies. The effect of HC on trust was significant in the AQU group but not in the EBN group. This implies that individuals who take health supplements possess a certain level of knowledge on health (Dickinson and Mackay, 2014). The effect of FA on action was significant in the AQU group but not in the EBN group. Similarly, we assume that the impact of FA on purchase actions is reduced due to legal regulations regarding EBN traceability. For the AQU group, emphasis should be placed on raising awareness of FTS to drive consumer action and behavior.

For the EBN group, companies focus on highlighting product attributes or benefits that align with consumer preferences and legal requirements. The effect of HC on product action was also insignificant. However, previous studies have shown that HC enhances consumption behavior (Amit Kumar, 2021), while consumption uncertainty has been well documented during the COVID-19 era (Gómez-Corona et al., 2021). Therefore, further testing of this result is needed in the future.

6.3 Limitations

While our study extends the understanding of existing consumer behavior model theories and FTS predictions, it has some limitations. First, the sample size was relatively limited due to the complexity of the structure. Second, the in-sample indicators of PLS-SEM may not be generalizable to new datasets or similar situations. Third, we excluded respondents with low incomes, which restricted the scope of our new model. Future studies should focus on the general consumer population to ensure universality. Lastly, there is a lack of cross-sectional comparative studies on consumer behavior in different countries. Therefore, we will attempt to expand the sample and compare consumer behavior characteristics in different countries in the future.

6.4 Conclusions

Before the pandemic, the demand for FTS was increasing as people were becoming more health-conscious; however, the pandemic presented an opportunity to accelerate the demand for FTS. Despite the pandemic, it is undeniable that FTS could meet consumer food safety demands until new technologies become available. Our results reveal that food safety remains the most important factor in consumer purchase behavior. For our novel AISTTAS model, we propose the addition of trust and trace. This model is applicable to the food industry to address challenges related to consumers' food safety needs in the supply chain. Our model also demonstrates the capability to make timely adjustments in response to dynamic changes in consumer needs in the future.

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Appendix 1.

Model measurements results (Item loadings, VIF)

	All n=1000	
Constructs Indicators	**λ**	**VIF**
Awareness of FTS		
z1 <- I would consider buying traceable products	0.761	1.833
z2 <- I trust the food traceability platform	0.788	1.851
z3 <- I believe the information I see in the food traceability system	0.776	1.774
z4 <- I would like to see complete tracking information in the food traceability system	0.683	1.649
z5 <- I know a lot about the food traceability system	0.747	2.076
z6 <- I know how to use the food traceability system	0.762	2.084
Impact of Pandemic		
c1 <- I improved my diets and lifestyle behaviors during the COVID-19 restrictions	0.710	1.539
c2 <- I am more concerned about health issues during the COVID-19 pandemic	0.776	1.919
c3 <- I am more concerned about food nutrition during the COVID-19 pandemic	0.734	1.724
c5 <- I believe the government's anti-epidemic measures can protect me	0.712	1.999
c6 <- After the outbreak, I trust the government more	0.725	2.034
c7 <- I am very concerned about the news of COVID-19	0.765	1.856
c8 <- I followed the media about the information on COVID-19	0.642	1.487
Concern for Health		
v1 <- I reflect about my health a lot	0.660	1.510
v2 <- I'm alert to changes in my health	0.765	1.819
v3 <- I take care of myself as a matter of principle	0.714	1.517
v4 <- I'm willing to make daily sacrifices for good health	0.784	1.820
v5 <- I think it is essential to know well how to eat healthily	0.756	1.664
v6 <- I am prepared to sacrifice a lot for buying healthy products	0.719	1.482
Attention		
x1 <-I think the product attracts me	0.884	2.130
x2 <- I think the product draws my full attention	0.864	1.940
x3 <- I think the product caught my eye	0.878	2.103
Interest		
x4 <- After watching the product, I feel an interest in the product	0.873	1.957
x5 <- After watching the product, I like the product	0.871	1.956
x6 <- After watching the product, I have a good impression of the product	0.856	1.888
Search		
x7 <- After watching the product, I think I will search for information about the product on the Internet	0.860	1.772
x8 <- After watching the product, I think I will search for online word-of-mouth about the product on the Internet	0.866	1.780
x9 <- After watching the product, I think I will compare the prices of the product on the Internet	0.746	1.363
Trace		
x10 <- Before buying, I will confirm the traceability code of traceable goods	0.863	1.927
x11 <- Before buying, I will trace the product information to confirm safety and security	0.883	2.095
x12 <- After buying, I will trace the product information to confirm the authenticity	0.845	1.768
Trust		
x13 <- I think this product is trustworthy	0.855	1.752
x14 <- This product gives the impression that it keeps promises and commitments	0.863	1.800
x15 <- I believe that this product has my best interests in mind	0.794	1.499
Action		
x16 <- After reading the product information, I think the product in the review is worth purchasing	0.862	1.920
x17 <- After reading the product information, I think I am willing to buy the product	0.882	2.067
x18 <- After reading the product information, I think the product will benefit me	0.860	1.898
Share		
x19 <- After consuming the product, I think I will forward this product to my friends	0.870	2.045
x20 <- After consuming the product, I think I will share the product with my friends	0.887	2.214
x21 <- After consuming the product, I think I will share my experiences and comments about the product on the Internet	0.865	1.908

λ → Loading, VIF → Variance inflation factor.