Humanities & Social Sciences Communications

ARTICLE

https://doi.org/10.1057/s41599-025-04683-5 OPEN

Why do travelers discontinue using integrated ride-hailing platforms? The role of perceived value and perceived risk

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Despite integrated ride-hailing platforms have provided many benefits to travelers, there are also various potential risks. This study aims to examine travelers' discontinuance behavioral intention toward integrated ride-hailing platforms. The research framework was established by extending the theory of planned behavior (TPB) with perceived value and perceived risk. Perceived value was classified into utilitarian, hedonic, and social values, while perceived risk was classified into privacy, performance, security, and financial risks. Additionally, the factors of switch cost and personal innovativeness were included. An empirical analysis was carried out using partial least-squares structural equation modeling (PLS-SEM) based on a survey conducted in Nanjing, China. Furthermore, a multi-group analysis (MGA) was performed to examine behavioral differences across demographic variables. The findings suggest that discontinuous behavioral intention is influenced by subjective norms, perceived behavioral control, and attitude. Among them, perceived behavioral control shows the strongest impact (−0.190). Perceived value, including utilitarian, hedonic, and social dimensions, negatively influences discontinuance intention, whereas the four variables of risk perception positively affect discontinuance intention. Notably, social value, performance risk, and privacy risk act higher total effects on discontinuance intention. Switch cost is negatively associated with attitude (−0.222), and positively affects discontinuance intention (0.189). Personal innovativeness has positive and stronger effects on perceived value (0.237), negative effects on perceived risk (−0.174), and negative effects on discontinuance intention. Regarding MGA results, older travelers demonstrate a stronger impact of social value on perceived value, higher-income groups exhibit greater sensitivity to security risks, and frequent travelers prioritize utilitarian value.

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Introduction

Ride-hailing, also known as ride-sourcing or e-hailing, connects travelers and drivers through a platform. In 2009, Uber was founded by Garrett Camp and Travis Kalanick, and it is widely recognized as the first ride-hailing company in the world. Subsequently, various ride-hailing platforms rapidly expanded globally, such as Lyft, DiDi, Ola Cabs, etc. In 2023, Uber generated $ 37.2 billion and completed 9.44 billion trips. In China, DiDi achieved revenues of CNY 192.4 billion and completed 13.47 billion trips in 2023. Therefore, ride-hailing services have enriched the travel choices of urban residents and significantly reshaped the transportation system worldwide (Olayode et al. 2023; Qiao and Gar-On Yeh, 2023; Z. Wang et al. 2024).

In recent years, due to the fierce competition in the ride-hailing market, integrated ride-hailing platforms have rapidly emerged by aggregating multiple ride-hailing providers (Bao et al. 2023; Chen et al. 2024; Jiang et al. 2024; Zhou et al. 2021, 2022). Travelers need only one application to request ride-hailing services offered by various providers. In China, several major integrated ride-hailing platforms have promoted their services, such as Gaode and Meituan. For example, as one of the largest online map companies in China, Gaode has integrated various smaller ride-hailing providers to provide integrated ride-hailing services since 2017 (China Finance Online, 2024; Global Times, 2021). Noteworthily, according to the Ministry of Transport of China, in May 2024, 242 million orders were completed through integrated ride-hailing platforms, accounting for 25.6% of the ride-hailing industry (Ministry of Transport of the PRC, 2024). Therefore, integrated ride-hailing platforms potentially improve efficiency and convenience for travelers. However, due to the issue of responsibility allocation between platforms and providers, new challenges arise for travelers when using integrated ride-hailing platforms. In addition, this issue is especially prominent in China, as a result of the rapidly expanding market and unmatched regulatory methods.

Over the past few years, several incidents involving integrated ride-hailing platforms have been reported in China, such as non-transparent charging (The Paper, 2024), drivers lacking professional training and rigorous screening (Tencent News, 2023), privacy breaches of travelers (The Paper, 2022a), and even severe crime cases (The Paper, 2022b). Furthermore, these integrated ride-hailing platforms often shift the responsibility to ride-hailing providers, which in turn leaves travelers in a dilemma and makes it difficult for them to assert their rights. To mitigate the potential risks of integrated ride-hailing platforms, several regulatory documents were issued by the Ministry of Transport of China and the China Consumers Association in 2023 (Ministry of Transport of the PRC, 2023). However, according to data published by the Ministry of Transport of China in May 2024, the average compliance rate of integrated ride-hailing platforms only reached 54.9%, which is relatively lower than that of traditional ride-hailing platforms (Ministry of Transport of the PRC, 2024). Therefore, risk issues are becoming increasingly prominent for integrated ride-hailing platforms, especially in terms of privacy, performance, security, and financial risks. Consequently, travelers are discouraged from using integrated ride-hailing platforms due to these potential risks. To investigate travelers' behavior towards the negative aspects of integrated ride-hailing services, discontinuance behavioral intention is introduced. Compared to continuance behavioral intention, studying discontinuance behavior can highlight shortcomings of integrated ride-hailing services, which are a significant concern for travelers. In addition, discontinuance behavioral intention has been validated as an effective method for studying behavioral decisions related to negative aspects (Hardman and Tal, 2021; Ma et al. 2019; Ng, 2023; Zhang et al. 2024).

Assessing the discontinuance of behavioral intention towards integrated ride-hailing services is also crucial for maintaining market performance and ensuring long-term sustainability. From an economic perspective, high discontinuance rates can lead to a decline in active consumers and drivers, reducing revenues and network effects (Y. Wang et al. 2024; Zhou et al. 2021). Ultimately, this decline can extend to job losses, as such services provide flexible employment opportunities (Shr and Chang, 2024). Socially, as flexible and more affordable travel modes, the decrease in integrated ride-hailing market could exacerbate social inequalities, which can reflected in several aspects, such as increased trip costs (Bao et al. 2023; Jiang et al. 2024), less travel service supply (Ding et al. 2024), and decreased social welfare (Chen et al. 2024), etc. Thus, several societal benefits can arise from this study. Firstly, by examining factors that lead to discontinuance behavioral intention towards integrated ride-hailing services, it can guide integrated ride-hailing companies in optimizing their services to better meet user expectations. Secondly, by studying the elements of perceived risk and perceived value it can inform the development of regulatory frameworks that balance both benefits and sacrifices. Thirdly, as an emerging and technology-related service, understanding discontinuance behavioral intention concerning switch cost and personal innovativeness can help policymakers design more effective services that are responsive to consumer needs and conducive to innovation. Thus, it is essential to investigate travelers' discontinuance behavioral intention toward integrated ride-hailing platforms. What is more, by considering the relatively large market size and the situation faced by travelers in the Chinese integrated ride-hailing market, it is possible to study this issue in the Chinese context.

In the existing literature, travelers' behavior related to ride-hailing services has been explored extensively (Akram et al. 2024; Hu and Yang, 2024; Ma et al. 2019; Nguyen-Phuoc et al. 2022, 2021; Si et al. 2024; Tumaku et al. 2023). However, few studies have examined travelers' behavioral intention regarding integrated ride-hailing platforms, particularly discontinuance behavior. Due to the potential benefits of ride-hailing services, travelers' behavior is significantly influenced, emphasizing the role of usefulness (Akram et al. 2024; Bhatt et al. 2024), satisfaction (Hu and Yang, 2024; Nguyen-Phuoc et al. 2022; Si et al. 2024), perceived enjoyment (Akram et al. 2024; Elnadi and Gheith, 2022), and social impact (Hu et al. 2022; Nguyen-Phuoc et al. 2022). In addition to the positive aspects of ride-hailing services, some studies have introduced the variable of perceived risk and demonstrated its negative impact on travelers' intention towards ride-hailing services, such as security risk (Hu and Yang, 2024; Liu et al. 2022), privacy risk (Nguyen-Phuoc et al. 2021; Wang et al. 2019), and functional risk (Ma et al. 2019), etc. However, few studies have adequately integrated both perceived risk and perceived value to examine travelers' behavioral patterns. Furthermore, as an emerging mode, little research to date has considered the impact of factors such as switch cost and personal innovativeness related to integrated ride-hailing platforms, which have been examined as crucial determinants in transportation (Asgari and Jin, 2020; Elnadi and Gheith, 2022; Rozin, 2022; Vu et al. 2024). Accordingly, this study aims to address the following questions.

(1) What are the determinant factors that influence travelers' discontinuance behavioral intention towards integrated ride-hailing platforms?

(2) How do perceived value and perceived risk affect travelers' discontinuance behavioral intention towards integrated ride-hailing platforms?
(3) What is the impact of switch cost and personal innovativeness on travelers' discontinuance behavioral intention toward integrated ride-hailing platforms?

To address these research questions, this study aims to explore travelers' discontinuance behavioral intention toward integrated ride-hailing platforms. This study develops a theoretical framework by introducing both perceived value and perceived risk to extend the Theory of Planned Behavior (TPB). Specifically, to fully capture the role of both positive and negative aspects, utilitarian value, hedonic value, and social value are considered to form perceived value, while perceived risk is reflected by privacy risk, performance risk, security risk, and financial risk. Additionally, switch costs and personal innovativeness are considered. Furthermore, a survey was conducted in Nanjing, China. Consequently, an empirical study was performed using partial least squares structural equation modeling (PLS-SEM). Moreover, a multi-group analysis (MGA) was carried out to investigate the underlying behavioral differences among different groups in terms of age, income, and usage frequency.

To bridge the research gap, this study offers several contributions as follows. Firstly, this study investigates the general pattern of travelers' discontinuance behavioral intention towards integrated ride-hailing platforms, which could deepen the understanding of consumer behavior in the ride-hailing industry. Secondly, the discontinuance behavioral intention towards integrated ride-hailing platforms is studied by considering the impact of both perceived value and perceived risk, which is a supplement to existing literature. Thirdly, by including factors such as switch cost and personal innovativeness, the study provides a more nuanced perspective on travelers' behavior regarding integrated ride-hailing platforms.

The remainder of this paper is organized as follows. In the section "Literature review and hypotheses development", the existing relevant literature is analyzed, and hypotheses are proposed. The research method and data collection are described in the section "Method and data collection". In the section "Results", the measurement assessment, fitness, and results of the research model are presented. The discussion based on the research results is carried out in the section "Discussion". Finally, conclusions, implications, and limitations are presented in the section "Conclusion".

Literature review and hypotheses development

Existing relevant research. Integrated ride-hailing platforms are services that enable travelers to request ride-hailing services from multiple providers simultaneously through a single application. By integrating service providers, integrated ride-hailing platforms have emerged as a new business model in many cities. Currently, integrated ride-hailing platforms have been studied in some existing literature. Specifically, the profit and social welfare related to the platform operation of integrated ride-hailing platforms have been studied (Bao et al. 2023; Chen et al. 2024; Jiang et al. 2024). However, few existing studies have focused on travelers' behavioral intentions towards integrated ride-hailing platforms.

Travelers' behavior related to ride-hailing services has been investigated extensively in existing studies, which can provide insights for research on integrated ride-hailing platforms, as presented in Table 1. Subjective well-being regarding ride-hailing services has been verified as one of the most crucial aspects, encompassing both positive and negative variables (Hu and Yang, 2024; Kumar et al. 2022; Liu et al. 2022; Nguyen-Phuoc et al. 2021; Si et al. 2024; Tumaku et al. 2023; Yapp and Yeap, 2023). For instance, aspects such as economic value, satisfaction, trust, convenience, and risk perception have been studied. Based on the Theory of Consumption Value, Yapp and Yeap (2023) examined the relationship between perceived value and customer satisfaction of ride-hailing services. Additionally, satisfaction related to ride-hailing services consists of several dimensions, Si et al. (2024) explored satisfaction and subjective well-being regarding ride-hailing services, including platform satisfaction, driver and car satisfaction, and social satisfaction.

Furthermore, these factors have been introduced to examine travelers' behavioral intention on ride-hailing services (Bhaduri and Goswami, 2023; Bhatt et al. 2024; Hu et al. 2022; Ma et al. 2019; Nguyen-Phuoc et al. 2022; Wang et al. 2019). Using an SEM-MIMIC Ordered Probit approach, Bhaduri and Goswami (2023) found that attitude and perceived usefulness are the most influencing factors in ride-hailing adoption. Besides, negative expectations regarding ride-hailing services can play a crucial role in travelers' behavioral intention (Hu et al. 2022; Ma et al. 2019; Nguyen-Phuoc et al. 2022; Wang et al. 2019). The effect of perceived risk on ride-hailing adoption has been investigated. Nguyen-Phuoc et al. (2022) found that perceived risk has a negative and direct influence on usage intention. Moreover, perceived risk can be divided into several aspects, such as security perception, safety, etc. By introducing privacy risk, performance risk, security risk, and conflict risk, Wang et al. (2019) demonstrated that perceived risk is negatively related to consumers' intentions and positively moderates the effect of perceived value on consumers' intentions. Hu and Yang (2024) studied the safety of female ride-hailing passengers and indicated that driver's words and actions directly influence female passengers' safety judgments regarding ride-hailing services and that traveling with companions significantly enhances their perceived safety.

Continuance behavior emphasizes travelers' long-term behavior compared to general behavioral intention (Akram et al. 2024; Elnadi and Gheith, 2022; Malik and Rao, 2019). Based on the Technology Acceptance Model and the Innovation Diffusion Theory, Elnadi and Gheith (2022) studied the reuse behavior of ride-hailing services, indicating that perceived usefulness, perceived ease of use, social influence, perceived risk, perceived enjoyment, compatibility, interactivity, and personal innovativeness affect reuse behavior indirectly through attitude. Using samples from the younger generation, Akram et al. (2024) found that mobile ease of use and usefulness significantly impact the continuous usage intention of ride-hailing. Furthermore, expectation has been verified as one of the determinant factors for the continued usage of ride-hailing services by Malik and Rao (2019).

Discontinuance behavioral intention refers to the intent or plan of an individual to stop using a product or service, mainly focusing on the potential loss of consumers. It has been studied in consumer behavior across various areas, such as social media, electric vehicles, public buses, etc. (Deka and Liu, 2024; Hardman and Tal, 2021; Pang and Ruan, 2023; Zhang et al. 2024). Generally, in these studies, discontinuance behavioral intention has been defined as a consumer's intention or likelihood to stop using a product or service. Specifically, the determinants of discontinuance behavioral intention vary in different research contexts. For instance, based on a multinomial logit model analysis on data collected from New Jersey Transit, Deka and Liu (2024) indicate that ride discontinuation is determined by disability, high education, car ownership, etc. According to Hardman and Tal (2021), the discontinuation of plug-in electric vehicles is linked to several factors, including charging inconvenience, less efficient alternative vehicles, the lack of home charging capabilities, etc. Pang and Ruan (2023) studied the discontinuance intention towards smartphone apps from the

Table 1 Existing relevant research.

Literature	Research subject	Study area	Factors
Subjective well-being, satisfaction, and safety			
Yapp and Yeap (2023)	Perceived value and customer satisfaction	Malaysia	Economic value; Convenience value; Symbolic value; Sustainability value; Hedonic value
Si et al. (2024)	Ridesourcing travelers' satisfaction and subjective well-being	China	Platform satisfaction; Driver and car satisfaction; Social satisfaction
Nguyen-Phuoc et al. (2021)	Passenger satisfaction and loyalty towards ride-sourcing services	Vietnam	Booking app-related risk; Vehicle & driver-related risk
Tumaku et al. (2023)	Consumer engagement in the sharing economy	China	Hedonic value; Utilitarian value; Trust; Satisfaction
Kumar et al. (2022)	Service quality assessment	India	Comfort; Safety; Security; Reliability; Responsiveness
Liu et al. (2022)	Security perceptions	China	Risk characteristics; Situation characteristics; Individual background
Hu and Yang (2024)	Safety of female ride-hailing passengers	China	Driver image; Driver behavior; Traveling together; Mobile phone dependence; Information attention; Risk avoidance
Behavioral intention on ride-hailing services			
Hu et al. (2022)	Choice of ride-hailing or traditional taxi services	China	Attitude; Subjective norm; Perceived behavioral control
Wang et al. (2019)	Consumers' willingness to use ride-sharing services	China	Utilitarian value; Hedonic value; Social value; Privacy risk; Performance risk; Security risk; Conflict risk
Nguyen-Phuoc et al. (2022)	Intention to use on-demand shared ride-hailing services	Vietnam	Perceived risk; Price sensitivity; Perceived green value; Attitude; Subjective norm; Perceived behavioral control
Bhatt et al. (2024)	Adoption of ride-hailing services	India	Perceived value; Attitude; Frugality; Status consumption
Bhaduri and Goswami (2023)	User attitudes towards ride-hailing services	India	Perceived usefulness; Perceived ease of use; Perceived behavioral control; Subjective norm; Attitude
Ma et al. (2019)	Risk perception and intention to discontinue use of ride-hailing services	China	Functional risk; Time risk; Physical risk; Financial risk; Psychological risk
Continuance behavioral intention on ride-hailing services			
Elnadi and Gheith (2022)	Reuse ride-hailing services	Egypt	Perceived usefulness; Perceived ease of use; Social influence; Perceived risk; Perceived enjoyment; Compatibility; Interactivity; Personal innovativeness
Akram et al. (2024)	Continue using the ride-hailing app	India	Utilitarian value; Hedonic value; Attitude
Malik and Rao (2019)	Continued usage of ODR/ride hailing apps	India	Perceived usefulness; Perceived ease of use; Confirmation; Perceived value
This study	Discontinuance behavioral intention on integrated ride-hailing platforms	China	Perceived value; Perceived risk; Switch cost; Personal innovativeness

perspective of cognition–affect–conation and suggest that discontinuance intention is positively related to social network exhaustion and privacy invasion. In addition, Zhang et al. (2024) examined intermittent discontinuance behavior in social media, confirming the role of several factors, such as information overload, system feature overload, usage fatigue, privacy concerns, transition costs, and transition fatigue. However, few studies have examined travelers' discontinuance behavior intention towards ride-hailing services, especially for integrated ride-hailing platforms. Nevertheless, existing studies on discontinuance behavioral intention can also provide insights for this research. As depicted above, integrated ride-hailing services involve various aspects of potential risks, which eventually affect travelers' choice behavior. Hence, it is essential to study travelers' behavioral patterns toward integrated ride-hailing platforms from the perspective of risk perception. Therefore, as an efficient research method that has been validated in the existing literature to evaluate behavioral patterns from the negative side, discontinuance behavioral intention is considered in this study.

To predict and explain travelers' discontinuance behavioral intention toward integrated ride-hailing platforms, a theoretical framework was developed by extending TPB. In TPB, factors such as attitude, perceived behavioral control, and subjective norm are included to explain behavior (Ajzen, 1991). Noteworthily, TPB has also been widely adopted to investigate discontinuance behavior and has been verified as an appropriate theory for this purpose (Avornyo et al. 2024; Luqman et al. 2018; Soliman and Tuunainen, 2022). Furthermore, perceived value and perceived risk are included by considering the features of integrated ride-hailing platforms. Besides the positive aspects, such services can also generate risks for travelers. Therefore, travelers' attitude toward integrated ride-hailing platforms is influenced by both perceived value and perceived risk (Acheampong et al. 2023; Bhatt et al. 2024; Ma et al. 2019). Additionally, perceived value consists of utilitarian value, hedonic value, and social value, while perceived risk includes privacy risk, performance risk, security risk, and financial risk. Nowadays, travelers are confronted with kinds of transport modes, making switching costs particularly relevant for these emerging services (Bursa et al. 2022; Nguyen-Phuoc et al. 2023b; Zhou et al. 2024). Thus, travelers' behavior and attitude toward integrated ride-hailing platforms are affected by switch costs. Further, as new technologies are involved in integrated ride-hailing services, the innovativeness of individuals can potentially affect their valuations and risk perceptions (Elnadi and Gheith, 2022). Thus, switch cost and personal innovativeness are introduced into the theoretical framework as well.

Theory of planned behavior. The theory of planned behavior (TPB), first proposed by Ajzen (1991), has become a pivotal framework for understanding and predicting behavioral intentions of consumers. The TPB suggests that an individual's behavioral intention is determined by three primary components, attitude, subjective norm, and perceived behavioral control (Chou et al. 2024; Hu et al. 2022; Irawan et al. 2023; Javid et al. 2022).

Attitude is a fundamental concept in TPB and refers to the evaluative judgments or feelings individuals hold toward a specific service or product. In the context of this study, attitude refers to travelers' degree of evaluation regarding the adoption of

integrated ride-hailing platforms. The effect of attitude on the behavioral intention of ride-hailing has been explored, suggesting that behavioral intention is significantly related to attitude (Acheampong et al. 2023; Akram et al. 2024, 2024; Nguyen-Phuoc et al. 2022). Conversely, a positive attitude towards integrated ride-hailing platforms will decrease the intention to discontinue using them. Subjective norm refers to an individual's perception of social pressure to perform or not perform a particular behavior. In this study, it encompasses the perceived social pressure to adopt integrated ride-hailing platforms. In existing studies, travelers' decisions are influenced by social pressure from friends, family members, colleagues, etc. (Bhaduri and Goswami, 2023; Hu et al. 2022). Therefore, if travelers are positively affected by their social networks, they will tend to decrease their intention to discontinue integrated ride-hailing platforms. Perceived behavioral control refers to travelers' belief about their ability to perform the behavior and overcome any obstacles to integrated ride-hailing platforms. If travelers perceive greater difficulties, their tendency to use such services will decrease (Bhaduri and Goswami, 2023; Nguyen-Phuoc et al. 2022). Consequently, this study proposes the following hypotheses.

H1: Attitude is negatively related with travelers' discontinuance behavioral intention.

H2: Subjective norm is negatively related with travelers' discontinuance behavioral intention.

H3: Perceived behavioral control is negatively related with travelers' discontinuance behavioral intention.

Perceived value. Perceived value has emerged as a crucial influencing factor in behavior research. In this research, perceived value refers to the overall evaluation of integrated ride-hailing platforms by travelers based on their assessment of the platforms' benefits. According to existing studies, travelers' attitudes will improve if their perception of the benefits from services is relatively high (Acheampong et al. 2023; Bhatt et al. 2024; Nguyen-Phuoc et al. 2022; Shao et al. 2022). Also, relevant research indicates that perceived behavioral control is positively affected by the perceived value (Adu-Gyamfi et al. 2022). In the context of this research, if travelers have a higher valuation of integrated ride-hailing platforms, they may have greater confidence in their ability to use such platforms. As for the relationship between perceived value and subjective norm, it shows that perceived value positively influences subjective norm (Izquierdo-Yusta et al. 2022; Shang et al. 2023). When travelers perceive greater benefits or values from using integrated ride-hailing platforms, their perception of the opinions of social members is likely to strengthen. Thus, the following hypotheses are proposed.

H4a: Perceived value is positively related with travelers' attitude.

H4b: Perceived value is positively related with travelers' perceived behavioral control.

H4c: Perceived value is positively related with travelers' subjective norm.

Generally, the evaluation of perceived value is not merely based on objective attributes but also considers subjective factors such as emotions and social experiences (Akram et al. 2024; Elnadi and Gheith, 2022; Si et al. 2024; Wang et al. 2019; Yapp and Yeap, 2023). Considering the features of integrated ride-hailing platforms, perceived value is reflected in three dimensions, utilitarian value, hedonic value, and social value. Utilitarian value pertains to the functional benefit of integrated ride-hailing platforms, while hedonic value captures the emotional responses elicited by these services. In addition, social value reflects the ability of integrated ride-hailing platforms to enhance travelers' social status or social image. Thus, the following hypotheses are proposed.

H5a: Utilitarian value is positively related with travelers' perceived value.

H5b: Hedonic value is positively related with travelers' perceived value.

H5c: Social value is positively related with travelers' perceived value.

Perceived risk. In this study, perceived risk refers to travelers' subjective assessment of potential negative outcomes associated with integrated ride-hailing platforms. A substantial body of literature has been dedicated to understanding the dimensions of perceived risk in research on ride-hailing services (Hu and Yang, 2024; Liu et al. 2022; Ma et al. 2019; Nguyen-Phuoc et al. 2021; Wang et al. 2019; Zhai et al. 2023). Furthermore, higher perceived risks will lead to a decreased attitude towards a specific service or product (Elnadi and Gheith, 2022; Nguyen-Phuoc et al. 2022; Shao et al. 2022). Conversely, a reduction in perceived risk can enhance travelers' willingness to adopt integrated ride-hailing platforms. Further, in some existing literature, it was found that perceived risk is also related to perceived behavioral control (Bae and Chang, 2021; Hansen et al. 2018). In addition, concerning the context of this study, an increased risk perception will decrease travelers' belief in their ability to adopt integrated ride-hailing platforms. Besides, some studies demonstrate that subjective norms are related to perceived risk as well (Bae and Chang, 2021; Sarosa, 2022). For integrated ride-hailing platforms, if travelers' risk perception is relatively high, then it will lead to a decrease in their belief in social pressures from close members. Therefore, the following hypotheses are proposed.

H6a: Perceived risk is negatively related with travelers' attitude.

H6b: Perceived risk is negatively related with travelers' perceived behavioral control.

H6c: Perceived risk is negatively related with travelers' subjective norm.

According to existing studies and the risks associated with integrated ride-hailing platforms, perceived risk is categorized into privacy risk, performance risk, security risk, and financial risk (Ma et al. 2019; Nguyen-Phuoc et al. 2021; Wang et al. 2019). Privacy risk refers to the concern that personal information may be mishandled or misused by integrated ride-hailing platforms. Performance risk is the uncertainty about whether integrated ride-hailing platforms will meet expectations or perform as advocated. Security risk involves concerns about safety during the use of integrated ride-hailing platforms. Financial risk is the possibility of losing money or experiencing financial loss as a result of using integrated ride-hailing platforms. These four dimensions jointly constitute the perceived risk of integrated ride-hailing platforms. Thereby, the following hypotheses are carried out.

H7a: Privacy risk is positively related with travelers' perceived risk.

H7b: Performance risk is positively related with travelers' perceived risk.

H7c: Security risk is positively related with travelers' perceived risk.

H7d: Financial risk is positively related with travelers' perceived risk.

Switch cost. In this research, switch cost refers to the perception of barriers associated with transitioning from general ride-hailing services to integrated ride-hailing platforms, encompassing economic, effort-related, and psychological aspects. Referring to extant studies, it is evident that switch cost plays a crucial role in consumer behavior (Asgari and Jin, 2020; Guo et al. 2023; Zhou et al. 2024), yet it has been neglected in research on ride-hailing

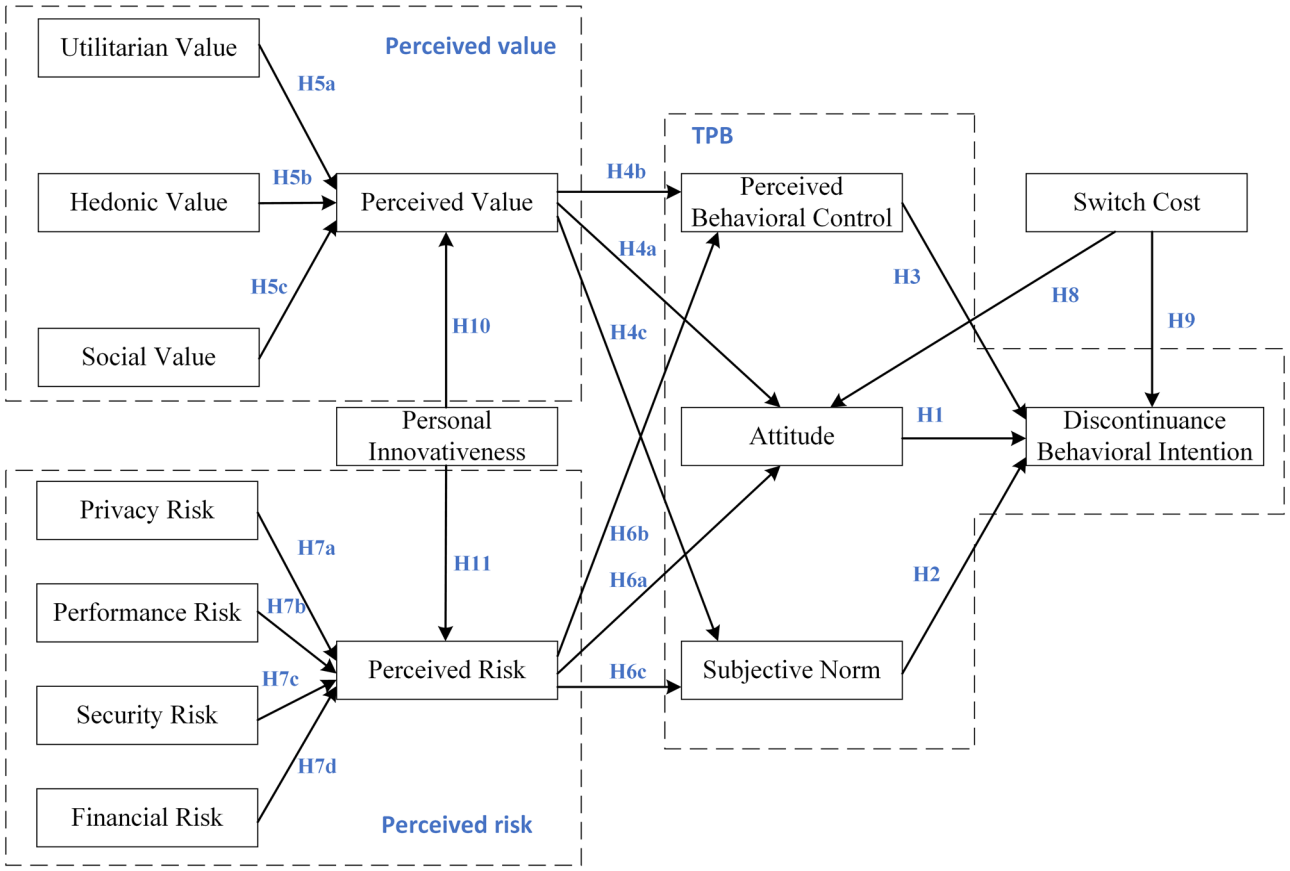

Fig. 1 Theoretical framework.

services. Typically, if the switching cost is relatively high, then it will lead to negative evaluations and intentions regarding integrated ride-hailing platforms, as travelers are less likely to overcome the associated barriers. Therefore, H8 and H9 are proposed.

H8: Switch cost is negatively related with travelers' attitude.

H9: Switch cost is positively related with travelers' discontinuance behavioral intention.

Personal innovativeness. Personal innovativeness, as a key driver of the formation of behavioral intention, has been examined in the research field of ride-hailing services (Elnadi and Gheith, 2022; Lee and Wong, 2021; Shaikh et al. 2023). In the context of integrated ride-hailing platforms, it refers to a travelers' ability and tendency to generate new ideas, solutions, or methods involving creativity, problem-solving skills, adaptability, etc. Effective personal innovativeness can potentially influence travelers' behavioral intentions. If personal innovativeness is established, it can increase the perceived value of travelers by providing clear benefits and reducing uncertainty, thereby lowering perceived risk. Therefore, this study proposes the following hypotheses:

H10: Personal innovativeness is positively related with travelers' perceived value.

H11: Personal innovativeness is positively related with travelers' perceived risk.

Based on the hypotheses proposed above, the theoretical framework was established, as depicted in Fig. 1.

Method and data collection

Survey design. To understand travelers' discontinuance behavioral intention toward integrated ride-hailing platforms, a questionnaire was designed that includes three aspects. (1) A brief introduction to integrated ride-hailing and the purpose of this survey. (2) Socio-demographic information of the respondents. (3) Measurement items of the latent variables. A 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree, was employed to evaluate the value of the items. To ensure the reliability of this survey, several measures were adopted. Firstly, the items of the questionnaire were designed by referring to existing literature and considering the actual situation of integrated ride-hailing platforms. Secondly, a group consisting of five transportation researchers and users of integrated ride-hailing platforms was employed to revise the questionnaire. Thirdly, 50 travelers with experience with integrated ride-hailing platforms were employed to conduct a pretest. Finally, the questionnaire was improved through these procedures. The detailed items of each construct are presented in Table A1 in Appendix.

Data collection. The data collection was conducted through Sojump, one of the most prominent online survey service providers in China. The quality of this platform has been verified in numerous previous studies (Del Ponte et al. 2024; Jiang and Lau, 2021; Lee et al. 2024; Ma et al. 2019; Si et al. 2024). The survey target of this study is travelers in Nanjing, China, one of the biggest cities in eastern China. According to the data released by Nanjing Municipal Bureau of Transportation, there were 10 legally licensed ride-hailing companies and over 313 thousand average daily orders as of June 2023. The paid sample service of Sojump was adopted to ensure data quality. The data collection process for this study involved several steps. Firstly, a pre-screening phase was carried out by Sojump to ensure that only respondents residing in Nanjing were included. Secondly, the Sojump platform sends out invitations to a randomly selected group from its member pool. An additional screening step was

Table 2 Descriptive statistics.

Value	Frequency	Percent	Value	Frequency	Percent
Gender			*Monthly Income (yuan)*		
Male	288	45.8	4000 and below	109	17.3
Female	341	54.2	4001–7000	155	24.6
Age			7001–10000	221	35.1
20 and below	85	13.5	10,001–15,000	102	16.2
21–30	269	42.8	15,001 and above	42	6.7
31–40	141	22.4	*Car ownership*		
41–50	109	17.3	Have a vehicle	258	41
51 and above	25	4.0	Do not have a vehicle	371	59
Education			*Usage frequency*		
High school and below	40	6.4	I never do this	36	5.7
Junior college	220	35	Yes, but not in the last 30 days	170	27
Bachelor	322	51.2	1–3 times per month	210	33.4
Master and above	47	7.5	4–6 times per month	133	21.1
			Above 8 times per month	80	12.7

then applied to remove any participants who did not have sufficient knowledge of ride-hailing services. Through this method, a total of 750 random responses were gathered by Sojump. Additionally, invalid responses were eliminated based on criteria related to IP address, time, etc. Finally, 629 valid questionnaires were returned for further analysis, yielding an effective response rate of 83.87%.

Descriptive statistics. The descriptive results are presented in Table 2. Regarding gender distribution, there is a slight majority of females (54.2%) compared to males (45.8%). In terms of age, the largest segment falls within the 21–30 age group (42.8%), followed by those aged 31–40 (22.4%). Concerning education level, the majority hold bachelor's degrees (51.2%), followed by junior college qualifications (35%). The results of monthly income level indicate that a significant portion of respondents earn between 7001–10000 yuan monthly (35.1%). In addition, 41% of participants reported owning a vehicle. Information related to integrated ride-hailing usage was collected as well, showing a diverse spectrum. A notable proportion (33.4%) used 1–3 times in 30 days, while a smaller cohort (5.7%) reported never engaging in such activities.

Empirical methodology. As shown in Fig. 1, the theoretical framework of this study consists of various latent variables related to integrated ride-hailing platforms. Specifically, these latent variables cannot be observed directly but must be indirectly measured through multiple indicators. Therefore, it is essential to introduce structural equation modeling in this research, which is a multivariate statistical analysis technique to test hypotheses about complex relationships among latent variables (Dash and Paul, 2021; Hair et al. 2017). Regarding SEM, two types of models have been frequently adopted in existing studies, i.e., partial least-square structural equation modeling (PLS-SEM) and covariance-based structural equation modeling (CB-SEM). Compared with CB-SEM, PLS-SEM offers several advantages for this research (Hair et al. 2011, 2019, 2014; Henseler et al. 2016; Sarstedt et al. 2022). Firstly, PLS-SEM is more robust to violations of normality assumptions, making it more practical for real-world data that may not perfectly adhere to normal distribution. Secondly, PLS-SEM can provide reliable estimates with small sample sizes, whereas CB-SEM generally requires larger samples. Thirdly, PLS-SEM is particularly suited for models with large numbers of constructs and paths. Thus, considering the abnormal distribution feature, sample size, and relatively complicated constructs of this research, PLS-SEM was employed as the empirical methodology.

In this study, SmartPLS 4 was used to evaluate the structural model, and the specific procedures are presented in Fig. 2. In Step 1, the theoretical framework was developed. In Step 2, the data was collected according to the requirements of the theoretical framework. In Step 3, reliability, validity, and collinearity were examined to assess the measurement model. In Step 4, the PLS-SEM model was evaluated, and with the results of fitness, path coefficients, and significance, the proposed hypotheses were tested. In Step 5, a multi-group analysis was conducted in terms of age, monthly income level, and usage frequency.

Results

Measurement model assessment. Before analyzing the research results, the measurement model needs to be examined (Henseler et al. 2016). Consequently, reliability, validity, and collinearity tests were conducted.

Reliability of constructs is generally indicated by indices of Cronbach's alpha (CA) and composite reliability (CR) (Hair et al. 2014; Sarstedt et al. 2022). Additionally, Rho_A is used as an alternative indicator to assess internal consistent reliability. As shown in Table 3, the values of Cronbach's alpha for all constructs range from 0.846 to 0.879, all exceeding the benchmark of 0.70. Moreover, the values of composite reliability are all above 0.896, which is much higher than the threshold of 0.7. The Rho_A values for all constructs range between 0.850 and 0.880, all exceeding 0.7. These results collectively indicate that the reliability of constructs in this study is acceptable.

In terms of the validity test, both convergent validity and discriminant validity are often considered (Hair et al. 2011, 2020). Average variance extracted (AVE) and factor loadings were used to assess the convergence of the constructs. As depicted in Table 3, the values of AVE range from 0.684 to 0.734, exceeding the benchmark of 0.5. Furthermore, all factor loadings exceed 0.814. Overall, the results of AVE and factor loadings imply that the convergent validity of the measurement model is good. The Fronell–Lacker criterion and heterotrait–monotrait ratio (HTMT) are presented in the Appendix as Tables A2 and A3 to assess the discriminant validity of the measurements. All diagonal values of the Fronell–Lacker Criterion are above the internal-construct correlations, and the values of HTMT are all <0.5, suggesting that the constructs have satisfactory discriminant validity.

As is shown in Table A4 of Appendix, all the values of variance inflation factor (VIF) are below 5. This result indicates that there are no collinearity issues in the measurement model.

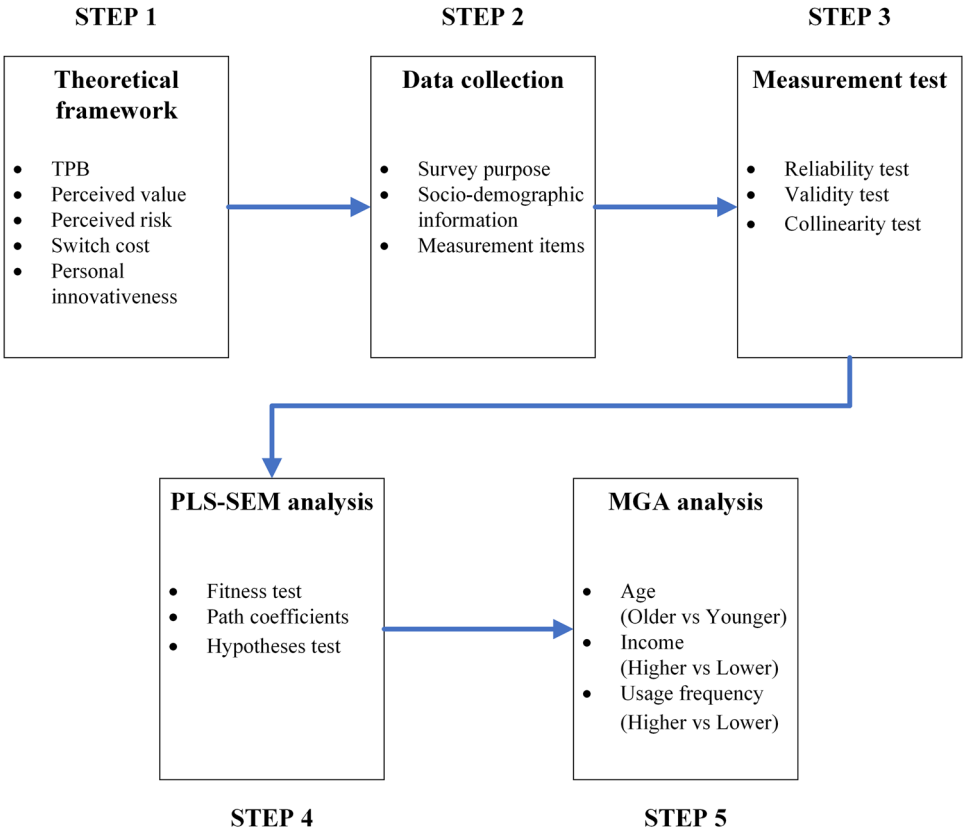

Fig. 2 Research methodology.

Structural model evaluation

Hypotheses test. PLS-SEM was employed to evaluate the theoretical framework using SmartPLS 4. To examine the hypotheses in the structural model, a bootstrapping algorithm was applied based on 5000 resamplings. By referring to existing research, the standardized root mean square residual (SRMR) and normed fit index (NFI) were used as criteria to test the fitness of this model (Hair et al. 2011, 2020, 2019). The results show that the values of SRMR and NFI are 0.090 and 0.846, respectively, jointly indicating that the fitness of the theoretical model is good and acceptable with the collected data. Moreover, the explanatory and predictive abilities of the model were examined by *R* Square and *Q* Square. The values of *R* Square of ATT, DCI, PBC, PR, PV, and SN are 0.276, 0.251, 0.204, 0.320, 0.314, and 0.185, respectively. The values of *Q* Square of ATT, DCI, PBC, PR, PV, and SN are 0.195, 0.176, 0.146, 0.226, 0.224, and 0.131, respectively, all >0. Hence, according to the results of *R* Square and *Q* Square, the structural model has good explanatory and predictive power.

The results of the hypotheses test are presented in Table 4, Figs. 3, and 4. It can be observed that attitude (−0.143**), subjective norm (−0.158***), and perceived behavioral control (−0.190***) negatively affect discontinuance intention. Therefore, H1–H3 are supported.

As a crucial factor in this study, perceived value has a positive effect on attitude (0.164***), perceived behavioral control (0.263***), and subjective norm (0.211***). Thereby, confirming hypotheses H4a, H4b, and H4c. Further, in this study, perceived value consists of three aspects, utilitarian value, hedonic value, and social value. As shown in Table 4, the positive and significant effects of utilitarian value (0.137***), hedonic value (0.171***), and social value (0.204***) on perceived value, indicate that H5a, H5b, and H5c are supported.

Regarding the results of perceived risk, it negatively affects attitude (−0.281***), perceived behavioral control (−0.277***), and subjective norm (−0.300***). Thus, H6a, H6b, and H6c are confirmed. As for the components of perceived risk, the results show that privacy risk (0.175***), performance risk (0.197***), security risk (0.093*), and financial risk (0.141***) positively relate to perceived risk, thereby confirming H7a, H7b, H7c, and H7d.

Concerning the role of switch cost, it negatively affects attitude (−0.222***), which confirming H8. Moreover, switch cost has a positive influence on discontinuance intention (0.189***). Thus, H9 is supported. As for the effect of personal innovativeness, it indicates that personal innovativeness has a positive influence on perceived value (0.237***) and a negative influence on perceived risk (−0.174***). In addition, both influences are significant. Hence, the results support hypotheses H10 and H11.

Total effects. To understand the determinants of discontinuance behavioral intention more comprehensively towards integrated ride-hailing services, this study further examined the total effects of relevant variables on the TPB framework, as shown in Tables 5 and 6. In summary, perceived value is negatively related to discontinuance behavioral intention (−0.107***), while perceived risk exhibits a positive impact on discontinuance behavioral intention (0.140***).

Regarding the components of perceived value, the results indicate that the total effect of social value is the strongest (−0.022***), followed by hedonic value (−0.018**), and utilitarian value (−0.015**). As shown in Table 6, perceived behavioral control acts as a significant mediator for both hedonic value (−0.009**) and social value (−0.010**) to influence the discontinuance of behavioral intention. In addition, attitude is more strongly affected by social value in influencing discontinuance behavioral intention (−0.005*), and subjective norm significantly mediates the effect of

Table 3 Reliability and validity test.

Construct	Items	Factor loadings	Cronbach's alpha	Rho_a	Composite reliability	AVE
ATT	ATT1	0.865	0.867	0.868	0.909	0.715
	ATT2	0.835				
	ATT3	0.828				
	ATT4	0.855				
DCI	DCI1	0.832	0.865	0.865	0.908	0.712
	DCI2	0.859				
	DCI3	0.838				
	DCI4	0.846				
FNR	FNR1	0.843	0.846	0.850	0.896	0.684
	FNR2	0.831				
	FNR3	0.814				
	FNR4	0.821				
HV	HV1	0.863	0.872	0.877	0.912	0.722
	HV2	0.832				
	HV3	0.838				
	HV4	0.866				
PBC	PBC1	0.858	0.876	0.876	0.915	0.728
	PBC2	0.851				
	PBC3	0.851				
	PBC4	0.852				
PER	PER1	0.856	0.879	0.880	0.917	0.734
	PER2	0.860				
	PER3	0.851				
	PER4	0.860				
PIN	PIN1	0.845	0.860	0.861	0.905	0.705
	PIN2	0.839				
	PIN3	0.842				
	PIN4	0.831				
PR	PR1	0.857	0.869	0.870	0.911	0.719
	PR2	0.842				
	PR3	0.846				
	PR4	0.845				
PRI	PRI1	0.836	0.856	0.859	0.902	0.698
	PRI2	0.818				
	PRI3	0.854				
	PRI4	0.833				
PV	PV1	0.849	0.874	0.876	0.914	0.726
	PV2	0.859				
	PV3	0.871				
	PV4	0.829				
SER	SER1	0.852	0.863	0.867	0.907	0.708
	SER2	0.838				
	SER3	0.846				
	SER4	0.830				
SN	SN1	0.845	0.868	0.869	0.910	0.716
	SN2	0.861				
	SN3	0.831				
	SN4	0.849				
SV	SV1	0.851	0.870	0.871	0.911	0.719
	SV2	0.835				
	SV3	0.848				
	SV4	0.858				
SWC	SWC1	0.842	0.864	0.865	0.908	0.710
	SWC2	0.849				
	SWC3	0.837				
	SWC4	0.843				
UV	UV1	0.837	0.858	0.863	0.904	0.701
	UV2	0.850				
	UV3	0.824				
	UV4	0.839				

social value (−0.007**). Thus, based on the TPB framework, these three variables are negatively related to discontinuance behavioral intention.

As for variables of perceived risk, privacy risk, performance risk, security risk, and financial risk, all present negative correlations with attitude, perceived behavioral control, and subjective norm, and eventually positively affect discontinuance behavioral intention. Overall, the four variables of risk perceptions are positively related to discontinuance behavioral intention. Among them, performance risk (0.028***) exhibits the highest

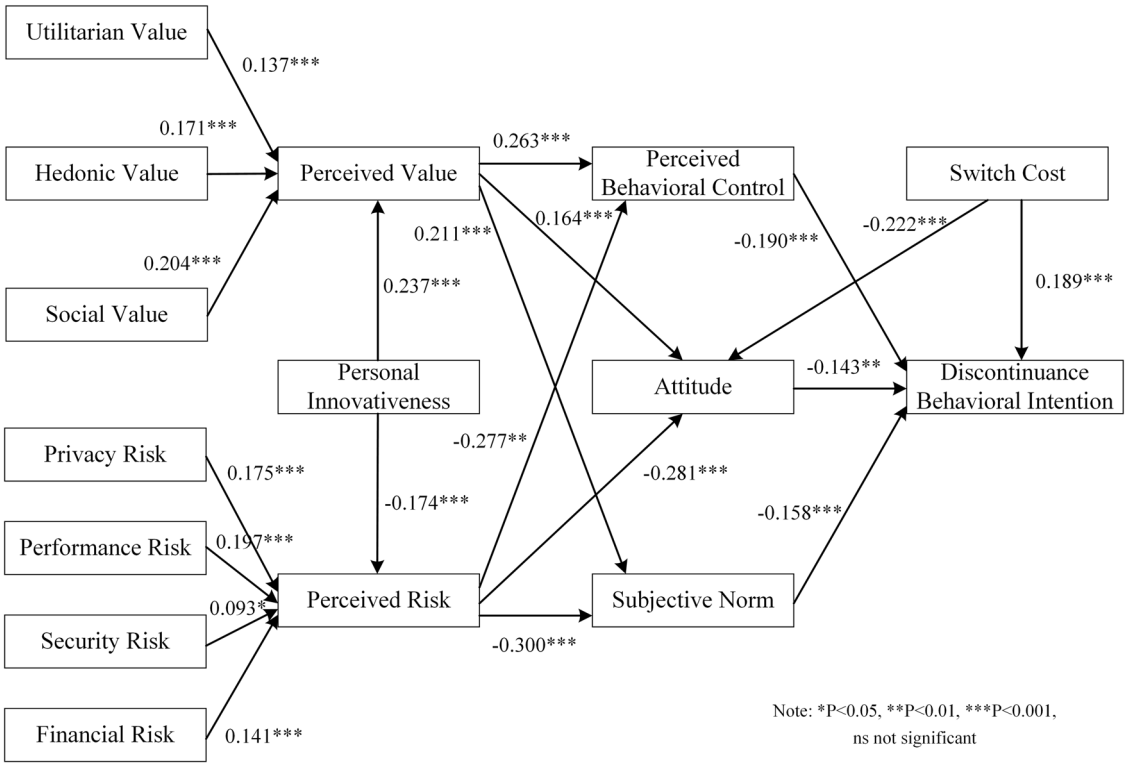

Fig. 3 Results of hypotheses test.

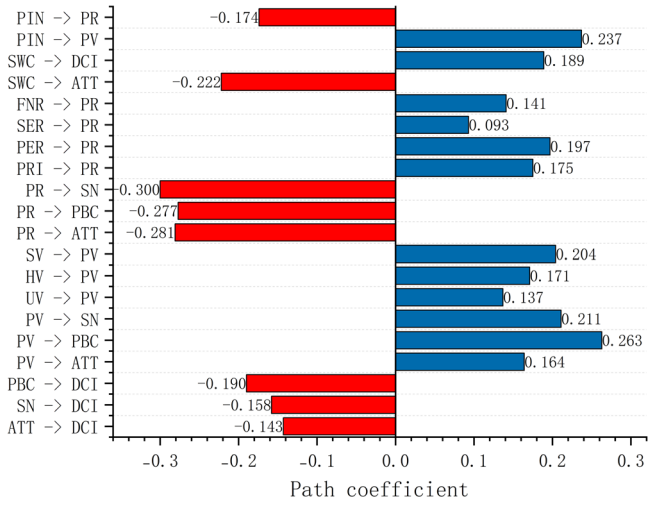

Fig. 4 Path coefficient.

total effects, followed by privacy risk (0.025***), financial risk (0.020**), and security risk (0.013*). Although the total effects of security risk are slightly weak, the negative effects also confirm the determinant role of this variable. According to the results in Table 6, attitude, perceived behavioral control, and subjective norm serve as effective mediators for privacy risk, performance risk, and financial risk. However, the indirect effect of security risk on discontinuance behavioral intention is not significant through mediators of attitude and subjective norm.

Additionally, personal innovativeness indirectly influences the TPB framework through perceived value and perceived risk and exhibits a negative total effect on discontinuance behavioral intention (−0.050***). Regarding the indirect effects, the results show that perceived behavioral control serves as a more effective mediator for personal innovativeness on discontinuance behavioral intention (−0.012**). With respect to switch cost, it negatively affects discontinuance behavioral intention both directly and indirectly, with a relatively high total effect (0.220***).

MGA analysis

Results of MGA. A multi-group analysis was conducted to further investigate potential differences in relationships among groups in terms of age (AGE), monthly income level (INC), and usage frequency (FRE). Regarding age, the samples were divided into two groups: respondents with an age above 41 years old (Older) and those aged below 40 years old (Younger). Based on monthly income level, two groups were generated, INC_Higher (above 7000 CNY) and INC_Lower (7000 CNY and below). Further, regarding usage frequency, respondents who used such service one time per week or more were classified as FRE_Higher, while the others were classified as FRE_Lower.

Measurement invariance of composite models (MICOM) should be assessed before conducting MGA. The results of the MICOM test, including three procedures, are presented as Tables A5–A7 in Appendix, which are acceptable for further study, as suggested by Matthews (2017). The results of the MGA in terms of AGE, INC, and FRE are shown in Table 7 and Fig. 5. According to the MGA results, there are no significant differences in the paths directly related to discontinuance behavioral intention. However, behavioral distinctions can also be found across several paths concerning age, income level, and usage frequency.

Regarding age, there exists a significant difference in the effect of social value on perceived value. For both older and younger groups, social value positively affects perceived value. However, the perceived value for the older group (0.351***) is influenced more by social value than that for the younger group (0.167***). In terms of monthly income level, significant differences are found in perceived value, security risk, and switch cost. For

Table 4 Results of hypotheses test.

Hypotheses	Path	Path coefficient	Standard deviation	*T* statistics	2.50%	97.50%	*P* values	Confirmations
H1	ATT →DCI	−0.143**	0.042	3.400	−0.226	−0.061	0.001	Supported
H2	SN → DCI	−0.158***	0.039	4.013	−0.236	−0.081	0.000	Supported
H3	PBC → DCI	−0.190***	0.039	4.916	−0.266	−0.115	0.000	Supported
H4a	PV → ATT	0.164***	0.039	4.223	0.086	0.239	0.000	Supported
H4b	PV → PBC	0.263***	0.036	7.214	0.191	0.335	0.000	Supported
H4c	PV → SN	0.211***	0.039	5.420	0.137	0.288	0.000	Supported
H5a	UV → PV	0.137***	0.039	3.523	0.062	0.214	0.000	Supported
H5b	HV → PV	0.171***	0.042	4.071	0.088	0.251	0.000	Supported
H5c	SV → PV	0.204***	0.036	5.687	0.134	0.274	0.000	Supported
H6a	PR → ATT	−0.281***	0.037	7.504	−0.355	−0.207	0.000	Supported
H6b	PR → PBC	−0.277***	0.038	7.222	−0.350	−0.201	0.000	Supported
H6c	PR → SN	−0.300***	0.037	8.123	−0.370	−0.226	0.000	Supported
H7a	PRI → PR	0.175***	0.040	4.374	0.098	0.255	0.000	Supported
H7b	PER → PR	0.197***	0.038	5.146	0.120	0.272	0.000	Supported
H7c	SER → PR	0.093*	0.038	2.423	0.020	0.169	0.015	Supported
H7d	FNR → PR	0.141***	0.037	3.817	0.069	0.214	0.000	Supported
H8	SWC → ATT	−0.222***	0.038	5.869	−0.295	−0.147	0.000	Supported
H9	SWC → DCI	0.189***	0.040	4.697	0.110	0.269	0.000	Supported
H10	PIN → PV	0.237***	0.040	5.911	0.156	0.314	0.000	Supported
H11	PIN → PR	−0.174***	0.040	4.383	−0.251	−0.095	0.000	Supported

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, ns not significant.

Table 5 Results of total effects.

	Total effect	Standard deviation	*T* statistics	*P* values
ATT	−0.143**	0.042	3.400	0.001
PBC	−0.190***	0.039	4.916	0.000
SN	−0.158***	0.039	4.013	0.000
PV	−0.107***	0.018	5.975	0.000
UV	−0.015**	0.005	2.834	0.005
HV	−0.018**	0.006	3.279	0.001
SV	−0.022***	0.005	3.994	0.000
PR	0.140***	0.019	7.291	0.000
PRI	0.025***	0.007	3.594	0.000
PER	0.028***	0.007	4.120	0.000
SER	0.013*	0.006	2.205	0.028
FNR	0.020**	0.006	3.243	0.001
PIN	−0.050***	0.009	5.405	0.000
SWC	0.220***	0.039	5.703	0.000

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, ns not significant.

groups with higher income levels, perceived value has a relatively higher influence on subjective norm (0.298***) than that for groups with lower income levels (0.092 ns). Security risk has a positive and significant effect on perceived risk for groups with higher income levels (0.159**), while it is not significant for groups with a lower income level (0.005 ns). Further, switch cost has a stronger and negative influence on attitude for groups with lower income levels (−0.336***). Regarding usage frequency, utilitarian value shows a significant difference in perceived value between groups with higher and lower usage frequency. It can be found that the perceived value for the group with higher usage frequency is more affected by utilitarian value (0.297***). On the contrary, for the group with lower frequency, although utilitarianism positively affects perceived value, it remains not significant (0.055 ns).

Total effects of MGA. Despite the absence of behavioral differences in paths of discontinuance behavioral intention, this study can also investigate the relative importance of relevant determinants for travelers' discontinuance behavioral intention towards integrated ride-hailing services. As shown in Table 8, the total effects on discontinuance behavioral intention across groups are presented. Within the TPB framework, attitude exhibits stronger effects on discontinuance behavioral intention for groups with older age (−0.287**), lower income level (−0.152*), and lower usage frequency (−0.141**). As for perceived behavioral control, it has a relatively higher influence among groups of younger (−0.222***), higher income level (−0.234***), and lower usage frequency (−0.197***). In addition, subjective norm serves as a more important determinant for groups of younger (−0.176***), lower income level (−0.171**), and higher usage frequency (−0.189**).

Compared to the results in terms of age, the older group is more easily influenced by perceived value (−0.140**) than the younger group (−0.105***). Particularly, this difference is relatively large in the total effects of social value. For perceived risk, the results of privacy risk (0.036*), performance risk (0.044*), and financial risk (0.033*) all exhibit higher total effects for the older group than that for the younger group, except for the impact of security risk (−0.006ns). Regarding the results of groups based on income level, the group with higher income level tends to be more affected by perceived value (−0.145***), alongside the results of utilitarian value (−0.022*), hedonic value (−0.033**), and social value (−0.027**). Nevertheless, the group with a lower income level is more influenced by perceived risk (0.141***). However, the group with a higher income level is more sensitive to the impact of privacy risk (0.025**), performance risk (0.031**), and security risk (0.021**), whereas financial risk shows a relatively higher total effect on the group with a lower income level (0.026*). As for the total effects of groups with different usage frequencies, group with higher usage frequency places greater importance on perceived value (−0.118**), especially utilitarian value (−0.035*). For the group with lower usage frequency, hedonic value (−0.020**) and social value (−0.025***) play a more determinant role in the discontinuance behavioral intention. According to the results of perceived risk, the higher usage frequency group is affected more by privacy risk (0.029*) and performance risk (0.029*), while security risk is of greater concern for the group with lower usage frequency (0.016*). Furthermore, it can be observed that the

Table 6 Results of indirect effect.

Path	Coefficient	Standard deviation	T statistics	P values
UV → PV → ATT → DCI	−0.003*	0.002	2.061	0.039
UV → PV → PBC → DCI	−0.007*	0.003	2.505	0.012
UV → PV → SN → DCI	−0.005*	0.002	2.024	0.043
HV → PV → ATT → DCI	−0.004*	0.002	2.128	0.033
HV → PV → PBC → DCI	−0.009**	0.003	2.722	0.007
HV → PV → SN → DCI	−0.006*	0.002	2.363	0.018
SV → PV → ATT → DCI	−0.005*	0.002	2.166	0.030
SV → PV → PBC → DCI	−0.010**	0.003	3.135	0.002
SV → PV → SN → DCI	−0.007**	0.002	2.731	0.006
PRI → PR → ATT → DCI	0.007*	0.003	2.360	0.018
PRI → PR → PBC → DCI	0.009**	0.003	2.728	0.006
PRI → PR → SN → DCI	0.008**	0.003	2.725	0.006
PER → PR → ATT → DCI	0.008*	0.003	2.413	0.016
PER → PR → PBC → DCI	0.010**	0.003	3.050	0.002
PER → PR → SN → DCI	0.009**	0.003	2.985	0.003
SER → PR → ATT → DCI	0.004ns	0.002	1.727	0.084
SER → PR → PBC → DCI	0.005*	0.002	2.006	0.045
SER → PR → SN → DCI	0.004ns	0.002	1.881	0.060
FNR → PR → ATT → DCI	0.006*	0.003	2.186	0.029
FNR → PR → PBC → DCI	0.007**	0.003	2.752	0.006
FNR → PR → SN → DCI	0.007*	0.003	2.448	0.014
PIN → PR →ATT → DCI	−0.007*	0.003	2.385	0.017
PIN → PR → PBC → DCI	−0.009**	0.003	2.973	0.003
PIN → PR → SN → DCI	−0.008**	0.003	2.672	0.008
PIN → PV → ATT → DCI	−0.006*	0.002	2.333	0.020
PIN →PV → PBC → DCI	−0.012**	0.004	3.093	0.002
PIN → PV → SN → DCI	−0.008**	0.003	2.712	0.007
SWC → ATT → DCI	0.032**	0.011	3.023	0.003

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, ns not significant

Table 7 Results of MGA.

Path	Coefficient	*P*-value	Coefficient	*P*-value	Difference	Permutation *P*-values (two-tailed)	MGA results
Age	*Older*		*Younger*				
SV → PV	0.351***	0.000	0.167***	0.000	0.184*	0.035	Yes/Yes
INC	*INC_Higher*		*INC_Lower*				
PV → SN	0.298***	0.000	0.092ns	0.115	0.206*	0.011	Yes/No
SER → PR	0.159**	0.001	0.005ns	0.938	0.154*	0.042	Yes/No
SWC → ATT	−0.137**	0.010	−0.336***	0.000	0.199*	0.010	Yes/Yes
FRE	*FRE_Higher*		*FRE_Lower*				
UV → PV	0.297***	0.000	0.055 ns	0.243	0.242**	0.003	Yes/No

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, ns not significant.

younger group is more influenced by personal innovativeness (−0.054***), and switch cost acts as a more important determinant for the group with lower income levels (0.258***).

Discussion

The present study explored the influencing factors on travelers' discontinuance behavioral intention towards integrated ride-hailing platforms from the perspectives of perceived value and perceived risk. A theoretical framework was constructed based on the TPB, incorporating switch cost and personal innovativeness. Furthermore, this study also investigated the behavioral differences of travelers with heterogeneous characteristics in terms of age, income, and usage frequency. The findings of this research confirm the explanatory power of the theoretical framework.

Determinants of discontinuance behavioral intention. Within the framework of TPB, the negative and significant influence of attitude, subjective norm, and perceived behavioral control on discontinuance behavioral intention verifies the effectiveness of the theoretical framework developed in this study (Bhaduri and Goswami, 2023; Hu et al. 2022; Nguyen-Phuoc et al. 2022). Furthermore, it confirms the explanatory power of TPB on discontinuance intentions, providing valuable insights into the complex behavioral processes (Avornyo et al. 2024; Luqman et al. 2018; Soliman and Tuunainen, 2022). Collectively, these findings demonstrate the comprehensiveness and applicability of the TPB in explaining discontinuance behavioral intentions.

Both perceived value and perceived risk were found to be predictive factors influencing travelers' discontinuance behavioral intention through attitude, perceived behavioral control, and subjective norm. Similar to previous research, perceived value positively affects attitude, while perceived risk negatively affects attitude (Akram et al. 2024; Elnadi and Gheith, 2022; Ma et al. 2019; Nguyen-Phuoc et al. 2022; Shao et al. 2022; Wang et al. 2019). As for relationships among perceived value, perceived risk, perceived behavioral control, and subjective norm, the results of

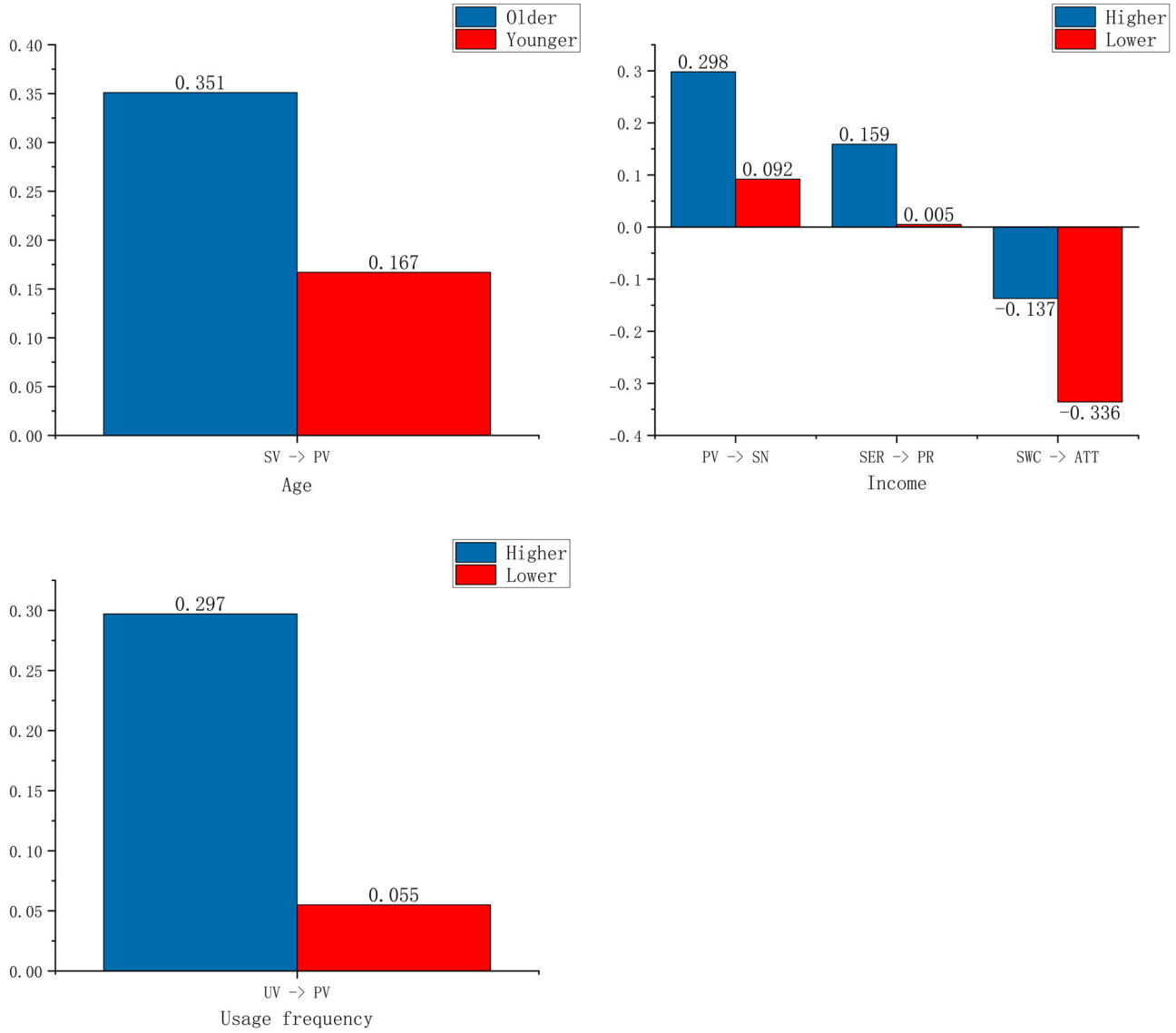

Fig. 5 Results of MGA.

Table 8 Total effects on DCI of multi-groups.

	AGE_Older	AGE_Younger	INC_High	INC_Low	FRE_High	FRE_Low
ATT	−0.287**	−0.107*	−0.140**	−0.152*	−0.146ns	−0.141**
PBC	−0.106ns	−0.222***	−0.234***	−0.132*	−0.174**	−0.197***
SN	−0.094ns	−0.176***	−0.151**	−0.171**	−0.189**	−0.145**
PV	−0.140**	−0.105***	−0.145***	−0.066**	−0.118**	−0.101***
UV	−0.017ns	−0.015*	−0.022*	−0.006ns	−0.035*	−0.006ns
HV	−0.026ns	−0.018**	−0.033**	−0.007ns	−0.013ns	−0.020**
SV	−0.049**	−0.018**	−0.027**	−0.017*	−0.018ns	−0.025***
PR	0.146**	0.146***	0.135***	0.141***	0.130***	0.147***
PRI	0.036*	0.022**	0.025**	0.023*	0.029*	0.022**
PER	0.044*	0.025**	0.031**	0.021*	0.029*	0.027**
SER	−0.006ns	0.019**	0.021**	0.001ns	0.006ns	0.016*
FNR	0.033*	0.018*	0.016*	0.026*	0.019ns	0.020**
PIN	−0.042*	−0.054***	−0.047***	−0.052**	−0.046**	−0.052***
SWC	0.183ns	0.230***	0.199***	0.258***	0.237**	0.212***

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, ns not significant.

this study provide supplements to the existing literature on consumer behavior (Adu-Gyamfi et al. 2022; Bae and Chang, 2021; Sarosa, 2022; Shang et al. 2023). Overall, the findings suggest that the variables of the TPB framework will be enhanced with higher perceived value or lower perceived risk of integrated ride-hailing services, which will eventually influence their discontinuance behavioral intention. However, the strength of the impact of perceived risk on attitude is slightly higher than that of perceived value, which differs from the findings of Ma et al. (2019). This result further indicates that travelers' attitude is more easily affected by the perceived risks of adopting integrated ride-hailing platforms than by the potential benefits. In addition, the positive influence of perceived value and negative influence of perceived risk on perceived behavioral control and subjective norm, jointly demonstrate the importance of enhancing perceived value and mitigating perceived risk in reducing the likelihood of travelers discontinuing the service (Bae and Chang, 2021; Hansen et al. 2018; Izquierdo-Yusta et al. 2022). Further, in comparison to existing research, these findings stress the significant role of perceived risk in discontinuance behavioral intention (Cheng et al. 2021; Lee et al. 2024; Nguyen-Phuoc et al. 2021; Wang et al. 2019). Therefore, by incorporating perceived risk, this study enhances the understanding of travelers' behavior toward integrated ride-hailing services.

The findings regarding perceived value are intriguing, offering valuable insights into the complex relationship among utilitarian value, hedonic value, social value, and perceived value. The positive and significant effects of all three types of value on perceived value align with previous research, suggesting that the perception of value towards integrated ride-hailing platforms can be explained from multiple dimensions. The results of total effects on discontinuance behavioral intention demonstrate that the effects of social value and hedonic value are relatively greater than those of utilitarian value, which contrasts with existing research (Wang et al. 2019). This might suggest that, in the context of this study, travelers placed greater emphasis on the emotional and social benefits of integrated ride-hailing platforms over their functional or practical benefits, which could be attributed to changing preferences or the specific characteristics of these services. What is more, perceived behavioral control serves as the strongest mediator for both social value and hedonic value, while the effect of social value on the discontinuance of behavioral intention is primarily mediated by subjective norms, thereby contributing to the understanding of travelers' behavior in the existing literature (Akram et al. 2024; Elnadi et al. 2024; Elnadi and Gheith, 2022). Compared to existing studies, considering perceived value from utilitarian, hedonic, and social aspects shed insights into understanding the behavioral patterns toward integrated ride-hailing platforms (Acheampong et al. 2023; Tumaku et al. 2023; Yapp and Yeap, 2023).

As for perceived risk, it was examined through four dimensions. The results show that privacy risk, performance risk, security risk, and financial risk all significantly influence perceived risk. Among these four dimensions, performance risk and privacy risk emerged as the primary factors influencing perceived risk. Noteworthily, the results of total effects on discontinuance behavioral intention further emphasize the determinant role of performance risk and privacy risk, followed by financial risk and security risk. Further, the variables of the TPB framework effectively mediate the effects of these risk-related factors on the discontinuance of behavioral intention towards integrated ride-hailing services. It suggests that travelers are highly concerned about the functionality and reliability of integrated ride-hailing services, as well as the potential for unauthorized access to their personal information. These findings align with the increasing emphasis on data privacy and the demand for products and services to meet or exceed performance expectations in the ride-hailing market (Qian et al. 2023; Wang et al. 2019). Financial risk, while not as dominant as performance and privacy risks, remains significant in shaping travelers' overall risk perception. This underscores the importance of managing financial risks effectively to improve the attitude of travelers. Security risk appears to have less impact on perceived risk compared to the other three dimensions and mainly impacts the discontinuance behavioral intention through perceived behavioral control. This might be due to travelers' belief in improved security measures, for example, Chinese government has published several policies to ensure the security of ride-hailing users (Jiang and Yang, 2023; Jing et al. 2021). Overall, the results demonstrate the role of perceived risk in influencing travelers' discontinuance behavioral intention. In addition, the findings related to components of risk perception highlight the complexities of travelers' behavior on integrated ride-hailing platforms (Cheng et al. 2021; Lee et al. 2024; Liu et al. 2022; Nguyen-Phuoc et al. 2021), which further contributes to the existing literature by considering risk perception from various aspects.

This study further examined the roles of switch cost and personal innovativeness, which have been neglected in previous research. Concerning switch cost, the findings indicate that it negatively affects attitude while positively affecting discontinuance behavioral intention. Additionally, switch cost has a relatively high and positive total effect on travelers' discontinuance behavioral intention. These findings further emphasize the important role of switch costs in the adoption of integrated ride-hailing platforms (Asgari and Jin, 2020; Guo et al. 2023). Thus, it suggests that travelers' behavior is influenced when the perception of hassle costs is higher, including additional time or monetary expenses. Regarding the role of personal innovativeness in indirectly influencing discontinuance behavioral intention through perceived risk and perceived value, this finding offers an intriguing dimension in understanding travelers' behavior towards integrated ride-hailing platforms, differing from existing studies (Elnadi and Gheith, 2022; Lee and Wong, 2021; Shaikh et al. 2023). In conjunction with the negative total effects of personal innovativeness, these findings indicate that personal innovativeness can shape travelers' perceptions of integrated ride-hailing platforms, thereby influencing their behavioral intentions and providing new insights into existing literature (Lee and Wong, 2021; Vu et al. 2024). As a travel mode based on new technology, integrated ride-hailing platforms provide a new travel choice for urban residents. Thus, investigating travelers' behavior on such services from the perspectives of switch cost and personal innovativeness can provide a better understanding of existing studies (Elnadi and Gheith, 2022; Fauzi and Sheng, 2020; Vu et al. 2024).

Heterogeneity among multi-groups. To further examine the general pattern of travelers' discontinuance behavioral intention towards integrated ride-hailing platforms, this study conducted a multi-group analysis based on age, income, and usage frequency. The significant differences in several paths indicate that behavioral distinctions exist among different groups, and further provides insights into differences of behavioral pattern of travelers (Chou et al. 2024; Fauzi and Sheng, 2020; Nguyen-Phuoc et al. 2023a).

As for the influence of age, older individuals' perceived value is more influenced by social value compared to younger individuals. In addition to the total effects, the factors influencing the decision to discontinue the use of integrated ride-hailing services differ between older and younger users, providing insights into the existing literature (Gomez et al. 2021; Rafiq and McNally, 2023;

Tirachini and del Río, 2019). Older travelers are more sensitive to social values and various types of risks, such as privacy risks and performance risks, while younger travelers are more influenced by security risks but can be retained through their personal innovativeness. This finding suggests that older travelers may be more sensitive to social feedback or expectations when evaluating the value of a travel experience. On the other hand, younger travelers are likely less influenced by social values and more focused on individualistic or experiential aspects.

Regarding monthly income level, the differences in several paths with varying income levels provide valuable insights into the complexity of travelers' behavior. For the group with a higher income level, their perception of the subjective norm is highly influenced by perceived value than that of the group with a lower income level. In addition, according to the total effects for the high-income group, their discontinuance behavioral intention is negatively affected by all aspects of perceived value and is particularly sensitive to performance risk. These results suggest that the perceived value of integrated ride-hailing services for individuals with higher incomes may play a more significant role in shaping their behavior, which is consistent with existing literature (Acheampong et al. 2023; Akram et al. 2024). The positive and significant effect of security risk on perceived risk among higher-income groups suggests that these individuals are more sensitive to potential safety concerns when evaluating integrated ride-hailing platforms. Additionally, the lack of significance of security risk on perceived risk among lower-income groups may reflect different priorities and constraints. Moreover, the stronger and negative influence of switch cost on attitude among groups with lower income levels suggests that these individuals may be more sensitive to the costs associated with changing their travel mode. As for the total effects, for the low-income group, financial risk and switch cost are the most significant determinants of discontinuance intention. Affordability and cost-effectiveness are crucial, and high switch costs can also influence their decision to continue using the service.

The significant difference in the influence of utilitarian value on perceived value between groups with higher and lower usage frequency offers a fascinating perspective into travelers' behavior and preferences (Alemi et al. 2019; Gomez et al. 2021; Lavieri and Bhat, 2019). Among high-frequency users of integrated ride-hailing platforms, utilitarian value, which refers to the practical benefits, appears to play a significant role in shaping their perceived value. This suggests that high-frequency users prioritize practicality, efficiency, and cost-effectiveness when evaluating their ride-hailing experiences. In contrast, for individuals with lower usage frequency, hedonic and social values play a more significant role in mitigating discontinuance intentions, and they are more susceptible to security and financial risks.

In comparison to existing research, this study further investigated the total effects on discontinuance behavioral intention based on MGA. The results indicate that the role of determinants varies among different groups. Further, to investigate these differences is crucial to examine the behavioral patterns of travelers, and provide new insights into the general pattern of travelers towards integrated ride-hailing services (Nguyen-Phuoc et al. 2023a; Shao et al. 2022; Si et al. 2024). Furthermore, these new insights provide valuable information for understanding how travelers perceive and interact with integrated ride-hailing services.

Conclusion

Main results. The contemporary landscape of integrated ride-hailing platforms presents a multitude of challenges and complexities that impact travelers' intentions to discontinue their usage of such platforms. This study investigated the factors influencing travelers' discontinuance behavioral intention towards integrated ride-hailing platforms from the perspectives of perceived value and perceived risk. To address this issue, an extended TPB framework that includes the dimensions of perceived value (utilitarian, hedonic, and social), perceived risk (privacy, performance, security, and financial), switch cost, and personal innovativeness was constructed. Based on data collected in Nanjing, China, an empirical study was carried out using PLS-SEM. The results validated the proposed hypotheses and theoretical framework.

The findings indicate that travelers' discontinuance behavioral intention is jointly affected by subjective norms, perceived behavioral control, and attitude, thereby verifying the effectiveness of the theoretical framework. Perceived value, formed by utilitarian value, hedonic value, and social value, indirectly influences the discontinuance of behavioral intention. Specifically, social value has the strongest total effect, followed by hedonic value and utilitarian value. As for perceived risk, which consists of privacy risk, performance risk, security risk, and financial risk, it negatively affects the discontinuance of behavioral intention. Notably, the total effects of performance risk and privacy risk are relatively higher than financial risk and security risk. Switch cost was found to be a crucial factor that negatively affects attitude while positively related to discontinuance behavioral intention. Moreover, this study examined the role of personal innovativeness as well. It shows that personal innovativeness has a positive effect on perceived value and a negative effect on perceived risk. Based on these findings, the underlying general pattern of travelers' discontinuance behavioral intention toward integrated ride-hailing can be investigated.

Significant differences across various paths were observed among different groups, which revealed behavioral distinctions and offered insights into travelers' behavioral patterns. In terms of age, older individuals show a stronger influence of social value on perceived value than younger individuals. Moreover, the discontinuance behavioral intention of the older group is influenced more by performance risk, privacy risk, and financial risk as well, while the younger group is concerned more with security risk and personal innovativeness. Regarding income level, higher-income groups exhibit greater sensitivity to perceived value and security concerns, while lower-income groups are more affected by the costs associated with switching travel modes and financial risk. Additionally, variations in the impact of utilitarian value on perceived value exist between groups with different usage frequencies. Higher-frequency travelers place greater importance on practical benefits.

Implications

Theoretical implications. Based on the findings in this study, several implications can be provided. Firstly, this study is one of the first to explain travelers' discontinuance behavioral intention within the context of integrated ride-hailing platforms. Although some previous studies have paid attention to integrated ride-hailing platforms, but mostly focus on continuance behavioral intention or platform strategy. Even though discontinuance behavioral intention has been studied in the context of consumer behavior, this study not only reveals the general pattern of discontinuance behavioral intention but also verifies the determinant role of factors related to integrated ride-hailing platforms, paving the way for future research to explore discontinuance behavioral intention in greater depth.

Secondly, this study focuses on the discontinuance of behavioral intention towards integrated ride-hailing, which has been neglected in previous research. Hence, the contribution of this study is the construction of an extended theoretical

framework by integrating perceived value and perceived risk. The findings provide evidence that the determinant role of perceived value and perceived risk has been identified. From our understanding, this is the first study to examine travelers' discontinuance behavioral intention towards integrated ride-hailing platforms from a standpoint of value and risk perception, offering a deeper understanding of travelers' behavior related to such new emerging services.

Thirdly, this research provides theoretical evidence for the effect of switch cost and personal innovativeness in the field of integrated ride-hailing platforms, which has been overlooked in previous studies. The findings in this research further highlight the crucial role of switch cost and personal innovativeness in influencing on the behavioral intention of travelers, thereby extending the understanding of travelers' behavior regarding integrated ride-hailing platforms.

Practical implications. From a practical perspective, the implications of this study are equally significant. Firstly, service providers in the integrated ride-hailing industry can utilize the insights gained from this research to enhance their service offerings and improve travelers' retention. By understanding the role of perceived value and perceived risk in discontinuance behavioral intention, these companies should focus more on risk perceptions, as it has been shown to have a stronger impact than perceived value. Specifically, platforms can implement measures to improve performance and protect the privacy information of travelers. What is more, to enhance the valuation, platforms need to be concerned with the more on social and hedonic aspects of their services.

Secondly, the emphasis on switch costs highlights the demand for integrated ride-hailing service providers to consider external factors that can influence travelers' decisions. By reducing switch costs, such as through loyalty programs or seamless integration with other services, providers can minimize barriers for travelers to adoption and encourage the widespread use of integrated ride-hailing platforms. What is more, according to the results of personal innovativeness, platforms can tailor their services with advanced technology to better meet the expectations of travelers, thereby reducing the likelihood of travelers discontinuing their usage behavior.

Thirdly, by understanding the discontinuance behavioral intention of travelers across different groups, policymakers can target interventions that aim to promote the sustainability and efficiency of integrated ride-hailing platforms. For example, for older groups, policymakers should focus more on social value. As for income level, to promote integrated ride-hailing services, the security risk perception should be addressed for higher income groups while reducing the switching cost for lower income groups. In addition, policymakers can further improve the utilitarian value, especially for travelers who adopt integrated ride-hailing services more frequently.

Limitations and future research. The study achieved its primary objective of extending the TPB framework by incorporating perceived value and perceived risk. The findings provide valuable insights into the determinants of discontinuance intentions in the context of integrated ride-hailing platforms. However, to refine the theoretical framework and enhance its applicability, the following limitations and corresponding remedies can be implemented in future research.

Firstly, in this research, the sample was collected from Nanjing, a major city in China where ride-hailing services have developed well. Hence, it may limit the generalizability of the results to other regions with different socio-economic conditions and cultural norms. To address this limitation, future studies should consider a more diverse sample base, surveys can be conducted in more areas to collect sample that is more representative to ensure that the findings are applicable across a broader spectrum of users. For example, rural areas and cities in other countries.

Secondly, the data was gathered through self-reporting, which can introduce bias due to social desirability or recall errors. To mitigate this issue, future research could incorporate mixed-methods research, combining qualitative data with quantitative analysis, which can provide a more comprehensive understanding. This would include in-depth interviews, focus groups, and observational studies to complement the survey data, offering a richer texture to the interpretation of results.

Thirdly, the study focused on a static snapshot of travelers' intentions, which might not fully capture the dynamic nature of their decision-making processes over time. A longitudinal approach, tracking the same participants over several months or years, could offer deeper insights into the evolution of their intentions and the factors influencing discontinuance behavior. This would contribute significantly to the field by revealing the long-term effects of various factors on discontinuance behavior.

Fourthly, although the perceived value and perceived risk were considered from several aspects, the effect of these variables can be examined in more detail. For instance, the benefit or sacrifice of using integrated ride-hailing platforms can be divided into factors related to platforms or drivers, which may potentially provide further understanding of travelers' behavior on integrated ride-hailing platforms. Further, survey design, by considering specific interventions or changes can be put forward to investigate their impact on perceived risks, perceived value, and discontinuance behavior.

Lastly, the research focus of this study was discontinuance behavioral intention, and the underlying relationships have been investigated. However, behavioral intention is still different from actual choice behavior, which can more directly reflect travelers' decision process related to integrated ride-hailing. What is more, examining the actual choice behavior will be effective in understanding consumer behavior towards integrated ride-hailing platforms more comprehensively. In addition, it is necessary to consider additional variables that could influence discontinuance intentions, such as actual usage behavior, service quality, or external economic factors.

Data availability

The data will not be shared since further research will be carried out.

Received: 3 April 2024; Accepted: 26 February 2025;
Published online: 08 March 2025

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Acknowledgements

The study in this paper was jointly supported by research grants from the National Nature Science Foundation of China (Grant Nos. 72003098, 72271127), the Humanities and Social Science Foundation of the Ministry of Education of China (Grant No. 24YJCZH193), and the Philosophy and Social Science Fund of Education Department of Jiangsu Province (Grant No. 2019SJA0155).

Author contributions

Ke Lu: Conceptualization, investigation, data curation, software, writing—original draft; writing—review and editing, project administration, funding acquisition. Chunmei Shi: Validation, formal analysis; writing—review and editing.

Competing interests

The authors declare no competing interests.

Ethical approval

The ethical approval was confirmed as not required by the School of Management Science and Engineering, Nanjing University of Information Science and Technology, on June 9, 2023, and the reasons are as follows. All procedures in this study adhere to the institutional research guidelines and the 1964 Declaration of Helsinki and its subsequent

amendments or comparable ethical standards. Given that this study does not fall within the scope of medical research and does not involve human experimentation as stated in the Declaration of Helsinki, and considering that the questions in the questionnaire have no adverse effects on the mental health status of the respondents, according to the regulations of the authors' institution (Nanjing University of Information Science and Technology), ethical approval is not required for this questionnaire-based study. In detail, during the study process, the research adhered strictly to the following guidelines. Firstly, all participants were thoroughly informed about the study's objectives and procedures prior to participating in the survey. Secondly, a straightforward questionnaire was employed, designed to gather anonymous data about the participants, excluding any identifying information. Thirdly, the confidentiality of all collected data was upheld with utmost vigilance.

Informed consent

The survey was conducted online via Sojump, a Chinese online survey platform, in December, 2023. Before initiating the data collection process, the authors provided all participants with written informed consent. Participants were clearly informed that their participation was voluntary and that the information they provided would be treated with the utmost confidentiality and anonymity. Furthermore, this research intentionally avoided collecting any identifying details, such as names, addresses, or affiliations. Additionally, participants were fully informed of their right to withdraw from the survey at any point during the process.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1057/s41599-025-04683-5.

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