



Impact of Traceability Technology on Purchase Decisions in Fresh Food E-commerce

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Abstract. Driven by information technology advances and COVID-19, the fresh food e-commerce industry has seen tremendous growth. However, the fresh e-commerce platform has a tiny market share, owing to quality assurance, food safety trust, and other factors. Built by blockchain, the fresh food traceability system is considered an effective means to crack the development dilemma. This paper constructs a theoretical research model of traceable fresh food consumer behavior based on the Technology Acceptance Model theory and investigates consumers' traceability cognition (CTC), perceived usefulness (PU), social influence (SI), perceived ease of use (PEOU), attitudinal disposition (AD), and purchase intention (PI) by conducting a structural analysis of 230 questionnaires. The results indicate that, firstly, a higher level of CTC leads to a positive impact on PEOU but not PU. Secondly, SI positively affects PEOU and has the same effect on CTC and PU. Thirdly, PEOU and PU will promote PI by positively affecting AD. In the end, the author based on the findings makes recommendations to promote the growth of fresh e-commerce by blockchain technology.

Keywords: Fresh Food E-commerce · Traceable Fresh Food · Blockchain · Purchase Decision · Consumer Behavior

1 Introduction

The share of e-commerce shopping in daily life is growing due to the rapid growth of online payment and information technology. Fresh retail, an essential consumer industry in people's lives, is seen as having enormous online market potential by e-commerce companies. Fresh food e-commerce has seen unanticipated growth prospects as a result of COVID-19 since 2020. According to research, China's fresh food retail e-commerce business would be worth over 730 billion yuan in 2020, up 39.73% year over year [1]. The internet penetration rate of the fresh food retail business is still expanding as consumers become increasingly acclimated to online purchasing of fresh items. However, when compared to China's massive network economy, fresh food e-present commerce's usage rate is low, and the profit margin isn't ideal.

The difficulty in developing fresh food e-commerce is due not only to the complexity of the industrial chain and the difficulty of supply chain management but also to

the asymmetry of transaction information between buyers and sellers, which makes it difficult for consumers to distinguish between the quality and the true origin of fresh products. Furthermore, in recent years, COVID-19 has spread frequently in the logistics and transportation links of fresh food e-commerce, negatively impacting consumer confidence in food safety. Anti-counterfeiting traceability, decentralization, timeliness, non-tampering, and the capacity to optimize and coordinate the supply chain are all features of blockchain technology [3]. As a result, it is regarded as an efficient technique for overcoming the e-commerce shopping confidence crisis, and it is highly valued by many countries. The Chinese government, for example, issued the “Notice on Doing a Good Job in Food Cold Chain Logistics Traceability Management” in November 2020, a work guideline document highlighting the importance of food traceability management in epidemic prevention and control. China has officially launched a cold chain traceability management platform for imported food that can determine the source and destination of problematic food to assure food safety and prompt recalls when food safety issues arise [6]. E-commerce companies like JD Fresh have also invested substantially in blockchain traceability supply chains in recent years to increase the operational efficiency, transparency, and product quality of the fresh food supply chain [16].

There are several research on fresh food e-commerce with blockchain traceability technologies at present time. These researches are concerned with circulation efficiency, transportation loss, and food safety monitoring. Their findings offer useful advice for e-commerce companies looking to improve their supply chain management. However, few academics have looked at the impact of customers’ traceable fresh food cognition on their consumption behavior from the consumer’s perspective. In light of this, we construct a theoretical research model of traceable fresh food consumption behavior based on the Technology Acceptance Model theory [2], and investigate consumers’ traceability cognition, perceived usefulness, social influence, perceived ease of use, attitudinal disposition, and purchase intention. Our findings will give an analytical framework for explaining customers’ purchasing behavior toward traceable fresh food in e-commerce scenarios.

2 Literature Review

Scholars have done a lot of study on fresh food e-commerce consumption, which is directly connected to our research. Shao and Lv (2018) [12] developed a C2B2B2C model for fresh food e-commerce based on consumption experience. The empirical findings reveal that logistical distribution, after-sales support, and quality traceability all have a substantial impact on the consumer experience. Maruyama et al. (2016) [10] studied inhabitants of three Chinese cities’ online buying behavior for fresh food and discovered that freshness and product quality influence consumers’ purchase intentions. Through behavioral tests, Qi and Lin (2018) [14] discovered that intimate social distance may effectively boost the influence of customers’ propensity to buy fresh food, with perceived risk serving as a mediating factor. Chen et al. (2021) [1] based on the UTAUT research framework, discovered that purchase intention was significantly influenced by predicted utility and social influence, whereas perceived risk was significantly influenced by perceived risk. Regardless of the negative impact of perceived risk, consumers’ desire to buy is increased when products sold online come with a guarantee

of after-sales care. Wei et al. (2019) [7] developed an online review text mining algorithm, conducted sentiment analysis on commodity review texts, and discovered that convenient and dependable logistical services can boost customer satisfaction.

The application of blockchain traceability technology to fresh food e-commerce is another sort of research that is closely related to this topic. Blockchain technology includes technical qualities such as decentralization, openness, independence, security, and anonymity, and can guarantee the confidentiality, centrality, and availability of all transactions and data [5]. Blockchain offers transformational potential for supply chain management optimization because of its technical properties [3], and several organizations are attempting to use it to improve the traceability of fresh food. JD.com, for example, employs blockchain technology to track all information on beef produced in Inner Mongolia and supplied throughout China [16]. As a result, consumers can scan the JD.com QR code to acquire detailed information about the beef. Food safety surveillance and retrospective recall are made easier with blockchain technology. According to Wass' research (2017) [13], it takes 6.5 days to trace the circulation path of a package of mangoes using traditional methods, but it just takes a few seconds using blockchain traceability technology. Food firms can use blockchain technology to swiftly identify and address food concerns, reducing the risk of food fraud [9]. According to Galvez et al. (2018) [4], food safety and information integrity will be improved thanks to increased traceability, which has significant positive consequences for consumers. Blockchain technology has the potential to improve food safety while also having a favorable impact on the supply management of fresh food businesses. Gong and Chen (2012) [11] investigated a food supply chain model with numerous suppliers and a single seller, demonstrating that improving the traceability of any circulation link can raise the whole food safety degree of the supply chain, with the seller benefiting as well. Li et al. (2019) [15] built a dual-channel supply chain model, and their findings demonstrate that a traceable supply chain would considerably enhance the circulation efficiency of fresh agricultural goods while also reducing loss during the process.

To summarize, the majority of existing studies only look at the impact of common factors like quality, logistics service, and after-sales service on fresh food online shopping, or the importance of blockchain traceability technology in improving operational efficiency and food safety in the fresh food supply chain. However, it appears that few researchers have related the consumers' traceability cognition to the factors of online fresh food shopping. Consumers' real perceptions of the safety value of traceable fresh goods, as well as their purchase intents of traceable fresh food, have not been adequately explored.

3 Research Model and Hypotheses

From the aforementioned research, we know that quality, freshness, after-sales service, logistics service, and social relations are the important influencing variables for customers buying fresh food online. Thus, based on TAM theory, we synthesized these research findings and built a research model of consumers' online fresh food shopping behavior that considers consumers' traceability cognition, as shown in Fig. 1. In the model, consumers' traceability cognition (CTC) and social influence (SI) affect the perceived usefulness (PU) and perceived ease of use variables (PEOU), then have an indirect

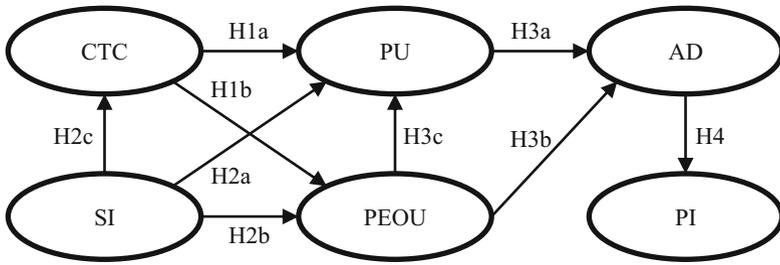


Fig. 1. Research model of online fresh food consumption

effect on attitudinal disposition (AD), and then have an impact on purchase intention (PI). At the same time, social influence will have an impact on consumers' traceability cognition, while perceived usefulness would be impacted by perceived ease of use.

3.1 Consumers' Traceability Cognition

Consumers' online buying behavior is tied to their level of expertise [8], and as people's cognition of technology grows, they will have a better sense of its utility and simplicity of use. Since traceable fresh food is still in the early stages of marketing, consumers are unfamiliar with them and blockchain traceability technology. Therefore, a small percentage of customers who have learned about traceable fresh food or blockchain technology may have more faith in traceable fresh food than common consumers. Therefore, we hypothesize that:

H1a: Greater consumers' traceability cognition will lead to greater perceived usefulness.
 H1b: Greater consumers' traceability cognition will lead to greater perceived ease of use.

3.2 Social Influence

Because observing comments about a product is a popular method for customers to avoid risks, consumer behavior is strongly influenced by word of mouth about a product [17]. Consumers' purchasing decisions are impacted not just by themselves, but also by their social networks, due to people wanting their purchases to be approved by others, particularly key people in their lives. These social variables will surely impact the perceived usefulness and simplicity of use positively or negatively. At the same time, people's cognition of products will be enhanced through word-of-mouth communication on social media. Therefore, we hypothesize that:

H2a: Greater social influence will lead to greater perceived usefulness.
 H2b: Greater social influence will lead to greater perceived ease of use.
 H2c: Greater social influence will lead to greater consumers' traceability cognition.

3.3 Perceived Ease of Use and Perceived Usefulness

In the light of some researchers (Davis 1989), perceived usefulness and simplicity of use are important elements in people's adoption of new technology. Traceability is a blockchain-based technology that is attached to fresh food to assure customer service after the sale. Consumers will adopt traceability technology more readily if they can see its benefits. If not, they may be ambiguous. In addition, simplicity of use might motivate individuals to try new things, and a favorable user experience will be positive feedback as perceived usefulness. As a result, we propose the following hypothesis:

H3a: Greater perceived usefulness will lead to greater attitudinal disposition.

H3b: Greater perceived ease of use variables will lead to greater attitudinal disposition.

H3c: Greater perceived ease of use will lead to greater perceived usefulness.

3.4 Attitudinal Disposition

Consumers' attitudes usually have a significant impact on their consumption behavior, such as buy willingness, referral willingness, and premium payment willingness. Therefore, we make the following hypothesis:

H4: Higher attitudinal disposition will result in higher purchase intention.

4 Data Analysis

4.1 Characteristics of the Sample

The questionnaire is made up of three parts, the first part contains the respondents' basic information. The second is the traceable fresh food consumption of the individuals. The third part is the test questions hidden in the questionnaire to evaluate the validity of the questionnaire. The second part of the questionnaire has been tweaked based on some past research and integrated with the features of e-commerce traceable fresh food. A Likert scale is used to show the questionnaire, containing five options: "extremely dissatisfied," "dissatisfied," "average," "satisfied," and "extremely satisfied," each with a score of 1, 2, 3, 4, and 5. The particular content of the Latent variables and measurement scale is shown in Table 1.

This survey gathered a total of 264 questionnaires, 230 of which were valid, for an effective rate of 87.12%. In Table 2, we show the profile of the respondents in the samples. We surveyed youngsters at several universities and pedestrian walkways in Guangzhou, as the main consumer of fresh food e-commerce is youngsters. The respondents are entirely under the age of 30, of which 57.83% are male and 42.17% are female. The household permanent residency distribution is also fairly balanced. Overall, the respondents' information is consistent with actual fresh food e-commerce consumption in China, showing that the sample data is acceptable.

Table 1. Latent variables and Observed variables

Latent variables	Observed variables
Consumers' traceability cognition	A1: I know traceable fresh food and its traceable QR code
	A2: I've utilized the traceable QR code to track down product details several times
	A3: I am familiar with the technical aspects of traceable fresh food
	A4: I've seen some reports or information in the media concerning traceable food
Social influence	B1: On the recommendations of my relatives and friends, I shall purchase traceable fresh food
	B2: Many people in my social circle have purchased traceable fresh food
	B3: Advertising may persuade me to try traceable fresh foods
	B4: Positive (negative) internet information increases (decreases) my trust in product traceability authenticity
Perceived usefulness	C1: Traceable fresh food can improve my shopping efficiency by saving product screening time
	C2: The freshness of traceable fresh food shall be better
	C3: Buying traceable fresh food online is more convenient since it is not restricted by time or geographical area.
	C4: I believe that the traceable fresh food after-sales guarantee service would be improved
	C5: Fresh food with a traceable QR code is more appealing to inexperienced consumers
Perceived ease of use	D1: It is simple to utilize the fresh food source code.
	D2: It is simple to examine the circulation information of traceable fresh food on a mobile phone.
	D3: I can rapidly access entire product quality and circulation information through traceable QR code
Attitudinal disposition	E1: I believe that traceable fresh offers a higher level of quality assurance
	E2: Product traceability can help consumers avoid being duped by merchants
	E3: Commodity traceability is beneficial to protecting consumer rights and interests

(continued)

Table 1. (continued)

Latent variables	Observed variables
Purchase intention	E4: In terms of food safety, traceable fresh is more trustworthy
	F1: I'd want to try some traceable fresh foods
	F2: I am inclined to recommend traceable fresh food to my friends
	F3: I am willing to pay a premium for a traceable QR code
	F4: I will prioritize traceable items while buying fresh food online

Table 2. Basic information of the samples

Question	Options	Percentage
Gender	Female	57.83%
	Male	42.17%
Age	under 20	32.17%
	20 to 25	54.78%
	26 to 30	13.04%
Education	College degree or below	7.83%
	Bachelor degree	80.00%
	Postgraduate degree	12.17%
Household permanent residency distribution	Countryside	32.17%
	Urban-rural junction	25.22%
	City	42.61%

4.2 Reliability Test

Cronbach's Alpha coefficient is the most generally used method for determining a scale's internal consistency. The reliability test was performed with SPSS 26.0 in this study, and the results are shown in Table 3. The general principle is that values greater than 0.7 are considered acceptable. Table 3 shows that the values vary from 0.865 to 0.962, all of which are higher than the acceptable limit. It demonstrates that the questionnaire data has a high level of internal consistency and stability and that the overall dependability can support the next research work.

Table 3. Reliability test of each Latent variable

Latent variables	Number of items	Cronbach's Alpha
Consumers' traceability cognition	4	0.866
Social influence	4	0.865
Perceived usefulness	5	0.962
Perceived ease of use	3	0.924
Attitudinal disposition	4	0.947
Purchase intention	4	0.942

Table 4. KMO and Bartlett's test of each latent variable

Latent variables	Number of items	KMO	Sig of Bartlett's sphericity test
Consumers' traceability cognition	4	0.780	0.000
Social influence	4	0.818	0.000
Perceived usefulness	5	0.903	0.000
Perceived ease of use	3	0.744	0.000
Attitudinal disposition	4	0.871	0.000
Purchase intention	4	0.844	0.000

Table 5. Validity analysis of the questionnaire

Latent variables	CR	AVE	1	2	3	4	5	6
Consumers' traceability cognition	0.870	0.628	0.792					
Social influence	0.869	0.627	0.387	0.792				
Perceived usefulness	0.962	0.836	0.571	0.635	0.914			
Perceived ease of use	0.926	0.806	0.097	0.450	0.239	0.898		
Attitudinal disposition	0.947	0.818	0.202	0.506	0.410	0.875	0.904	
Purchase intention	0.944	0.808	0.181	0.453	0.368	0.785	0.896	0.899

4.3 Confirmatory Factor Analysis

A validity test is used to assess the scale questionnaire's reliability. The greater the validity, the more relevant the items are, and the findings of the data analysis are meaningful. First, we did the KMO and Bartlett sphericity tests, and the results are shown in Table 4. The general principle is that the KMO values greater than 0.7 are considered acceptable. The KMO value of each latent variable in this study was greater than 0.6, and the significance level test of Bartlett sphericity tests was passed. As shown in Table 5, we

also performed confirmatory factor analysis (CFA) to test the converge validity and discriminant validity of the questionnaire. Each latent variable’s combined reliability (CR) was greater than 0.7, and the average variance extracted (AVE) was greater than 0.5. Furthermore, the square root of each variable’s AVE value (the bolded number in Table 5) is greater than the correlation coefficient between it and other variables, indicating that there is a better distinction validity among the variables.

5 Result

In order to test the hypothesis proposed earlier, we used Amos24.0 to analyze the structure. We performed a fitting evaluation for each sample, and show the results of each fitting index in Table 6. The general fitting condition of the samples is acceptable, as can be seen. This shows that the model and data of this study can effectively test and explain the research hypothesis. In Table 7, we show the empirical test results of the research hypothesis and the model path coefficients.

Table 6. Model fitting results

Index	CMIN/DF	CFI	IFI	GFI	RMSEA	TLI	NFI
Evaluation criterion	<5	>0.9	>0.9	>0.9	<0.08	>0.9	>0.9
Research model	2.723	0.928	0.928	0.809	0.087	0.918	0.891

Table 7. Test results of research hypothesis

Hypothesis	Model path	Unnormalized path coefficients	Normalized path coefficients	C.R.	Result
H1a	CTC → PU	-0.114	-0.077	-.937	refuse
H1b	CTC → PEOU	0.422***	0.383	5.885	pass
H2a	SI → PU	0.775***	0.502	5.245	pass
H2b	SI → PEOU	0.564***	0.486	7.014	pass
H2c	SI → CTC	0.407***	0.387	4.724	pass
H3a	PU → AD	0.774***	0.824	15.796	pass
H3b	PEOU → AD	0.267***	0.213	5.677	pass
H3c	PEOU → PU	-0.047	-0.035	-0.348	refuse
H4	AD → PI	0.985***	0.896	17.843	pass

NOTES: *** P < 0.001

6 Conclusion

6.1 Research Findings

Based on the TMA theory, we developed a research framework for online fresh food consumption behavior that takes into account consumers' traceability cognition. The questionnaire data collected in Guangzhou was analyzed using SPSS and Amos. The following are the specific research findings:

First, attitudinal disposition has a positive influence on consumer purchase intention in an e-commerce context, as do perceived usefulness and perceived ease of use variables on attitudinal disposition. According to the path coefficient, attitudinal disposition has a significant effect on purchase intention (0.896). Both perceived ease of use variables and perceived usefulness have a positive effect on attitudinal disposition, but perceived usefulness (0.824) is larger than perceived ease of use (0.213). The rationale for this is that perceived usefulness stands for practicality and is the primary motivator for people to consume. Perceived ease of use, on the other hand, represents the convenience that can improve the user experience, resulting in a higher attitudinal disposition.

Second, social influence has a considerable impact on perceived usefulness (0.775), perceived ease of use is positively influenced by both consumers' traceability cognition (0.422) and social influence (0.564), and social influence has the potential to improve consumers' traceability cognition (0.407). Social influence is made up of social networks and media data in this study. Social influence has a stronger effect on perceived ease of use and consumers' traceability cognition, implying that consumers are heavily influenced by other people's perspectives, i.e., traceability cognition may easily be raised through friend recommendations or media reporting. It's worth mentioning that hypothesis H3c (Greater perceived ease of use will lead to greater perceived usefulness) cannot be verified, but that doesn't mean it's incorrect. This is because the respondents this time have seldom faced food safety risks, making it impossible for them to directly experience the function of traceability in food safety. As a result, increased traceability awareness often increases perceived ease of use but not perceived usefulness.

6.2 Recommendations

The aforementioned research conclusions give operational inspiration for solving the confidence issue and development dilemma of fresh e-commerce food safety in the post-epidemic period. Following are some recommendations for fresh food e-commerce companies.

To begin, while promoting the development of a fresh food traceability supply system and blockchain technology, it is vital to concentrate on making the information traceability function easier to use and improving user perception. Open up communication conduits between buyers and sellers so that customers can see and feel the quality guarantee that traceability technology provides.

The second is to enhance product promotion spending, such as by aggressively using fission marketing techniques. The study's findings reveal that social influence has a substantial impact on purchase decisions. Increased social network advertising can help

customers not only comprehend traceable fresh food but also increase their perception of its utility and simplicity of use, boosting their buy intent.

The third is to leverage blockchain technology to boost business efficiency and reduce costs. With the advantage of the cost advantage, companies can organize some discounted activities at the market launch stage of traceable fresh food to attract the first clients. Then, as a reward for a good product experience, customers could develop a consumption habit that prioritizes traceable fresh items.

7 Limitation and Future Research

This study does have some drawbacks. To begin with, the survey sample is small and mostly made up of youngsters, especially the student group. The breadth of the sample survey in the future study should be expanded. Secondly, there are additional influencing elements that were not taken into account in this research. It's possible that these variables will interact. Thirdly, the breadth of theoretical study should be expanded. Then, the level of theoretical research should then be further studied. In this study, just the theory of the technology acceptance model is utilized to examine the impact of consumers' traceability cognition on their readiness to consume fresh food online, and it is merely a basic application of the technology acceptance model's theoretical framework. Future studies should continue to develop a theoretical model of customers' behavior while purchasing traceable fresh food online, merging it with other theories to improve the theory's explanatory power to current practical developments.

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