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# Crowdsourcing delivery for fresh agricultural products in China—exploring the factors influencing individual participation

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As a new delivery model in China, crowdsourcing delivery for fresh agricultural products presents a promising approach to reducing both costs and losses linked to last-mile delivery. To attract more individuals to participate in crowdsourced delivery, we developed a model to examine the effects of expected reward (ER), expected cost (EC), trust (TR), risk (RI), social influence (SI), travel characteristics (TC), promotion conditions (PCs), and constraints (COs) on individuals' participation willingness (PW) in crowdsourced delivery of fresh agricultural products. Based on the questionnaire data from 332 potential participants in China, we used structural equation modeling (SEM) to explore the influence paths. As hypothesized, expected reward, trust, and social influence positively affect individuals' PW in crowdsourcing delivery, while expected cost (EC) has a negative effect. Additionally, we found that social influence exerts a significant indirect effect on participation by mediating trust. Based on these findings, we propose several practical recommendations to enhance participation in crowdsourcing delivery of fresh agricultural products. These include increasing the variety of rewards, establishing an interactive community within the crowdsourcing delivery app, and establishing a trust mechanism.

## KEYWORDS

fresh agricultural products, crowdsourcing delivery, participation willingness, structural equation model, individual participation

## 1 Introduction

The rapid development of the mobile Internet has significantly transformed the way people purchase fresh agricultural products (Guo et al., 2022a). In China, an increasing number of consumers now prefer online shopping over traditional offline methods (Wang et al., 2022; Gong et al., 2013). Recently, the overall market scale of China's fresh food e-commerce has grown steadily. According to statistical data, China's online retail sales of agricultural products in 2020 exceeded CNY 414.89 billion (equivalent to US\$64.84 billion), with a year-on-year increase of 26.2% (Guo et al., 2022b). Due to the coronavirus disease 2019 (COVID-19) pandemic, Chinese consumers have increasingly turned to online platforms to purchase fresh food in order to reduce exposure to the virus (Lu et al., 2022). The market size exceeded US\$83.6 billion in 2021. These figures highlight the substantial development potential of China's fresh food e-commerce market. However, due to the characteristics of fresh agricultural products, such as perishability and difficulty in storage, the delivery cost of fresh farm products has always been high (Wu et al., 2023). The high delivery costs have become a significant bottleneck hindering the further expansion of the fresh food e-commerce industry (Liu X. et al.,

2024). In response to this challenge, the rise of the sharing economy has introduced crowdsourcing delivery as a promising solution.

Crowdsourcing refers to a company or organization outsourcing work that used to be performed by employees to a non-specific social network on the Internet (Zhen et al., 2021). For businesses, crowdsourcing presents an opportunity to access external expertise and labor at reduced costs (He et al., 2022). With the development of society, the application of crowdsourcing has expanded across various industries, including the delivery sector (Carbone et al., 2017). Crowdsourcing delivery means that the public replaces traditional delivery staff and independently chooses orders and routes to complete the delivery activities within the same city (Liang et al., 2017, 2024). The detailed process is illustrated in Figure 1. Unlike traditional knowledge-based crowdsourcing, participants in crowdsourcing delivery primarily pay for physical labor rather than providing solutions or knowledge to enterprises (Elsokkary et al., 2023). Therefore, the majority of the public can participate in crowdsourcing delivery. Crowdsourcing delivery involves the participation of four parties: the issuer, the receiver, the crowdsourcing platform, and the consumers who purchase goods. The differences between crowdsourcing delivery and knowledge-based crowdsourcing are summarized in Table 1.

Compared to knowledge-based crowdsourcing, the professional requirements for participating in crowdsourcing delivery of fresh agricultural products are relatively low. In practice, the predominant “last-mile” delivery method for fresh agricultural products relies on the use of foam boxes combined with ice packs to maintain optimal temperatures during delivery (Priya et al., 2025). This approach is widely adopted in China due to its simplicity and relatively low cost. This lowers the entry barrier, allowing a larger portion of the population to engage in delivery tasks and helping meet the rapidly increasing demand for instant delivery services. Unlike traditional delivery, crowdsourcing delivery typically offers a one-to-one service model, which better satisfies consumers’ expectations for timely and personalized service. Moreover, unlike conventional delivery models that require substantial infrastructure investment and payment of basic wages to employees, crowdsourcing delivery operates on a more flexible and decentralized basis. Therefore, crowdsourcing delivery

can create a lean asset model within the delivery industry, reducing fixed costs for enterprises without significantly increasing shopping costs of consumers (Howe, 2006). As a result, crowdsourcing delivery is particularly well-suited for last-mile delivery. However, as an emerging delivery model, crowdsourcing delivery of fresh agricultural products remains relatively underdeveloped and unfamiliar to many individuals. Therefore, it is essential to raise public awareness and encourage greater participation in crowdsourcing delivery of fresh agricultural products. In this context, exploring the key factors that influence individuals’ participation willingness (PW) in crowdsourcing delivery is critical for the development and success of crowdsourcing platforms.

The participation of individuals is crucial to the viability and success of crowdsourcing the delivery of fresh agricultural products. Although some studies have explored individual participation in crowdsourcing, prior research has mainly focused on the influence of expected benefits and costs on individual intention to participate in crowdsourcing (Thuan et al., 2016). However, a significant research gap remains regarding the role of risk (RI) perceptions and travel behavior characteristics—factors that are particularly relevant in the context of perishable goods like fresh agricultural products, where timely and secure delivery is critical.

To address this gap, this study developed a model to explain individual participation in crowdsourcing delivery in terms of expected reward (ER), cost, trust (TR), social influence (SI), promotion conditions (PCs), and constraints. Additionally, the influence of travel characteristics (TC) was explored in this study. Specifically, we studied the influence of time risk, privacy risk, economic risk, security risk, travel time, travel distance, and travel frequency on individuals’ PW in the crowdsourcing delivery of fresh agricultural products. This integrated approach enables a more comprehensive understanding of what drives or hinders individual participation in the crowdsourcing delivery of fresh agricultural products. Additionally, we also provide several implications for businesses and platforms to attract individual participation in the crowdsourcing delivery of fresh agricultural products.

This article is organized as follows: First, we reviewed the related literature about individual knowledge-based crowdsourcing

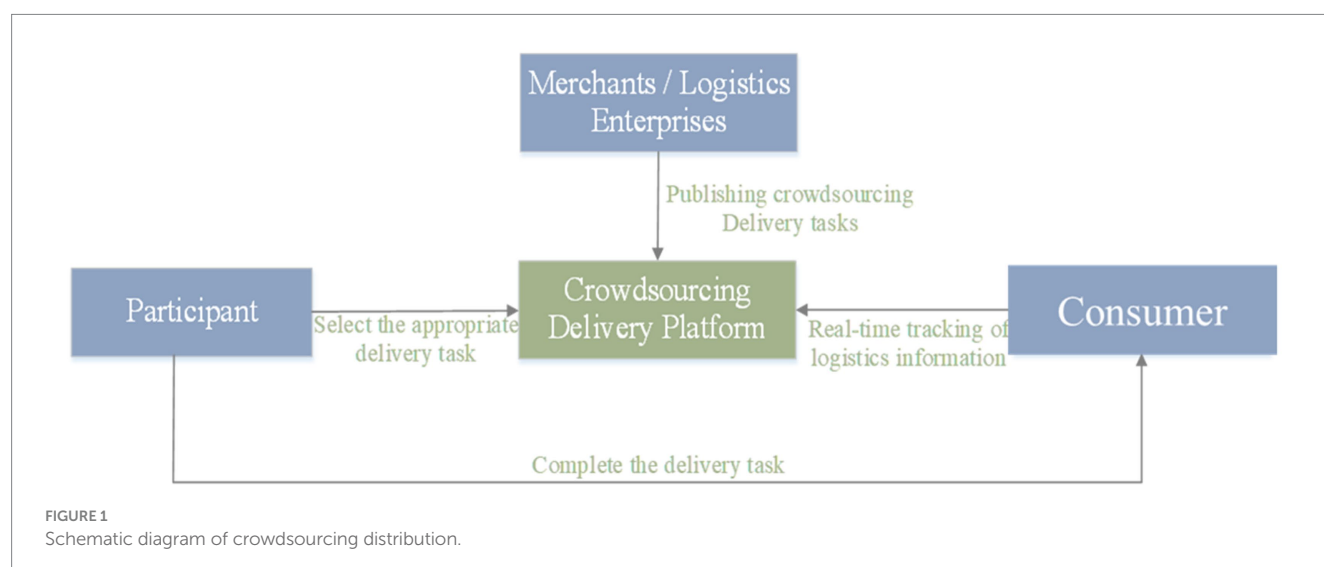


TABLE 1 Differences between crowdsourcing delivery and knowledge-based crowdsourcing.

Comparison dimension	Crowdsourcing delivery	Knowledge-based crowdsourcing
Professional requirements	Low	high
Crowdsourcing task	Complete the delivery task	provide solutions, methods, and knowledge
Trading mechanism	Piece counting mechanism	rewards, bidding, employment, or piece counting
Monetary reward	Low	mainly higher
RI type	RI of traffic accident, product damage, delayed rejection, and information leakage	intellectual property RI, information leakage RI, and capability RI

participation and individual crowdsourcing delivery participation. Then, based on the unified theory of acceptance and use of technology, we developed a new model to explain the impacts of expected reward, cost, trust, risk, social influence, travel characteristics, promotion conditions, and constraints (COs) on individuals' PW in crowdsourcing delivery. Next, we tested the model with 332 valid questionnaires from potential participants, and we employed analysis of moment structure (AMOS) to analyze the data and influence paths. Finally, we discussed the study's main findings and practical implications.

## 2 Literature review

With the rapid growth of fresh food e-commerce, an increasing number of studies are focusing on the delivery of fresh agricultural products and crowdsourcing delivery. This study reviews existing studies and theories that explain individual participation in knowledge-based crowdsourcing. Then, we reviewed individual participation in crowdsourcing delivery.

### 2.1 Individual participation in knowledge-based crowdsourcing

Individual willingness and behavior decision-making is a complex and systematic process influenced by multiple factors (Sahu et al., 2020). Depending on the specific research domain, scholars have adopted different theoretical models to explain public participation behavior (PH).

Recently, a few studies have examined Individual participation in knowledge-based crowdsourcing conceptually (Terwiesch and Xu, 2008) and empirically (Boons et al., 2015). In addition, most existing studies believe that economic reward, enjoyment, improvement of skills, trust, and other factors are essential motives that affect individual participation in crowdsourcing. For example, Shao et al. (2012) developed a model to explain individual participation in crowdsourcing and tested it using data from Chinese crowdsourcing websites. The results showed that higher rewards, more manageable tasks, longer task time, and lower competition intensity would attract more crowdsourcing participants. Based on the social exchange theory, Ye and Kankanhalli (2017) developed a model to explain how rewards, costs, and trust affect individual participation behavior in crowdsourcing. The study found that monetary rewards, skill enhancement, job autonomy, entertainment, and trust have a positive effect on solvers' participation in crowdsourcing. In contrast, cognitive efforts hurt their participation. In addition, Li and Hu (2017) developed a model based on expectation theory to explore the impact

of rewards and competition intensity on participant registration and submission behavior. The research found that the task reward was positively correlated with the number of registered and submitted tasks, while the competition intensity was negatively correlated with the solver's submission. Based on the self-determination theory (SDT), Suen et al. (2022) advanced the theoretical understanding of the effects of employee motivation antecedents (the three basic psychological needs: autonomy, competence, and relatedness) on participation efforts in internal crowdsourcing activities.

### 2.2 Individual participation in crowdsourcing delivery

At present, crowdsourcing delivery mode is still in its early stages of development. Previous studies have typically focused on the current development status of crowdsourcing delivery and analyzed the advantages and disadvantages of crowdsourcing delivery (Pourrahmani and Jaller, 2021). Research on the PW of crowdsourcing delivery was rare. Some scholars have noted that crowdsourcing delivery could reduce delivery costs while ensuring fast and reliable delivery (Devari et al., 2017).

Among the limited research on PW of crowdsourcing delivery, the majority of studies suggest that factors such as expected reward, effort, the environment of the crowdsourcing website, and cost of execution would affect individuals' PW of crowdsourcing delivery. For instance, Bin et al. (2020) developed a model to explore the influencing factors of enterprises' willingness to implement crowdsourcing logistics based on the technology–organization–environment (TOE) theoretical model. In a similar vein, Liang et al. (2017) developed a model of influencing factors for the continuous PW of crowdsourcing delivery and found that participation motivation, subjective norms, and satisfaction would affect individual continuous PW in crowdsourcing delivery. Liu Y. et al. (2024) explored the moderating effect of perceived risk on the correlations between satisfaction and continuous-use intention, perceived value and continuous-use intention, and trust and continuous-use intention. The findings revealed that trust, perceived value, and satisfaction positively contributed to continuous-use intention, where trust contributed the most.

### 2.3 Summary

According to our review, we found that due to the rapid development of crowdsourcing in China in recent years, there is a lack of existing theoretical foundations. Additionally, the majority

of the existing research focused on the feasibility of crowdsourcing delivery and the advantages and disadvantages of crowdsourcing delivery. However, relatively few have examined individuals' PW in crowdsourcing delivery. Furthermore, the majority of researchers believed that expected revenue, effort expectations, crowdsourcing website environment, execution cost, and other factors would affect the individuals' PW in crowdsourcing delivery. However, there is very little empirical research examining the influence of risk and travel characteristics factors on individual participation in crowdsourcing delivery of fresh agricultural products. Therefore, this study selects crowdsourcing delivery as the research object, considering various factors including risk and travel characteristics from the perspective of social exchange theory, and analyzes the factors that affect individual participation in crowdsourcing delivery.

In this study, we investigate the PW in crowdsourcing delivery of fresh agricultural products, considering the influencing factors of individual trust, participation risks, travel characteristics, and constraints within the research model.

### 3 Research model and hypotheses

Drawing on the literature, we propose that expected reward, cost, social influence, and promotion conditions will affect individuals' PW of crowdsourcing delivery of fresh agricultural products. Considering the characteristics of crowdsourcing delivery of fresh agricultural products, we propose that participation risk, trust, travel characteristics, and constraints will affect individuals' PW of crowdsourcing delivery. In addition, we propose that risk has a significant mediating effect on individual participation in

crowdsourcing delivery through expected cost (EC). Social influence has a significant mediating effect on individual participation in crowdsourcing delivery through trust. The model we developed is shown in Figure 2.

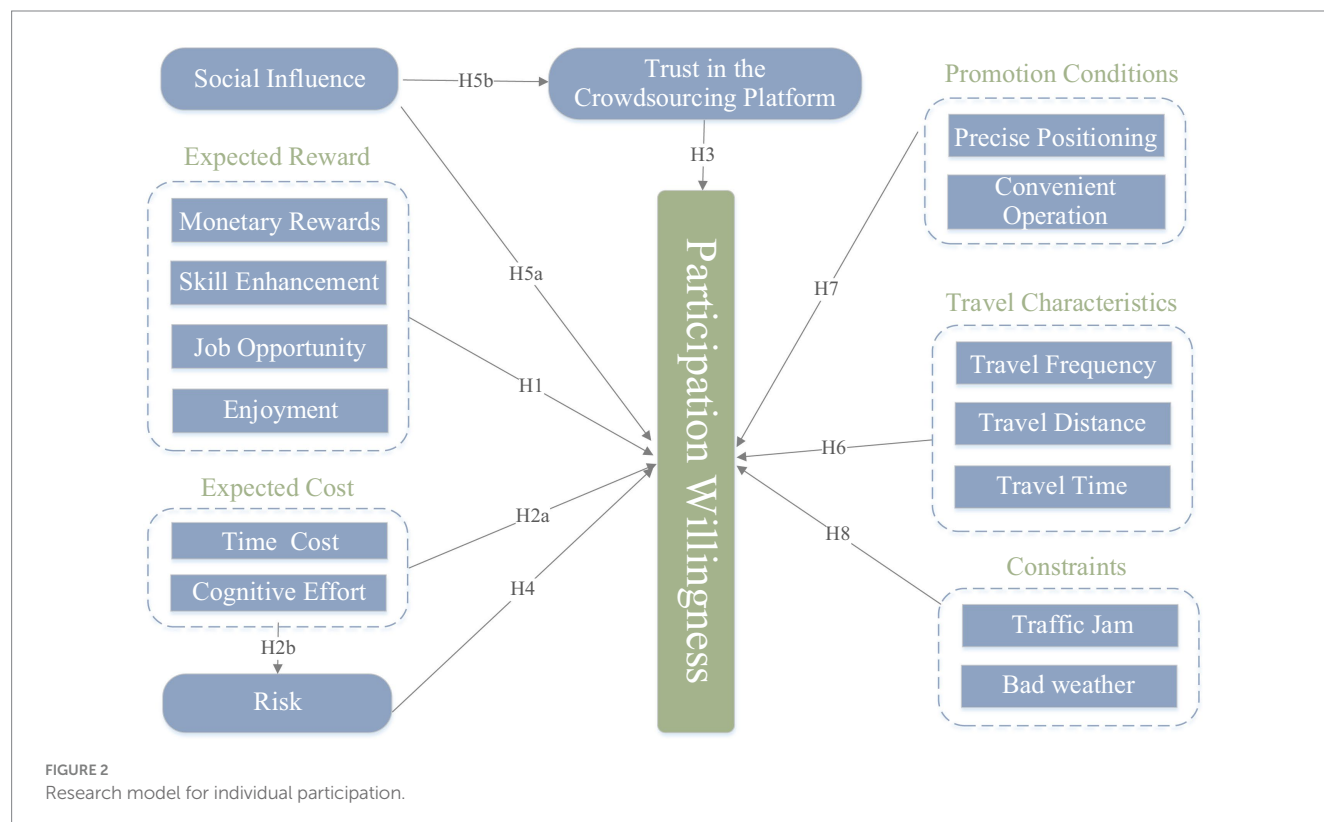
#### 3.1 Subsection expected reward

Expected reward (ER) refers to the prediction of the reward that crowdsourcing delivery participants can obtain, assuming no accidents occur. Except for monetary rewards, rewards include non-monetary rewards, such as enjoyment, job opportunities, and skill enhancement. Previous literature has suggested that expected rewards are important drivers for individuals to participate in crowdsourcing delivery. For example, Peng and Zhang (2010) found that learning knowledge and financial rewards are the primary reasons for attracting individuals to participate in crowdsourcing. Gonçalves et al. (2014) analyzed some cases and found that crowdsourcing platforms can obtain better service quality and more individual participation through incentives. Following the discussion above, we propose hypothesis H1 that the expectation of reward will enhance individuals' PW in crowdsourcing delivery of fresh agricultural products:

*H1: Expected reward is positively related to individuals' PW of crowdsourcing delivery of fresh agricultural products.*

#### 3.2 Expected costs

Expected costs (EC) refer to the various costs that individuals perceive when participating in crowdsourcing delivery of fresh





agricultural products. Similar to expected rewards, expected costs encompass both monetary costs and non-monetary expenses. The non-monetary costs primarily refer to time, search, and travel costs (Patel et al., 2023). When individuals decide whether to participate in crowdsourcing delivery, they will consider not only their benefits but also the various costs they incur for participating in crowdsourcing delivery of fresh agricultural products. Such as the time required to participate in the various operational links of the task process, the energy required to participate in the delivery task, searching for suitable delivery tasks will take up time, etc. Therefore, this study proposes hypothesis H2a:

*H2a: Expected costs are negatively related to individuals' PW in crowdsourcing delivery of fresh agricultural products.*

Additionally, we propose that the expected cost will affect individuals' perceived participation risk. The higher the expected cost perceived by individuals, the more worried individuals are about their participation in crowdsourcing delivery, and it will increase their perceived risk or weaken their PW. That is, the higher the expected cost, the greater the perceived risk of participation by individuals. Thus, this study proposes hypothesis H2b:

*H2b: Risk has a significant mediating effect on individual participation in fresh agricultural products through crowdsourcing delivery as influenced by expected cost.*

### 3.3 Trust

During crowdsourcing delivery activities, an exchange occurs between the individual and crowdsourcing delivery platform, with trust (TR) playing a key role in the process. The crowdsourcing delivery of fresh agricultural products involves many aspects of trust-related concerns, such as whether the platform delivers services effectively, adheres to its commitments to the public, and objectively defines responsibilities while taking into account the interests of all participants. Therefore, we believe that these trust issues will affect the public's PW in crowdsourcing delivery according to the above discussion. Thus, this study proposes hypothesis H3:

*H3: Trust is positively related to individuals' PW in crowdsourcing delivery of fresh agricultural products.*

### 3.4 Risk

Participation risk in this study refers to various risks that the public perceives when participating in crowdsourcing delivery activities, such as time risk and security risk (Cui et al., 2022). We believe that the public may face a few risks when participating in crowdsourcing delivery. For example, time risk refers to the fact that customers cannot pick up on time, or participating in crowdsourcing delivery may take up your original travel time. Security risk refers to the possibility that the individual may encounter traffic accidents during the delivery. Since there are currently no relevant laws or regulations that clearly stipulate this, it may result in participants being at a disadvantage in crowdsourcing delivery, and weaken the

public's PW in crowdsourcing delivery of fresh agricultural products. Therefore, this study proposes hypothesis H4:

*H4: Risk is negatively related to individuals' PW in crowdsourcing delivery of fresh agricultural products.*

## 3.5 Social influence

People have sociality, so they will inevitably be affected by people around them in their daily lives and interactions with others. In this research, social influence (SI) refers to the impact of the surrounding groups' attitudes, thoughts, and behaviors on the public's participation in crowdsourcing delivery when the public determines whether they are willing to participate in crowdsourcing delivery. Thus, this study proposes hypothesis H5a:

*H5a: Social influence is positively related to individuals' PW in crowdsourcing delivery of fresh agricultural products.*

In addition, if people around the individuals have good evaluations of crowdsourcing delivery, the individuals will have more positive attitudes toward crowdsourcing delivery and it will increase their trust in the crowdsourcing delivery platform. Thus, this study proposes hypothesis H5b:

*H5b: Social influence has a significant mediating effect on the individual participation in crowdsourcing delivery of fresh agricultural products through trust.*

## 3.6 Travel characteristics

Unlike the knowledge-based crowdsourcing, crowdsourcing delivery accompanies individual travel. Thus, travel characteristics will affect individuals' PW in crowdsourcing delivery. The indicators used to measure the characteristics of residents' travel mainly include the frequency of travel, the purpose of travel, the mode of transportation, the travel distance, and the travel time. However, the purpose of travel and the transportation of travel cannot be quantified and cannot be researched in this study. Combined with the characteristics of crowdsourcing delivery, we primarily consider three aspects: residents' travel time, the travel distance, and the frequency of residents' travel. So, we propose hypothesis H6:

*H6: Travel characteristics have an impact on individuals' PW in crowdsourcing delivery of fresh agricultural products.*

## 3.7 Promotion conditions

Promotion conditions (PCs) in our study refer to the help that the public can get from firms or crowdsourcing delivery platforms when they participate in crowdsourcing delivery. Economic incentives are important factors that can increase the public's motivation to participate in an activity (Ali and Anwar, 2021). Drawing on the above discussion, we believe that promotion conditions can strengthen the individuals' PW in crowdsourcing delivery. The firms or platforms can

encourage the public to participate in crowdsourcing delivery through a series of incentive measures. Specifically, promotion conditions in our study include closer orders to travel destinations, the precise location of merchants and customers, an incentive system, updating the delivery tasks in time, a reasonable web design of a platform and a more convenient operation. Thus, this study proposes hypothesis H7:

*H7: Promotion conditions are positively related to individuals' PW in crowdsourcing delivery of fresh agricultural products.*

### 3.8 Constraints

Crowdsourcing delivery differs from traditional crowdsourcing activities, which typically involve completing tasks online. Crowdsourcing delivery of fresh agricultural products assumes that the packages were delivered on time. This leads to some constraints that prevent the public from participating in crowdsourcing delivery. For example, an individual may not want to participate in crowdsourcing delivery when there is a traffic jam or the weather is bad. Thus, this study proposes hypothesis H8:

*H8: Constraints are negatively related to individuals' PW in crowdsourcing delivery of fresh agricultural products of fresh agricultural products.*

### 3.9 Participation willingness

Willingness is an individual's view and thoughts on something, and personal subjective thinking directly affects the probability and intensity of the individual's execution of something. In this study, participation willingness (PW) refers to the subjective thinking of an individual's attempt to participate in crowdsourcing delivery, including searching for appropriate tasks and accomplishing the delivery.

## 4 Research methodology and data analyses

A survey methodology was employed to test our research model. Survey methodology is a crucial approach for collecting data in empirical research. As a tool for collecting quantitative information, the questionnaire can quantify individual attitudes and behaviors, which is convenient for further processing and analysis.

### 4.1 Questionnaire design and structure

The questionnaire in this study consisted of three parts. The first part provided a description of crowdsourcing delivery of fresh agricultural products, so that the interviewees could better fill out the questionnaire. The second part collected personal information from the interviewee, such as gender, age, education, and income. The third part was items of the research variables.

This survey involved nine variables they are expected reward, expected cost, trust, risk, social influence, promotion conditions, constraints, travel characteristics, and PW. To analyze all the

measurements conveniently, items in our survey are adopted by Likert's 5-level scale, with a 5-point format from 1 = strongly disagree to 5 = strongly agree. The items of all variables in the survey are listed in [Table 2](#).

### 4.2 Data collection

The respondents in this study were selected from potential participants, specifically individuals who had not previously engaged in crowdsourcing delivery. To test the research model, we collected questionnaires using both online and offline methods, resulting in a total of 354 questionnaires. Excluding questionnaires with very short response times and a highly consistent selection of items, we obtain 332 valid questionnaires.

To ensure the accuracy of the analysis results, we conducted a descriptive statistical analysis of the 332 valid samples collected. The Statistical Package for the Social Sciences (SPSS, the software developed by IBM Corporation) was used to analyze the interviewees' sex, age, education level, and monthly income. The respondent demographics and background were summarized in [Table 3](#).

According to [Table 3](#), the age of the valid sample is mainly distributed in the 18–45 age range, accounting for 85.5% of the overall valid sample. In real life, individuals involved in delivery activities are primarily between 18 and 45 years old, young and middle-aged people. Therefore, the age structure of the sample in this study is reasonable. In addition, 97% of the respondents in this study have an education level of a bachelor's degree or below. In real life, the majority of individuals involved in delivery activities have an education of a bachelor's degree or below, so the education level of the sample in this study is in line with reality. Additionally, [Table 3](#) lists that the majority of respondents have a monthly income of less than 5,000 renminbi (RMB), with a sample size of 74.7%. Crowdsourcing delivery is still predominantly part-time, so groups with low or no income are more likely to participate in crowdsourcing delivery of fresh agricultural products.

### 4.3 Instrument validity

To validate our survey instrument, convergent validity tests were conducted. Convergent validity was assessed by examining composite reliability (CR), average variance extracted (AVE), and the results of the factor analysis. When the value of AVE > 0.5 and CR > 0.7, it indicates that the validity of the instrument is reliable ([Cheung et al., 2024](#)). [Table 4](#) shows that the values of CR and AVE for each model construct satisfy the thresholds, except for travel characteristics. Therefore, in the subsequent analysis, this study excluded the items related to travel characteristics.

## 5 Results of hypotheses testing

For the analysis, structural equation modeling (SEM) was chosen to test our model and hypotheses because SEM can simultaneously analyze all paths with latent variables in one analysis ([Sarstedt et al., 2022](#)). Before testing the hypotheses, we first tested the fitness of the model. The results of the index are shown in [Table 5](#). It can be seen that the fitting indices of the models have reached acceptable values, which shows that the model in this research has good fitness.

TABLE 2 Items of measurement constructs.

Constructs	Code	Items
ER	ER1	I can receive monetary rewards by participating in crowdsourcing delivery of fresh agricultural products
	ER2	I enjoy participating in crowdsourcing delivery of fresh agricultural products
	ER3	Participating in crowdsourcing delivery of fresh agricultural products can provide me a new job opportunity
	ER4	I can improve my skills in a particular area through participating in crowdsourcing delivery of fresh agricultural products
ECs	EC1	It takes me a few times to master the various operation steps of the crowdsourcing delivery process
	EC2	Participating in crowdsourcing delivery may take up my travel time
	EC3	It takes me a few energies to participate in crowdsourcing delivery of fresh agricultural products
	EC4	Searching for suitable tasks of delivery will take me a few time
TR	TR1	I believe that the platform can guarantee the safety of my personal information and account
	TR2	I hope that the platform is professional and well-known
	TR3	I believe the platform can objectively define relevant responsibilities and consider the benefits to participants
RI	RI1	When delivering fresh agricultural products, I may encounter traffic accidents
	RI2	Customers cannot sign for the delivery in time will extend my task time for completing delivery
	RI3	If the package is not delivered in time, I will bear the relevant responsibilities
	RI4	Extrusion and spoilage of fresh agricultural products may occur during delivering
SI	SI1	If people around me (such as family and friends) suggest me to participate, I will try
	SI2	The praise from people around me gives me a sense of accomplishment
	SI3	If there are many people involved in crowdsourcing delivery of fresh agricultural products, I will try.
TC	TR1	How many times do you travel per week?
	TR2	How long do you travel every time?
	TR3	The distance you travel each time is
PCs	PC1	The platform's precise location of merchants and customers makes my work more convenient
	PC2	I hope the platform can update the delivery tasks in time
	PC3	I hope the web design of the platform is reasonable and the operation is convenient
COs	CO1	I do not want to participate in crowdsourcing delivery when it has traffic jam
	CO2	I do not want to participate in crowdsourcing delivery when the weather is bad
PW	PW1	In the future, I will participate in crowdsourcing delivery
	PW2	I will recommend the crowdsourcing delivery to my relatives and friends
	PW3	I think participating in crowdsourcing delivery platform is in line with my interests
PH	PH1	In my free time, I will do the work of crowdsourcing delivery
	PH2	I will ship multiple delivery orders at the same time when possible
	PH3	I will pay attention to the service attitude when delivering

ER, expected reward; EC, expected costs; TR, trust; RI, risk; SI, social influence; TC, travel characteristics; PCs, promotion conditions; COs, constraints; PH, participation behavior; PW, participation willingness.

Then we used AMOS to test the model and hypotheses of our research, the results are shown in [Tables 6, 7](#).

According to [Table 6](#), expected reward, trust, social influence, and promotion conditions were positively related to individuals' PW in crowdsourcing delivery of fresh agricultural products, while expected cost was negatively related to individuals' PW in crowdsourcing delivery of fresh agricultural products. However, contrary to our hypotheses, risk and constraints were not related to individuals' PW in crowdsourcing delivery of fresh agricultural products.

According to [Table 7](#), the effect value of the path, social influence → trust → PW is within the confidence interval, and the value of  $p$  is less than 0.05. Therefore, social influence has a significant mediating effect on the individuals' PW in crowdsourcing delivery through trust. In contrast, the confidence interval under the path of expected cost → risk

of participation → PW contains zero, and the path of risk of participation → PW is not significant. Therefore, the mediation effect of expected cost through participation risk on individuals' PW was not verified.

## 6 Discussion

To successfully promote the development of crowdsourcing delivery of fresh agricultural products, it is essential for platforms and firms to understand how to effectively encourage individual participation. Based on the relevant literature, this study developed and empirically tested a model to explain individual participation in crowdsourcing delivery of fresh agricultural products. The findings indicate that expected reward, expected cost, trust, and social

TABLE 3 Respondents' background.

Variables		Frequency	Percentage (%)
Sex	Male	200	60.2
	Female	132	39.8
Age (years)	18–24	177	53.3
	25–45	107	32.2
	Above 46	48	14.5
Education level	High school	56	16.9
	Junior college	74	22.3
	Bachelors	192	57.8
	Masters	10	3.0
Monthly income (yuan)	No income/students/unemployed	108	32.5
	<5,000	140	42.2
	5,000–8,000	69	20.8
	8,000–10,000	11	3.3
	>10,000	4	1.2

TABLE 4 Results of fitting index.

Construct	Items	AVE	CR	Cronbach's $\alpha$
ER	4	0.549	0.829	0.818
EC	4	0.520	0.844	0.802
TR	3	0.512	0.758	0.818
RI	4	0.5166	0.738	0.809
SI	3	0.502	0.749	0.811
TC	3	0.157	0.386	0.360
PC	3	0.689	0.899	0.874
CO	2	0.537	0.765	0.838
PW	3	0.504	0.794	0.819
Participation Behavior	3	0.524	0.767	0.806

ER, expected reward; EC, expected costs; TR, trust; RI, risk; SI, social influence; TC, travel characteristics; PC, promotion condition; CO, constraint; PW, participation willingness.

influence are significantly related to individuals' PW in crowdsourcing delivery. The expected cost was negatively related to individuals' PW in crowdsourcing delivery of fresh agricultural products.

Contrary to our prediction, the risks and constraints were not significantly associated with individuals' PW in crowdsourcing delivery of fresh agricultural products. The possible explanation is that, with the rapid development of e-commerce, an increasing number of people are familiar with delivery services and thus have a more accurate understanding of delivery-related risks. The risk items in our questionnaire likely aligned with public perceptions, making the risks associated with fresh produce delivery via crowdsourcing generally acceptable to respondents.

Additionally, objective constraints did not show a significant relationship with participation intention in crowdsourcing delivery of fresh agricultural products. We speculate that this may be because crowdsourcing delivery is typically integrated into individuals' existing

TABLE 5 Results of fitting index.

Value type	CMIN/DF	GFI	AGFI	CFI	RMSEA
Suggested value	<3.0	>0.7	>0.7	>0.7	<0.08
Actual value	2.79	0.89	0.86	0.85	0.068

travel plans. Even though there are objective restrictions, such as traffic jams and bad weather, individuals will still complete their original travel. Therefore, the objective constraints may have a limited impact on participation in the crowdsourcing delivery of fresh agricultural products.

Moreover, we found trust mediates the significant effect of social influence on individuals' PW in crowdsourcing delivery of fresh agricultural products. The findings of this study contribute to filling a gap in the empirical literature regarding the impact of risk factors on individuals' participation in crowdsourcing delivery of fresh agricultural products. Thereby helping platforms and businesses design more effective strategies to attract and retain individual participants in the crowdsourcing delivery of fresh agricultural products.

## 7 Conclusion

### 7.1 Recommendations

Individual participation in crowdsourcing delivery of fresh agricultural products is critical to platforms' survival and profitability of firms and platforms. To better understand how to motivate individual participation, we developed and tested a model to identify the key factors influencing individuals' willingness to engage in crowdsourcing delivery of fresh agricultural products. Our findings indicate that expected reward, trust, social influence, and promotion conditions positively influence individuals' PW in crowdsourcing delivery, while expected cost is negatively related to individuals' PW in crowdsourcing delivery of fresh agricultural products. From a practical standpoint, this study offers several recommendations for firms and crowdsourcing platform administrators seeking to attract and retain individual participants.

First, platforms should focus on enhancing various forms of rewards to incentivize participation. According to the results of this study, expected rewards (including monetary rewards, enjoyment, skill enhancement, and work autonomy) and incentive mechanisms have a significant effect on the PW in crowdsourcing delivery of fresh agricultural products. Therefore, additional revenue is the most effective incentive. To capitalize on this, crowdsourcing delivery platforms can establish an incentive mechanism to attract individuals to participate in crowdsourcing delivery of fresh agricultural products. For example, after the cumulative number of deliveries or miles per month reaches a certain threshold, the platform can provide participants with a specified additional reward.

Second, according to the results of this study, trust was positively related to individual participation in crowdsourcing delivery of fresh agricultural products. Therefore, platforms should focus on establishing effective trust-building mechanisms to enhance public confidence. Specifically, platforms could ensure that participants obtain appropriate rewards once their deliveries are accomplished. Additionally, the platform should uphold its commitment to participants and enhance its service level.



TABLE 6 Results of hypotheses testing.

Hypothesis	Path	Estimate	<i>p</i>	Supported/not supported
H1	PW ← Expected reward	0.380	***	Supported
H2	PW ← Expected Cost	−0.237	0.038	Supported
H3	PW ← Trust	0.212	0.019	Supported
H4	PW ← Risk	0.135	0.382	Not supported
H5	PW ← Social Influence	0.629	***	Supported
H7	PW ← Promotion Conditions	0.468	***	Supported
H8	PW ← Constraints	0.096	0.150	Not supported

PW, participation willingness. \*\*\**p* < 0.001.

TABLE 7 Results of hypotheses testing.

Path	Estimate	Bias-corrected 95% CI		
		Lower	Upper	<i>p</i>
Expected cost → Risk → PW	0.057	−0.137	0.209	0.755
Social influence → Trust → PW	0.104	−0.022	0.244	0.018

CI, confidence interval; PW, participation willingness.

Third, the results of this study show that social influence has a significant effect on individuals' PW in crowdsourcing delivery of fresh agricultural products. Therefore, from the perspective of social influence, platforms can set up an interactive community that relies on the app for crowdsourced delivery. Using interpersonal networks to influence the attitude of potential participants and increase their PW in crowdsourcing delivery of fresh agricultural products. An interactive community as a communication platform of participants in crowdsourcing delivery can focus on exchanging work experience, helping each other, and so on. Additionally, platforms can regularly organize some offline activities to create a relaxed and pleasant community environment. These activities can strengthen the bonds among participants by expanding their interpersonal networks, thereby enhancing individuals' PW in crowdsourcing delivery of fresh agricultural products.

## 7.2 Limitations and future work

This study has several limitations. First, expected benefits, expected costs, trust, participation risk, key travel characteristics, facilitating conditions, and constraints were identified as the primary factors influencing individual participation in this study. Although the data analysis indicates that the proposed model demonstrates strong explanatory power, these seven factors may not encompass all the variables that influence individuals' intentions to participate in crowdsourcing delivery of fresh agricultural products. Future research could further explore additional influencing factors and underlying mechanisms affecting individuals' PW in crowdsourcing delivery of fresh agricultural products. These may include attributes of the fresh produce, supportive government policies, political environment, and broader economic conditions. In addition, as the number of participants in crowdsourcing delivery of fresh agricultural products is currently relatively limited, this study focuses on how to attract potential participants. However, with the continued development of the industry, the number of actual participants is expected to grow significantly. Accordingly, future research should shift its focus toward optimizing operational models and enhancing platform functionalities

to sustain and strengthen individual engagement in fresh produce crowdsourcing delivery over the long term.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the [patients/ participants OR patients/participants legal guardian/next of kin] was not required to participate in this study in accordance with the national legislation and the institutional requirements.

## Author contributions

YL: Writing – original draft. YG: Methodology, Writing – review & editing. WS: Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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